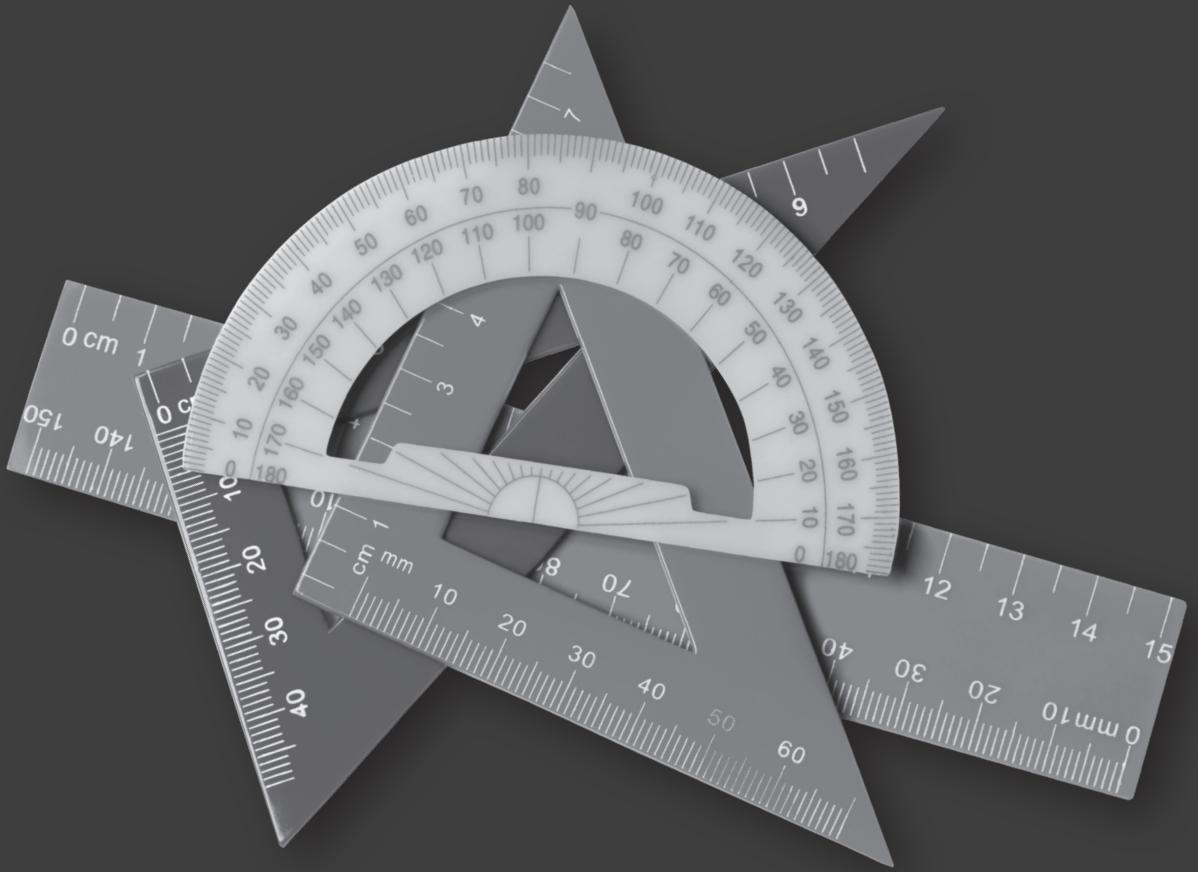




ESSENTIAL Mathematics Primary 5

Teacher's Guide



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Teacher's Guide

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Introduction

The new *Mathematics Curriculum for Primary Schools (Basic 4–6)* is standards based, which means that the Ministry of Education wants to place learning at the heart of every classroom and ensure that every learner receives quality education. Quality education should be accessible to everyone, without exception, so that the human capital needs of our country can be met.

This Teacher’s Guide clearly sets out the learning areas recorded in the curriculum, how they should be taught and how they should be assessed. It provides a set of core competencies and standards that learners should know, understand and demonstrate as they progress through the content standards and phases.

The Teacher’s Guide promotes the fundamental belief of the curriculum that education should be inclusive and gender-responsive within the context of learning-centred teaching methods so that every learner can participate and enjoy learning.

The role of the teacher is vital to make these books work for the intended purpose – to teach the core competencies and values and to make learning happen and thereby improve learning outcomes.

Rationale for primary Mathematics

Mathematics forms an integral part of our everyday lives. It is a never-ending creative process that serves to promote discovery and understanding and considers mathematics to be vital to the country’s future development.

To provide quality Mathematics education, teachers must facilitate learning in the Mathematics classroom. This will provide the foundations for discovering and understanding the world around us and provide the basics for further studies in this field. This Teacher’s Guide will help you to guide learners to understand how mathematics can be used to explain what is occurring, predict how things will behave and analyse causes and origins of things in our environment. It considers the desired outcomes of education for learners at the basic level in terms of the new curriculum. In order to ensure that the learners are mathematically and technologically literate, mathematics ought to be taught using hands-on and minds-on approaches that learners will experience as fun and will remember for the rest of their lives.

Philosophy

The Ministry of Education promotes two basic philosophies:

Teaching philosophy	Learning philosophy
<ul style="list-style-type: none">• An effective Mathematics education should be inquiry-based.• It must provide learners with opportunities to expand, change, enhance and modify the ways in which they view the world.• It should be pivoted on learner-centred Mathematics teaching and learning approaches that engage learners physically and cognitively in the knowledge-acquiring process in a rich and rigorous inquiry-driven environment.	<ul style="list-style-type: none">• Mathematics learning is an active contextualised process of constructing knowledge based on learners' experiences rather than acquiring it.• Learners are information constructors who operate as researchers.• Teachers serve as facilitators by providing the enabling environment that promotes the construction of learners' own knowledge, based on their previous experiences.• This makes learning more relevant to the learner and leads to the development of critical thinkers and problem solvers.

General aims

This Teacher's Guide works in conjunction with the new curriculum to develop individuals to become mathematically literate, good problem solvers, have the ability to think creatively and have both the confidence and competence to participate fully in society as responsible local and global citizens.

Subject aims

The Teacher's Guide follows the curriculum guidelines to help learners to:

- recognise that mathematics permeates the world around us
- appreciate the usefulness, power and beauty of mathematics
- enjoy mathematics and develop patience and persistence when solving problems
- understand and be able to use the language, symbols and notation of mathematics
- develop mathematical curiosity and use inductive and deductive reasoning when solving problems
- become confident in using mathematics to analyse and solve problems both in school and in real-life situations
- develop the knowledge, skills and attitudes necessary to pursue further studies in mathematics
- develop abstract, logical and critical thinking and the ability to reflect critically upon their work and the work of others.

Instructional expectations

This Teacher's Guide will help you, the teacher:

- guide and facilitate learning by encouraging discussions among learners and challenging them to accept and share responsibility for their own learning
- select mathematics content, adapt and plan lessons to meet the interests, knowledge, understanding, abilities and experiences of your class
- work together with colleagues within and across disciplines and grade levels to develop communities of mathematics learners who exhibit the skills of mathematical inquiry and the attitudes and social values conducive to mathematics learning
- use multiple methods and systematically gather data about learners' understanding and ability to guide mathematics teaching and learning
- arrange to provide feedback to both learners and parents
- design and manage learning environments that provide learners with the time, space and resources needed for learning mathematics.

Core competencies

The core competencies are a set of skills that teachers need to develop in their learners. These are ways in which teachers and learners engage with the subject matter as they learn the subject. These competencies form a connected body of core skills that are acquired throughout the processes of teaching and learning.

Critical thinking and problem solving (CP)	This skill develops learners' cognitive and reasoning abilities to enable them to analyse and solve problems. CP skill enables learners to draw on their own experiences to analyse situations and choose the most appropriate out of a number of possible solutions.
Creativity and innovation (CI)	This skill promotes entrepreneurial skills in learners through their ability to think of new ways of solving problems and developing technologies for addressing the problem at hand. It requires ingenuity of ideas, arts, technology and enterprise. Learners are also able to think independently and creatively.
Communication and collaboration (CC)	This promotes the skills to use language, symbols and text to exchange information about themselves and their life experiences. Learners actively participate in sharing their ideas. They engage in dialogue with others by listening to and learning from them. They also respect and value the views of others.

Cultural identity and global citizenship (CG)	Learners learn how to put country and service foremost by understanding what it means to be active citizens. They develop a strong sense of social and economic awareness and use their skills to contribute effectively towards the socioeconomic development of the country and on the global stage. They build skills to critically identify and analyse cultural and global trends.
Personal development and leadership (PL)	PL improves self-awareness and builds self-esteem. It also entails identifying and developing talents, fulfilling dreams and aspirations and learning from mistakes and failures of the past. They recognise the importance of values such as honesty and empathy and seeking the well-being of others and to distinguish between right and wrong. PL helps them acquire the skill of leadership, self-regulation and responsibility.
Digital literacy (DL)	DL helps learners to discover, acquire, and communicate through ICT to support their learning. It also makes them use digital media responsibly.

Learning domains (expected learning behaviours)

There are three integral learning domains that should be the basis for instruction and assessment:

- Knowledge, understanding and application
- Process skills
- Attitudes and values.

Knowledge, understanding and application

Under this domain, learners may acquire knowledge through some learning experiences. They may also show understanding of concepts by comparing, summarising, rewriting, etc., in their own words and constructing meaning from instruction. The learner may also apply the knowledge acquired in some new contexts.

See the new *Mathematics Curriculum for Primary Schools (Basic 4–6)* pages ix–x for a more detailed description.

Skills and processes

The mathematical method is the means by which a mathematician solves problems or seeks to gain information about events. Learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. The more often they are faced with these challenges, the more likely they are to develop a positive attitude toward mathematics, and the more likely they are to develop the relevant process skills.

See the new *Mathematics Curriculum for Primary Schools (Basic 4–6)* pages x–xi for a more detailed description.

Attitudes

To be effective, competent and reflective citizens who are capable of solving personal and societal problems, learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. Learners therefore need to acquire positive attitudes, values and psychosocial skills that will enable them to participate in debates and take a stand on issues affecting them and others.

See the new *Mathematics Curriculum for Primary Schools (Basic 4–6)* page xii for a more detailed description.

Values

At the heart of this curriculum is the belief in nurturing honest, creative and responsible citizens. As such, every part of this curriculum, including the related pedagogy should be consistent with a certain set of values.

See the new *Mathematics Curriculum for Primary Schools (Basic 4–6)* page xiii for a more detailed description.

Assessment

Assessment is a process of collecting and evaluating information about learners and using the information to make decisions to improve their learning.

In the curriculum, it is suggested that assessment is used to promote learning. Its purpose is to identify the strengths and weaknesses of learners to enable teachers to ascertain their learners' response to instruction. This Teacher's Guide contains a Teacher Assessment section to guide you how to assess the concepts taught. The new *Mathematics Curriculum for Primary Schools (Basic 4–6)* provides on page xiv a detailed outline of the difference between formative and summative assessment and how to apply it in your classroom.

When developing assessment procedures, it is important to remember to try to select indicators in such a way that you will be able to assess a representative sample from a given strand. Each indicator in the curriculum is considered a criterion to be achieved by the learners. When you develop assessment items or questions that are based on a representative sample of the indicators taught, the assessment is referred to as a 'criterion-referenced assessment'. In many cases, a teacher cannot assess all the indicators taught in a term or year. The assessment procedure you use, i.e. class assessments, homework, projects, etc., must be developed in such a way that the various procedures complement one another to provide a representative sample of indicators taught over a period.

Suggested time allocation

Two periods per day (two 30-minute periods)

Pedagogical approaches

Pedagogical approaches include the approaches, methods, strategies, appropriate relevant teaching and learning resources for ensuring that every learner benefits from teaching and learning process. You, as the teacher, should:

- create learning-centred classrooms through the use of creative approaches
- position inclusion and equity at the centre of quality teaching and learning
- use differentiation and scaffolding as teaching and learning strategies
- use information and communication technology (ICT) as a pedagogical tool
- identify subject-specific instructional expectations to make the subject relevant
- integrate all assessment strategies
- use questioning techniques that promote deep learning.

This Teacher's Guide provides teaching methodology for each lesson and concept to ensure that the correct pedagogical approach is used. However, this may need to change based on the skills levels of your class in any year, so use your own experience and discretion to adapt these methodologies accordingly.

Learning-centred pedagogy

A learning-centred classroom creates the opportunity for learners to engage in meaningful hands-on activities that relate what they are learning with the real world. Learners should discuss ideas, become actively engaged in looking for answers and work in groups to solve problems. They should also do information research, analyse and evaluate information. The aim of the learning-centred classroom is to enable learners take ownership of their learning.

Inclusion

Inclusion is ensuring access and learning for all learners especially those that are disadvantaged. Each lesson in this Teacher's Guide contains advice on how to teach that particular concept to large classes, and to learners with special needs.

Differentiation and scaffolding

Differentiation is a process by which differences (in learning styles, interest and readiness to learn) between learners are accommodated so that all learners in a group have the best possible chance of learning. Differentiation could be by content, tasks, questions, outcome, groupings and support.

Technique	Process	Example
Differentiation by task	Teachers set different tasks for learners of different abilities.	When sketching the plan and shape of their classroom, some learners could be asked to sketch free hand while others could be asked to trace the outline of the plan.
Differentiation by support	The teacher gives the needed support.	The teacher refers weak learners to the Guidance and Counselling Unit for academic support.
Differentiation by outcome	The teacher allows learners to respond at different levels.	Weaker learners are allowed more time for complicated tasks.
Scaffolding	The teacher uses a variety of instructional techniques to progress learners towards stronger understanding.	Break up the learning task, experience or concept into smaller parts and then provide learners with the support they need to learn each part.

Information and communication technology (ICT)

ICT has been integrated into the Mathematics curriculum as part of the core of education, alongside reading, writing and numeracy. Teachers are encouraged to use ICT as a teaching and learning tool to enhance deep and independent learning. If your school has Internet access, these functions can be done online. Alternatively, download the clips or games to use offline in the classroom.

Examples of ICT in the Mathematics classroom

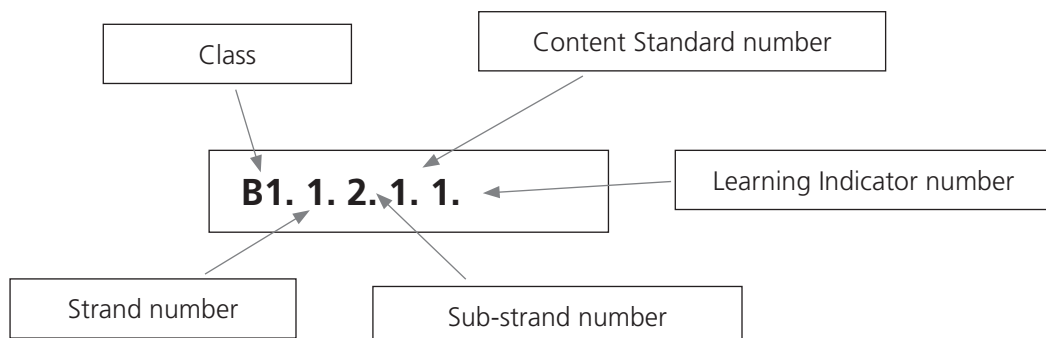
- Use calculators to solve problems.
- Use cameras to record results and steps in a problem-solving process.
- Use multimedia to support the teaching and learning process.
- Show YouTube videos to explain certain concepts visually.
- Search for grade-appropriate online mathematics games for each concept.
- Encourage learners to play the game online in groups, pairs or individually.
- Learners can research data online to bring to school when required.
- Start teaching the basic skills of MS Office, using basic word processing skills, spreadsheets and PowerPoint presentations.

The use of ICT as a teaching and learning tool is to provide learners with access to large quantities of information online and offline. It also provides the framework for analysing data to investigate patterns and relationships. Once learners have made their findings, ICT can help them organise, edit and print the information in many different ways.

The exposure that learners are given at the primary school level to use ICT in exploiting learning will build their confidence and will increase their level of motivation to apply ICT use in later years, both within and outside of education. ICT use for teaching and learning is expected to enhance the quality of learning and the competence level of learners.

Organisation and structure of the curriculum

This Teacher's Guide follows the curriculum in organising its content under key headings and annotations as shown in the figure below.



The content standards in this document are organised by grade level. Within each grade level, the contents are grouped first by strands. Each strand is further subdivided into sub-strands of related indicators.

- **Class** is the grade level/year being studied.
- **Indicators** are learning outcomes that define what learners should know and be able to do.
- **Content standards** are groups of related indicators. Note that indicators from different content standards may sometimes be closely related, because mathematics is a connected subject.
- **Strands** are the main branches of the mathematics content to be studied.
- **Sub-strands** are larger groups of related indicators (or mathematics topics to be studied). Indicators from different sub-strands may sometimes be closely related.

The content standards are organised under four strands:

1. Number
2. Algebra
3. Geometry and measurement
4. Data

The following table shows the scope and sequence of the strands addressed at the B4–B6 phase. The remaining part of the document presents the details of the content standards and indicators for each grade level.

Structure of the curriculum

Strands	Sub-strands		
	B4	B5	B6
Number (counting, representation, cardinality and operations)	Whole numbers counting and representation	Whole numbers counting and representation	Whole numbers counting and representation
	Whole numbers operations	Whole numbers operations	Whole numbers operations
	Fractions, representation and relationship	Fractions, representation and relationship	Fractions, representation and relationship
Algebra	Patterns and relationships	Patterns and relationships	Patterns and relationships
	Functions and unknowns	Functions and unknowns	Functions and unknowns
	Expressions	Expressions	Expressions
	Equations and inequalities	Equations and inequalities	Equations and inequalities
Geometry and measurement	Lines and shapes	Lines and shapes	Lines and shapes
	Measurement	Measurement	Measurement
	Geometrical reasoning	Geometrical reasoning	Geometrical reasoning
Data	Data (collection, organisation, interpreting, analysis)	Data (collection, organisation, interpreting, analysis)	Data (collection, organisation, interpreting, analysis)
	Data	Chance (probability)	Chance (probability)

Strands	Sub-strands	B4	B5	B6
Number	Whole numbers: counting and representation	✓	✓	✓
	Whole numbers operations	✓	✓	✓
	Fractions representation and relationship	✓	✓	✓
Algebra	Patterns and relationships	✓	✓	✓
	Functions and unknowns	✓	✓	✓
	Expressions	✓	✓	✓
	Equations and inequalities	✓	✓	✓
Geometry and measurement	Lines and shapes	✓	✓	✓
	Measurements	✓	✓	✓
	Geometrical reasoning	✓	✓	✓
Data	Data (collection, organisation, interpreting, analysis)	✓	✓	✓
	Chance (probability)		✓	✓

Curriculum coverage table – Basic 5

Strand 1: Number			
Sub-strand 1: Counting, representation and cardinality			
Content standard	Indicator	Page references	
		LB	TG
<p>B5.1.1.1 Demonstrate an understanding of quantities and place value for multidigit numerals up to 1,000,000. Refer to Workbook pages 1–16 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	B5.1.1.1.1 Model number quantities up to 1,000,000 using graph sheets and multi-base blocks	1–7	1–4
	B5.1.1.1.2 Read and write numbers in figures and in words up to 1,000	8–15	5–8
	B5.1.1.1.3 Identify numbers in different positions around a given number in a number chart	16–17	10–12
	B5.1.1.1.4 Compare and order whole numbers up to 100,000 and represent the comparison using $>$, $<$ or $=$	18–22	13–16
	B5.1.1.1.5 Round (off, up, down) whole numbers up to 100,000 to the nearest ten thousands, thousands, hundreds and tens	23–27	16–19
	B5.1.1.1.6 Skip count forwards and backwards in 500s, 1,000s, etc., up to and from 100,000	28–29	19–20
<p>B5.1.1.2 Demonstrate an understanding of Roman numerals up to C (i.e. 100). Refer to Workbook pages 17–19 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	B5.1.1.2.1 Recognise the Roman numerals system up to C (i.e. 100)	30–31	21–23
	B5.1.1.2.2 Count and convert Hindu–Arabic numbers to Roman numerals up to 100 (C) and vice versa	32–33	24–26

Content standard	Indicator	Page references	
		LB	TG
<p>B5.1.1.3 Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100. Refer to Workbook pages 20–24 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	B5.1.1.3.1 Identify the factors of whole numbers 1–100	34–36	27–29
	B5.1.1.3.2 Generate and identify prime numbers and composite numbers between 1 and 100	37–39	30–33
	B5.1.1.3.3 Identify even and odd numbers between 1 and 100 as numbers that can be arrayed in twos arrays and those that cannot	40–42	34–36
	B5.1.1.3.4 Determine the highest common factor of any 2 or 3 numbers by prime factorisation	43–51	37–45
	B5.1.1.3.5 Recognise the relationship between factors and multiples of whole numbers from 1 to 100	52–54	46–47

Sub-strand 2: Number operations

Content standard	Indicator	Page references	
		LB	TG
<p>B5.1.2.1 Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts. Refer to Workbook pages 25–28 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	B5.1.2.1.1 Apply mental mathematics strategies and number properties, such as skip counting from a known fact, using doubling or halving, using patterns in the 9s facts, using repeated doubling or halving, to determine answers for basic multiplication facts to 81 and related division facts	55–59	50–54
	B5.1.2.1.2 Apply mental mathematics strategies for multiplication, such as annexing then adding zero, halving and doubling using the distributive property	60–64	55–59

Content standard	Indicator	Page references	
		LB	TG
<p>B5.1.2.2 Demonstrate an understanding of multiplication of a 2- or 3-digit number by a 2- or 3-digit number. Refer to Workbook pages 29–32 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.2.2.1 Multiply multidigit numbers by 2-digit numbers efficiently</p>	65–70	60–66
<p>B5.1.2.3 Recall basic division facts up to 100. Refer to Workbook pages 33–36 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.2.3.1 Determine basic division facts up to 81</p>	71–72	67–68
<p>B5.1.2.4 Demonstrate an understanding of division of a 2- or 3-digit number by a 1- or 2-digit number. Refer to Workbook pages 37–39 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.2.4.1 Divide 3-digit numbers by 1-digit numbers efficiently</p>	73–75	69–70

<p>B5.1.2.5 Translate word problems into mathematical sentences and solve. Refer to Workbook pages 40–43 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.2.5.1 Solve multistep word problems involving the four basic operations</p>	76–77	72–74
<p>B5.1.2.6 Demonstrate an understanding of integers. Refer to Workbook pages 44–46 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.2.6.1 Solve simple addition and subtraction problems involving integers</p>	78–80	75–77

Sub-strand 3: Number: Fractions

Content standard	Indicator	Page references	
		LB	TG
Revision		81–82	
<p>B5.1.3.1 Demonstrate an understanding of strategies for comparing, adding, subtracting and multiplying fractions. Refer to Workbook pages 47–52 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.3.1.1 Determine equivalent fractions of given fractions</p>	83–84	78–81
	<p>B5.1.3.1.2 Compare and order fractions</p>	85–88	81–84
	<p>B5.1.3.1.3 Use the concept of equivalent fractions in changing fractions to the same denominator for addition and subtraction of like fractions (one denominator being a multiple of the other)</p>	89–92	84–86
	<p>B5.1.3.1.4 Use the concept of equivalent fractions for addition and subtraction of fractions greater than one (improper or mixed fractions)</p>	93–97	87–90

	B5.1.3.1.5 Use models to explain the result of multiplying a whole number by a fraction	98–102	90–93
	B5.1.3.1.6 Use models to explain the result of multiplying a fraction by whole number		
Sub-strand 4: Number: Decimals			
Content standard	Indicator	Page references	
		LB	TG
B5.1.4.1 Demonstrate an understanding of decimals and strategies for comparing, adding and subtracting decimals. Refer to Workbook pages 53–61 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.	B5.1.4.1.1 Describe and represent decimals (up to the thousandths) concretely, pictorially, and symbolically and relate them to fractions	103–109	93–96
	B5.1.4.1.2 Compare and order decimals and a mixture of common fractions and decimals (up to the thousandths) using the symbols $<$, $>$ or $=$	110–112	97–100
	B5.1.4.1.3 Round decimals to the nearest tenth and hundredth	113	101–102
	B5.1.4.1.4 Use models to explain the result of addition and subtraction of decimals (up to the thousandths)	114–118	103–106
	B5.1.4.1.5 Use models to explain the result of multiplying a decimal (up to the thousandths) by a whole number	119–122	107–109

Sub-strand 5: Number: Percentage			
Content standard	Indicator	Page references	
		LB	TG
<p>B5.1.5.1 Demonstrate an understanding of a percentage of a given number.</p> <p>Refer to Workbook pages 62–68 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.1.5.1.1 Determine the percentage of a given quantity (limit to 2-digit whole numbers) and vice versa</p>	123–130	110–113
	<p>B5.1.5.1.2 Determine the benchmark percentages from their common fractions and use these to estimate percentages of quantities</p>	131–134	114–116
	<p>B5.1.5.1.3 Identify and describe percentage from real-life contexts and solve problems using percentage</p>	135–138	117–119
Strand 2: Algebra			
Sub-strand 1: Patterns and relationships			
Content standard	Indicator	Page references	
		LB	TG
<p>B5.2.1.1 Determine the pattern rule to make predictions about subsequent elements.</p> <p>Refer to Workbook pages 69–81 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.2.1.1.1 Extend a given pattern with and without concrete materials, and explain how each element differs from the preceding one</p>	139–143	120–123
	<p>B5.2.1.1.2 Describe, orally or in writing, a given pattern, using mathematical language, such as one more, one less, five more, one more than or less than twice, etc.</p>	144–146	124–127
	<p>B5.2.1.1.3 Predict subsequent elements in a given pattern</p>	147–149	128–130
	<p>B5.2.1.1.4 Represent a given pattern visually to verify predictions</p>	150–152	131–133
	<p>B5.2.1.1.5 Solve a given problem by using a pattern rule to determine subsequent elements</p>	153–155	134–135

	B5.2.1.1.6 Determine and explain why a given number is or is not the next element in a pattern	156–157	136–137
	B5.2.1.1.7 Write a rule in words and in algebra to represent a given pattern	158–160	138–140
	B5.2.1.1.8 Describe the relationship in a given table or chart, using a mathematical expression	161–162	141–143

Sub-strand 2: Algebraic expressions

Content standard	Indicator	Page references	
		LB	TG
<p>B5.2.2.1 Demonstrate an understanding of algebraic expressions. Refer to Workbook pages 82–84 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	B5.2.2.1.1 Demonstrate understanding of algebraic expressions as mathematical phrases that can contain letters which represent ordinary numbers and operators (like add, subtract, multiply, and divide)	163–167	144–146

Sub-strand 3: Variables and equations

Content standard	Indicator	Page references	
		LB	TG
<p>B5.2.3.1 Solve problems involving single-variable, one-step equations with whole number coefficients. Refer to Workbook pages 85–89 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	B5.2.3.1.1 Express a given problem as an equation where the unknown is represented by a letter or variable	168–171	147–149
	B5.2.3.1.2 Identify the unknown in a problem; represent the problem with an equation; and solve the problem concretely, pictorially or symbolically	172–176	150–152
	B5.2.3.1.3 Create a problem for a given equation	177–178	

Strand 3: Geometry and measurement

Sub-strand 1: Lines and shapes

Content standard	Indicator	Page references	
		LB	TG
B5.3.1.1 Identify and sort quadrilaterals, including rectangles, squares, trapezoids, parallelograms, and rhombuses, according to their attributes. Refer to Workbook pages 90–97 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.	B5.3.1.1.1 Demonstrate an understanding of the properties (e.g. sides, angles, and diagonals) of squares and rectangles	179–183	153–155
	B5.3.1.1.2 Use paper folding with cut-out squares and rectangles to investigate sides, angles, and diagonals properties	184–186	156–158
	B5.3.1.1.3 Prove that a polygon is regular by measuring the sides and angles or by folding and superimposing	187–191	159–161

Sub-strand 2: Measurement

Content standard	Indicator	Page references	
		LB	TG
B5.3.2.1 Estimate and measure perimeter and surface area of 2D shapes using centimetres and metres. Refer to Workbook pages 98–104 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.	B5.3.2.1.1 Estimate perimeter using referents for centimetres and metres, and calculate the actual perimeter and compare	192–197	162–163
	B5.3.2.1.2 Calculate perimeter of given shapes in centimetres and metres		164–165
	B5.3.2.1.3 Calculate surface area of given shapes in centimetres and metres	198–203	166–167

B5.3.2.2 Demonstrate an understanding of volume of common 3D shapes. Refer to Workbook pages 105–112 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.	B5.3.2.2.1 Select and justify referents for cm^3 or m^3 units	204–205	168–169
	B5.3.3.2.2 Determine the volume of boxes by finding how many cubes of sizes 1 cm^3 each contains	206–211	170–171
	B5.3.2.2.3 Determine different sizes of boxes that have the same volume	212–213	172–173
	B5.3.3.2.4 Demonstrate an understanding of capacity by describing the relationship between capacity and volume as well as litre and 10 cm^3	214–220	174–176

Sub-strand 3: Measurement: Angles

Content standard	Indicator	Page references	
		LB	TG
B5.3.3.3 Demonstrate an understanding of angles. Refer to Workbook pages 113–119 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.	B5.3.3.3.1 Identify examples of angles in the environment that are equal to, less than or larger than a right angle	221–223	177–178
	B5.3.3.3.2 Measure given angles with a protractor and classify them according to their measured sizes – right, acute, obtuse and reflex	224–228	179–182

Sub-strand 4: Geometric reasoning

Content standard	Indicator	Page references	
		LB	TG
B5.3.4.1 Describe the position of objects in space using the cardinal points. Refer to Workbook pages 120–122 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.	B5.3.4.1.1 Tell the position and motion of objects in space using the cardinal points north, south, east and west	229–233	183–184

<p>B5.3.4.2 Perform a single transformation (i.e. reflection) on a 2D shape. Refer to Workbook pages 123–125 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.3.4.2.1 Identify images of a single transformation (i.e. reflection) of a 2D shape in a plane</p>	234–239	185–187
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Strand 4: Data

Sub-strand 1: Data collection, organisation, presentation, interpretation and analysis

Content standard	Indicator	Page references	
		LB	TG
<p>B5.4.1.1 Differentiate between first-hand and second-hand data. Refer to Workbook pages 126–128 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.4.1.1.1 Explain the difference between first-hand and second-hand data</p>	240–242	188–190
	<p>B5.4.1.1.2 Find examples of second-hand data in print and electronic media, such as newspapers, magazines, and the Internet</p>	243–245	191–192
<p>B5.4.1.2 Construct and interpret double bar graphs to draw conclusions. Refer to Workbook pages 129–134 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.4.1.2.1 Draw double bar graphs, complete with title, labelled axes, key or legend, to represent data collected (up to 3 pairs of categories of data) and use it to solve problems</p>	246–251	193–195
	<p>B5.4.1.2.2 Identify examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines and the Internet</p>	252–255	196–198

Sub-strand 2: Chance (probability)			
Content standard	Indicator	Page references	
		LB	TG
<p>B5.4.2.1 Describe the likelihood of a single outcome occurring using words such as impossible, possible, and certain.</p> <p>Refer to Workbook pages 135–139 for additional activities. You can assign the activities as Extension activities. Alternatively, you can assign the activities for Homework.</p>	<p>B5.4.2.1.1 Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible or certain</p>	256–259	199–201
	<p>B5.4.2.1.2 Design and conduct an experiment in which the likelihood of a single outcome occurring is impossible, possible (likely or unlikely), certain</p>	260–261	202–203
	<p>B5.4.2.1.3 Conduct a given probability experiment a number of times, recording the outcomes, and explaining the results</p>	262	204–205

Sub-strand 1: Counting, representation and cardinality

Content standard

B5.1.1.1: Demonstrate an understanding of quantities and place value for multidigit numerals up to 1,000,000

Indicator

B5.1.1.1.1 Model number quantities up to 1,000,000 using graph sheets and multi-base blocks

1. Learning expectations

Learners need to be able to:

- model numbers up to 1,000,000 in a variety of ways and move flexibly between representations
- communicate their mathematical thinking coherently and clearly to peers and teacher.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 1–6
- Graph sheets
- Multi-base blocks

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities, you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

Learners need a solid foundation in number if they are going to be successful in Mathematics. It is important for them to have time to develop their own strategies and processes for modelling and working with numbers. Models also serve as a link between number as a concept and the symbols that are used to express the concept.

Concrete models also enable learners to show their thinking about a mathematical concept. The learners can also use these concrete models to show their counting strategies.

Begin this substrand by allowing learners to use concrete materials, such as graph paper and pencils, and concrete materials, such as multi-base blocks, to model different numbers. Begin by asking them to model numbers less than 500 and gradually move to numbers up to 1,000,000.

Allow learners to first work in pairs, and once they are confident enough, to work on their own. Work through the various examples given in the Learner's Book and answer any questions learners may have. Make sure all learners understand this concept before asking them to complete questions 1 and 2 of Exercise 1.

6. Homework

Ask learners to complete question 3 of Exercise 1 as a homework assignment. Explain to them that they can use the notes of page 7 to help them answer the question. Once back in class, allow time for learners to provide feedback on how they use the notes to model the amounts given.

7. Diagnostic assessment

Learners have worked with modelling numbers since Grade 1. You can begin by asking learners to model smaller numbers in order to establish their prior knowledge, identify any misconceptions and make informed decisions about your teaching moving forward.

This will also give you an opportunity to see the different ability groups within your class and assign groups or pairs accordingly.

8. Answers

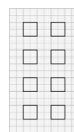
Exercise 1

(LB page 6)

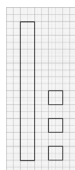
1. a)



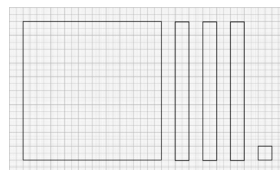
b)



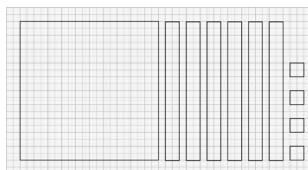
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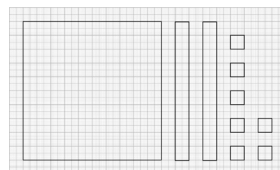
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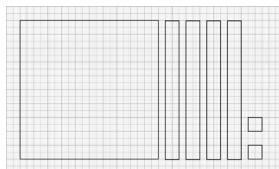
e)



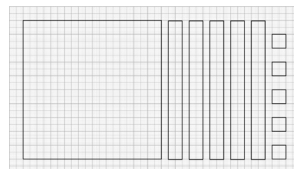
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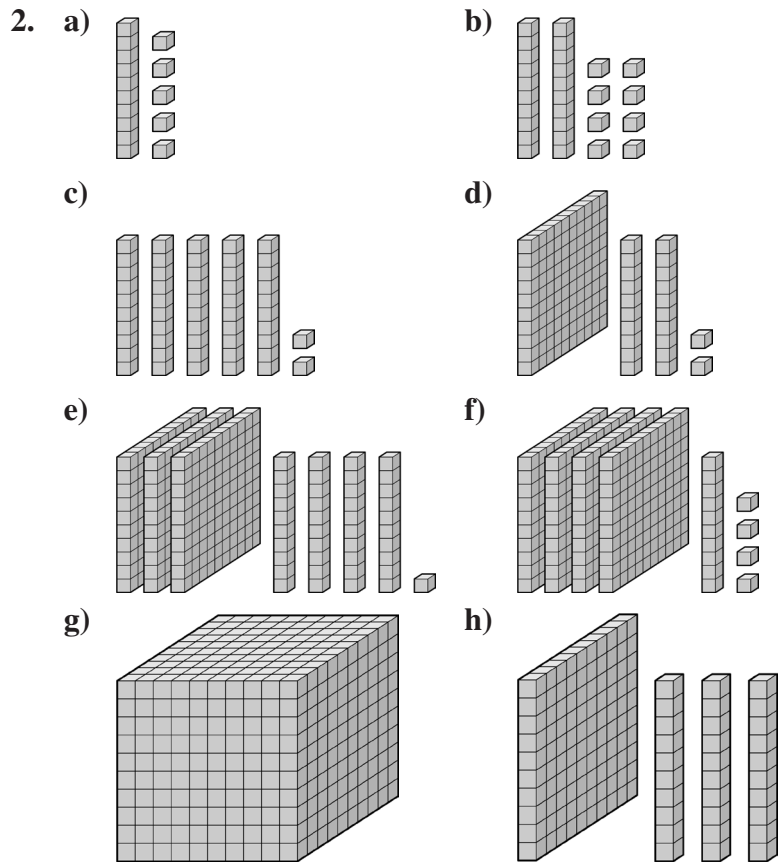


g)



h)





3. Learners' own work

Indicator

B5.1.1.1.2 Read and write numbers in figures and in words up to 1,000,000

1. Learning expectations

Learners need to be able to:

- write up to 7-digit numbers in words as well as to expand them.
- recognise and represent the numbers in order to describe and compare them.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 11–13
- Place value mats
- Place value charts
- Multi-base blocks or counters

3. Large class teaching

Place value is an important concept that learners need to understand in order to be successful in Mathematics. The ability to 'understand place value' becomes more complex every year. During this year, learners are expected to work with numbers up to 1,000,000 using number sense strategies based on place value.

To teach large classes, it is useful to work in collaborative peer groups. This will enable struggling learners as they learn from their peers. Using hands-on and visual manipulatives, such as base-ten blocks, enables learners to build whole numbers. Using games that learners can play in their peer groups will also help learners as they become adept at working out the place value of any digit in a number.

Remember that each block can represent different amounts – it all depends on how they are being used. You need to explain this to your learners and make sure that all groups understand the meaning of the blocks before trying to answer any questions in the activities.

You can also create simple place value charts for each group to use. These place value charts will teach groups to mimic the way a number is written from left to right.

4. Support for learners with special needs

Encourage your learners to help those learners who may require additional help in their groups because of a disability. They need to be sensitive to the needs of all the learners in their group and learn to work with differently abled people.

5. Teaching methodology

It is important for learners to understand the concept of place value. Begin this substrand by reminding learners that the place value of a number refers to the value of each digit in a number.

Instruct learners to work in pairs. Give each pair a place value chart. Write a number on the board, and ask the learners to represent the number on the place value chart. Once complete, they should join another pair and compare their answers. Invite a volunteer to come to the board to write the answer on the place value chart.

Provide enough examples for learners to practise, then work through the examples on pages 8 and 9 of the Learner's Book, before asking learners to complete Exercise 1 on their own.

When teaching place value, give learners enough time to work on representing a number using standard groupings and equivalent groupings. For example, the numeral 49 can be represented in standard form as 4 tens and 9 ones, but it can also be represented by 3 tens and 19 ones. Allow learners time to explore the relationship between the units and the relationship of place value including 10 units equal 1 ten, 10 tens equal 1 hundred, and so on.

Provide opportunities for learners to count in various groups of 10s, 100s, 1,000s, 10,000s, and so on. You may have learners in your class that still count in 5s, for example, when they could count more quickly in 10s. Encourage them to count in 10s because mentally it is easier and because our number system is based on 10s.

To reinforce place value, involve learners in a daily 'place value' warm-up game. Place value and understanding our base-10 number system is important for understanding other concepts in mathematics, so it is important that learners get enough practice in working with place value.

Work through the examples on pages 10–12 of the Learner's Book. Once you are confident that learners have a firm grasp on this concept, ask them to complete Exercise 2 and 3 on their own.

6. Homework

Ask learners to complete Exercise 4 as a homework assignment. Learners need to hand their books in to you for assessment. If you find that there are learners who are still struggling to grasp this concept, set aside some time to work with them in a smaller group.

7. Teacher assessment

Understanding place value is one of the foundations to understand mathematics at a higher level. However, often learners and teachers work through this section of the work quickly, instead of cementing a firm foundation in number sense. Many learners are able to engage in Mathematics classrooms without having a conceptual understanding of place value, but cannot access Mathematics when it becomes more complicated in higher grades.

Assess the learners' understanding of place value by allowing them time to work physically to construct numbers using place value mats, charts and multi-base blocks. Identify learners who are unable to construct bigger numbers and work with them in a group separate to the rest of the class. Again, co-teaching will enable you and your co-teachers to work in small collaborative groups that will give all learners an equal opportunity to achieve success.

8. Answers

Exercise 1

(LB page 9)

- a) Vatican City 800
Nauru 9,322
Marshall Islands 67,152
Iceland 311,058
Qatar 848,016

1. Learning expectations

Learners need to be able to:

- investigate the properties of whole numbers.
- recognise and list the multiples of 1,500 between 10,000 and 50,000.

2. Resources used in this chapter

- Learner's Book
- Workbook page 7
- Number charts
- Counters

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance and then provide opportunities for them to work with their peers in developing their strengths.

In this sub-strand, encourage learners to help one another by talking about the numbers that they are working with. If, for example, there are learners who have a visual impairment, other learners can tell them what the number is and ask them riddles about what comes before, after, and so on. Encourage

learners to find creative ways of helping their peers learn the concepts being taught. Through helping other learners, they will also be helping their own understanding of the concept.

5. Teaching methodology

Learners need many opportunities to learn and experience numbers. Learning to count, identify numbers and understand quantity are just a few of the important concepts they must master.

Repeated experiences build understanding and fluency with numbers. These experiences help expand understanding and learning new concepts. A strong number sense is vital for understanding more complex mathematics concepts in later grades.

Before this lesson, draw a number grid on the board and fill in numbers, with one number highlighted in the grid. At the start of the lesson, ask learners to identify the number. Ask them to come up with five facts about the number - guide them to say, for example, the number is 100 less than another number, the number is twice as big as a certain number, and so on. If there is enough time, you can give the learners another number on the grid and ask them to come up with five facts for that number.

Then look at the example on page 16 of the Learner's Book, as well as the solutions to the questions.

Ask learners to complete questions 1 and 2 of Exercise 1 on their own. Once complete, they can swap their work with a partner, who will assess their answers. If there are any differences, allow the pairs to discuss and come up with a solution they both agree on.

6. Homework

Learners complete question 3 as a homework assignment. Once back in class, allow learners to exchange their riddle with the partner and give them time to solve the problem.

7. Peer/group assessment

As learners work together, they can assist each other by assessing their work. When learners are completing the activities in this section, make sure they understand what is

required of them for each activity. Once they are done, write the answers on the board and ask learners to swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 17)

1. a) 46,000 b) 49,000 c) 17,500
 d) 77,500 e) 23,750 f) 95,000
2. 525,000
3. Learners' own work

Indicator

B5.1.1.1.4 Compare and order whole numbers up to 100,000 and represent the comparison using $>$, $<$ or $=$

1. Learning expectations

Learners need to be able to:

- investigate the whole numbers and order them in ascending or descending order
- use signs of equivalence when comparing numbers.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 7–9
- Number charts
- Counters

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

It will probably not be possible for you to give individual feedback to all the learners in your class. Therefore, teach learners the importance of peer-to-peer feedback as well as self-reflection. It might be difficult in the beginning, but with more practice, your learners will become adept at doing this and begin to accept it as part of their teaching and learning experience.

Another obstacle for teaching this concept might be a lack of resources. Use resources available in and around the school. Ask learners to bring old sucker sticks, bottle tops, stones, and so on, to school. You can even use pips of fruit (cleaned and dried) as counters.

4. Support for learners with special needs

By Grade 5, most learners understand the basic operations and the associated symbols ($+$; $-$; \times ; \div ; $=$). However, some students struggle to interpret the inequality signs ($>$; $<$).

These symbols, along with the equal symbol, should be understood as relational symbols. Learners need to understand that they are comparing two numbers and indicate the relationship between the numbers.

Spend time teaching these relationships to your learners. Those who struggle with learning disabilities should be given a chance to ask questions and make sense of the relationship represented by each symbol. Associate the symbols with something learners are familiar with or something that they can do physically to help them grasp the concepts. If learners are not given an opportunity to understand and practise working with these relational symbols, they will continue to misinterpret these as they progress to higher grades.

5. Teaching methodology

Explain to your learners that they will practise comparing numbers. Ask for a volunteer to explain to the rest of the class what the word ‘compare’ means. Remind learners about what it means to see if one number is the same as, smaller than or bigger than another number. Give opportunities for learners to compare different numbers using the words equal, greater than or smaller than.

Refer learners to the example on page 19 of the Learner's Book. Work through the example with your learners, making sure they understand what is being explained.

Then move on to using the symbols. Learners have worked with these symbols before, but check to see if there are any learners who still need support in using the symbols correctly. Use visual aids such as comparing the $>$ to a 7 (big) and $<$ to a 4 (small). You can use what is best for your class.

Read through the text on page 18 of the Learner's Book and then work through the example. The example uses learners' prior knowledge of place value to compare two numbers. Make sure your learners are able to work with the place value chart before moving on to using symbols. Provide more examples for learners to practise with.

On page 20 we introduce the symbols used to represent greater than, less than and equal to. Work through the examples with your learners before asking them to complete questions 1 to 4 of Exercise 1.

6. Homework

Assign questions 5 and 6 as a homework assignment. For question 6, learners need to come up with at least five of their own sentences for comparing the two numbers given. Once back in class, learners work in groups. They can check the answers each group member gave for question 5, then discuss their sentences for question 6. If there is enough time, allow groups to provide feedback.

7. Self/Peer assessment

Work through the answers to the activities with the class. Write them on the board. Ask learners to correct their own work or to swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 21)

- 698,866; 775,421; 815,336; 928,002
 - 482,869; 696,122; 784,231; 832,146
 - 357,289; 375,298; 677,125; 767,125
 - 175,175; 242,242; 809,809; 998,998
- >
 - >
 - >
 - <
 - =
 - <
 - =
- The blue vehicle
 - Blue vehicle = GH¢111,000
Yellow car = GH¢84,200
Green motorbike = GH¢6,000
Bicycle = GH¢1,100
 - The bicycle
- 712,544 or any other acceptable number
 - 754,214 or any other acceptable number
 - 254,714 or any other acceptable number
- Learners' own work
- Learners' own work

1. Learning expectations

Learners need to be able to:

- investigate relevant place values in the process of rounding a number
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 10–11
- Number lines
- Place value charts

3. Large class teaching

The best way to work with large classes is to get to know your learners. Check which of your learners are comfortable speaking in front of the whole class and which learners are comfortable speaking in smaller groups. As the learners work in groups, monitor their progress closely.

You can use all sorts of tips and tricks to teach the rounding of numbers. Ask learners to come up with chants or songs about rounding numbers in their small groups. Ask learners to write instruction cards or make a poster on how to round numbers. Make sure the whole group is involved in coming up with the 'fun' way of remembering. In this way, all the group members will remember their 'trick' for rounding.

4. Support for learners with special needs

Teaching rounding by using 'tricks' is a short-term solution. Once all the learners in the groups are comfortable with their strategy on rounding numbers, explain to them that to be successful in rounding numbers, they need to understand and be comfortable working with place value. If you find that

there are still learners struggling with place value concepts, work with them in smaller break-away groups. Be especially aware of learners with special needs and guide them using visual or auditory cues.

5. Teaching methodology

Rounding off numbers could be tricky for some learners, so work through the text and examples provided on pages 23 to 26 of the Learner's Book slowly, making sure all learners understand one concept before moving on to the next. Give learners ample opportunities to practise rounding.

Once all your learners are adept at using their strategy for rounding, begin teaching them how to use an open (empty) number line for rounding. This will not only help them with their rounding skills, but it will also help strengthen their place value understanding.

Learners begin working with an open number line and then use it to help them solve the problems they are working with. Once learners can work with the open number line to round off numbers, they will begin to visualise which number is closest to the number they are trying to round to.

Ask learners to work on their own to complete questions 1 and 2 of Exercise 1 on page 26 of the Learner's Book. Once they have completed their work, ask them to pair up with another learner. Instruct pairs to compare and correct their work. Once they are complete, write the answers on the board and ask learners to double check their work and correct any mistakes they may have made.

If you find that there are still learners who are struggling with rounding, arrange a time where you can work with them in a smaller group.

6. Homework

Assign questions 3 and 4 as Homework. Read through the questions and allow learners to ask questions. Refer them back to the example on page 26, which will aid them when solving the problems for question 4. Once back in class, ask learners to hand their books to you for assessment.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 26)

1.

43,865	Rounded up	Rounded down	Rounded off
To the nearest ten	43,870	43,860	43,870
To the nearest hundred	43,900	43,800	43,900
To the nearest thousand	44,000	43,000	44,000
To the nearest ten thousand	40,000	40,000	40,000

2. a) 75,420 b) 75,400 c) 75,000 d) 80,000

3. a) seventy-eight thousand three hundred and fifty-six
eighty-nine thousand six hundred and fifty-four
ninety thousand two hundred and seventy-eight
forty-five thousand nine hundred and ninety-eight

b) – e)

Round off to:	b) nearest 10	c) nearest 100	d) nearest 1,000	e) nearest 10,000
78,356	78,360	78,400	78,000	80,000
89,654	89,650	89,700	90,000	90,000
90,278	90,280	90,300	90,000	90,000
45,998	46,000	46,000	46,000	50,000

4. a) $70,000 + 20,000 = 90,000$
b) $40,000 + 60,000 = 100,000$
c) $20,000 + 40,000 = 60,000$
d) $50,000 + 30,000 = 80,000$
e) $30,000 - 20,000 = 10,000$
f) $80,000 - 40,000 = 40,000$
g) $60,000 - 20,000 = 40,000$
h) $90,000 - 70,000 = 20,000$

Indicator

B5.1.1.1.6 Skip count forwards and backwards in 500s, 1,000s, etc. up to and from 100,000

1. Learning expectations

Learners need to be able to:

- develop attention to precision

2. Resources used in this chapter

- Learner's Book
- Workbook pages 14–15
- Number lines
- Number charts
- Counters

3. Large class teaching

A big challenge when teaching a large class is to make learners aware that the teacher is in charge. Learners will respond negatively if you are insecure, unprepared or show ineffective management skills.

Encourage learners to participate in the lesson by asking questions, but be sure to always have control and to keep them focussed on what is being taught. Introducing humour or group work or demonstrations helps to provide breaks during the lesson. It is also useful for learners to work in pairs or small groups on an example given in the Learner's Book. They can read through the example, use manipulatives to set up the problem scenario, use drawings to help them understand the example, and so on. Once groups are complete, discuss the examples and the content as a whole class. This actively engages the class in learning and gives you an opportunity to check for any misconceptions that may have arisen.

4. Support for learners with special needs

When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the

best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities, you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

Skip counting is counting by a number that is not 1. This is an important skill for learners and they need continuous practice to sharpen their skills. You can play simple games, for example call out five learners to the front of the class. Start off with simple skip counting in 2s. Start at any random number. Have learners skip count till you say stop. The rest of the class must check that they are counting correctly.

Another teaching strategy is questioning. Ask learners to think critically about skip counting. It is easy for most learners to count in 2s using even numbers. Try asking them to count in 2s starting with an odd number. Ask other questions, such as 'How many ways can you count to 1,000', instead of asking learners if they can count to 10,000 in 100s, ask them if they can count to 10,000 in 75s.

Work through the text and examples before asking learners to complete Exercise 1.

6. Teacher assessment

Use the Answers section to assess learners' work.

7. Answers

Exercise 1

(LB page 29)

1.
 - a) 17,890; 18,890; 19,890; 20,890; 21,890; 22,890
 - b) 38,320; 37,820; 37,320; 36,820; 36,320; 35,820
 - c) 78,955; 78,980; 79,005; 79,030; 79,055; 79,080
 - d) 91,268; 89,786; 88,268; 86,768; 85,268
2.
 - a) 46,730 should be inserted between 46,480 and 46,980
 - b) 92,080 should be 90,730
 - c) 4,409 should be 4,490
3. Learners' own work

Content standard

B5.1.1.2: Demonstrate an understanding of Roman numerals up to C (i.e. 100)

Indicator

B5.1.1.2.1 Recognise Roman numerals up to C (i.e. 100)

1. Learning expectations

Learners need to be able to:

- investigate and convert Roman numerals to Hindu-Arabic numerals and vice versa
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 17–19
- Roman numeral chart

3. Large class teaching

In a large class, learners work best in pairs and groups. These should be collaborative groups in which learners can learn from one another, so differently abled learners should be matched together. Using pair and group work will also ensure that learners are not left out or become bored because of listening to you doing all the talking.

More able learners in the group can help the others to master the concept being taught, but be sure to monitor each group's understanding of the concept. You can use group leaders or monitors who can assist those learners who work at a slower pace than others. Learners need to be encouraged to find creative ways of remembering the concepts taught.

Move around the classroom to see what progress learners are making and to catch any misconceptions that may come up. Give advice, encouragement and extra individual help where it is needed.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

In this sub-strand, encourage learners to help one another by talking about the numbers that they are working with. If, for example, there are learners who have a visual impairment, other learners can tell them what the number is and ask them riddles about what comes before, after, and so on. Encourage learners to find creative ways of helping their peers learn the concepts being taught. Through helping other learners, they will also be helping their own understanding of the concept.

5. Teaching methodology

Learners need many opportunities to learn and experience Roman numerals. Use real-life examples of where learners can find Roman numerals. Learning to count, identify numbers and understand quantity are just a few of the important concepts they must master for these numbers.

Repeated experiences build understanding and fluency with numbers. These experiences help expand understanding and learn new concepts. It is important to help your learners understand that numerals can be combined to make lots of different numbers. Show them a 1–100 Roman numeral table. Then explore various number combinations and explain how the numerals ‘work’.

Work through the text on pages 30 and 31 of the Learner’s Book. Look at the examples given for the addition and subtractions rules. Mastery of these rules will enable learners to write Roman numerals correctly. Once you are satisfied that all your learners understand the concept, ask them to work on their own to complete Exercise 1.

6. Homework

As a research task, you can ask learners to work in groups to find out more about the history of Roman numerals. Ask them to prepare a chart with their findings to class. Allow

Indicator

B5.1.1.2.2

Count and convert Hindu–Arabic numbers to Roman numerals up to 100 (C) and vice versa

1. Learning expectations

Learners need to be able to:

- investigate and convert Roman numerals to Hindu–Arabic numerals and vice versa
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner’s Book
- Workbook pages 17–19
- Roman numeral chart

3. Large class teaching

Large classes do not need to be less effective than smaller ones. However, teaching a large class will require you to be more conscious in your lesson planning.

Large classes work best when learners are actively involved in their learning and take an active interest in the subject. Learning a different number system to what they are used to can be scary for some learners, but once they are able to connect the number system to their own, they will become adept at using it.

You can even explain to them that there have been many different number systems that were used in the past. They can work in groups to research number systems and how they have developed, and why we use the number system that we do.

4. Support for learners with special needs

If you recognise that some learners are struggling to convert between Roman numerals and our number system, work with them in a separate break-away group. Encourage them not to become frustrated if they cannot grasp the concept the first

time around, but to continue learning at their own pace.

Provide number charts that have both Roman numerals and Arabic numbers and explain to them how they can move from one representation to the other and vice versa.

5. Teaching methodology

It is important for learners to understand that numbers can be represented in different ways. Before our current number system was used, people used many other different ways to represent numbers.

One of these ways was using Roman numerals. Even though learners may not see many examples of Roman numerals today, they need to understand that it can help us understand basic mathematics facts. Learning Roman numerals is also a great way to help them enhance their number sense, understand how numbers work, and helps to improve their mental maths skills.

Remind learners of what Roman numerals look like. To get started, show learners 'the basics'. While B5 learners are only required to learn the numbers 1 to 100, you can introduce 500 = D and 1,000 = M as part of the seven symbols used to represent Roman numerals.

1	5	10	50	100	500	1,000
I	V	X	L	C	D	M

Explain to learners how these symbols are combined together to make different numbers and how to read or convert them.

6. Self/Peer assessment

Go through the answers with the class. Write them on the board. Ask learners to correct their own work/swap books and mark each other's work.

7. Answers

Exercise 1

(LB page 33)

- | | |
|----------|-------|
| 1. a) 19 | b) 12 |
| c) 24 | d) 54 |
| e) 47 | f) 18 |
| g) 92 | h) 96 |

- | | |
|--------------|--------------|
| i) 38 | j) 71 |
| k) 93 | l) 42 |
| m) 84 | n) 65 |
| o) 49 | p) 74 |
| q) 97 | r) 39 |
| s) 43 | t) 58 |
| u) 67 | v) 80 |

- 2.
- | | |
|-------------------|------------------|
| a) IX | b) L |
| c) XLI | d) XXXII |
| e) XV | f) LXXII |
| g) XLVI | h) XI |
| i) XXVI | j) VIII |
| k) XVII | l) XXV |
| m) XXXVII | n) LV |
| o) LXXXI | p) XLVIII |
| q) LIX | r) XCIV |
| s) LXXVIII | t) LXIV |
| u) LXXXVII | v) XCVI |

Content standard

B5.1.1.3: Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100

Indicator

B5.1.1.3.1 Identify the factors of whole numbers 1–100

1. Learning expectations

Learners need to be able to:

- explain what a factor is.
- explain what a multiple is.
- distinguish between odd and even numbers
- identify prime and composite numbers.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 20–21
- 100-number chart
- Counters
- Arrays up to 100

3. Large class teaching

In a large class, learners work best in pairs and groups. These should be collaborative groups in which learners can learn from one another, so differently abled learners should be matched together. Using pair and group work will also ensure that learners are not left out or become bored because of listening to you doing all the talking.

More able learners in the group can help the others to master the concept being taught, but be sure to monitor each group's understanding of the concept. You can use group leaders or monitors who can assist those learners who work at a slower pace than others. Learners need to be encouraged to find creative ways of remembering the concepts taught.

Move around the classroom to see what progress learners are making and to catch any misconceptions that may come up. Give advice, encouragement and extra individual help where it is needed.

4. Support for learners with special needs

Learners should be familiar with the vocabulary of factors by now. However, you can provide translations, definitions and/or examples of unfamiliar vocabulary words to help those learners who struggle to grasp this concept. Allow learners to work with carefully selected partners, so that all learners will have the opportunity for success. If learners with special needs have a peer they feel comfortable working with, allow them to work with the same person. Also allow extra time for these learners to complete any independent work they need to do.

If you see that learners are still struggling with a problem, rather reduce the number of questions they need to answer. It is better for the learner to gain understanding when they are working with only one or two problems, than to have them struggling to complete many.

All concepts in mathematics require learners to continually practise what they have learnt. Reinforce this habit in learners at an early age, but do not put unnecessary pressure on learners with special needs.

5. Teaching methodology

Learners can use counters to revise their understanding of factors for numbers between 1 and 20. Remind them that a factor is a number that divides into another number exactly without leaving any remainder. Learners should also have experience with multiplication facts with products that are 20 or less.

Ask learners to answer the question: How many factors can different numbers have? Then ask, ‘Can you think of different ways to count to ten?’ Make sure learners understand that their counting method must land exactly on ten; counting by 3s or 6s is not appropriate for this question. Call on learners who discovered that you can also count to ten by five or ten to explain this concept. Write on the board:

Our ways to count to ten

- By ones
- By twos
- By fives
- By ten

Next ask learners if they can find any ways in which they could use the numbers in the list to equal a product of ten. Give learners some time to think and then call on a volunteer.

The appropriate response should be that $1 \times 10 = 10$ and $2 \times 5 = 10$.

Explain to your learners that when they were thinking of ways to count to 10, they were finding the factors of 10. Gradually increase the number range until learners understand that what they are finding are the factors of the numbers up to 100. Ask learners to explore the concept by finding the factors of 15, 20, 30, and so on, with their partners. Allow them to use counters to verify their ideas about the factors by putting their counters into groups.

Some learners may begin to see mathematical patterns when determining factors and may no longer need manipulatives. One pattern they may notice is that all even numbers have factors that are divisible by 2. Another is that all numbers that end in 0 or 5 have 5 as a factor. Encourage them to look for other patterns they can find.

6. Homework

Split learners into groups and instruct them to create their own factor chart (1–50) for their groups. Encourage them to be as creative as possible. This will help to reinforce the concept of factors.

7. Summative assessment

Determine if your learners have understood this concept by checking their work after they have answered the activities in the Learner's Book. If you find that some learners need extra support, provide additional worksheets or problems for them to complete. Offer support as needed.

8. Answers

Exercise 1

(LB page 36)

1.
 - a) 1 and 8; 2 and 4
 - b) 1 and 15; 3 and 5
 - c) 1 and 18; 2 and 9; 3 and 6
 - d) 1 and 20; 2 and 10; 4 and 5
 - e) 1 and 22; 2 and 11
 - f) 1 and 24; 3 and 8; 6 and 4; 2 and 12
2.
 - a) The last array is incorrect. It shows 2 rows of 6 instead of 2 rows of 8.
 - b) Two rows of 8

1. Learning expectations

Learners need to be able to:

- Find the prime numbers between 1 and 100
- Find the composite numbers between 1 and 100
- Validate their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 21–23
- 100-number chart
- Counters

3. Large class teaching

Large classes do not need to be less effective than smaller ones. However, teaching a large class will require you to be more conscious in your lesson planning.

Large classes work best when learners are actively involved in their learning and take an active interest in the subject. Learning the difference between prime and composite numbers will follow directly after learning about factors. Let learners continue to work in the pairs and groups they were working in.

4. Support for learners with special needs

Learners who struggle with finding factors will need additional support. Assess whether there might be a barrier to their learning and understanding. Then work with them independently or as a small group. Review arrays, finding factors as well as definitions of factors, prime and composite numbers.

Provide constant feedback about learners' performance and ask questions to check for understanding.

5. Teaching methodology

Remind learners about what they learnt about factors. Give them some examples to check their understanding and whether they are able to find factors for numbers up to 100.

Then explain to learners that they will be learning about prime and composite numbers. Explain that a prime number is a number with exactly 2 factors, namely 1 and the number itself, while a composite number is a number with more than 2 factors. Check to see if they can give you any examples of prime and composite numbers (prior knowledge).

Play a game with the learners called factor rainbow. Explain by illustrating on the board. Draw a rainbow with the number 15 at the top of the rainbow. Ask learners to come up with factors for 15 starting at 1. They should say, 1 and 15. Write 1 and 15 on either ends of the rainbow. Ask if there are any other factors they can think of. Learners should come up with 3 and 5. Next, tell each learner to work in pairs to draw their own rainbow. Then ask them to draw a number out of a box/hat and write the factors on their rainbows.

Walk around the classroom to check that learners are completing the task correctly. Then ask two or three pairs to share the factors of their numbers they chose. They should then also explain if they have a prime or composite number – and why they say so.

Work in a small group with those learners who still require help grasping the concepts of prime and composite numbers.

Instruct learners to work in pairs to complete Exercise 1.

6. Homework

Assign Exercise 2, questions 1 and 2 as homework. Once back in class, work together as a class to check the answers, then split the learners into groups and instruct them to complete question 3.

7. Assessment

Determine whether your learners have gained an understanding of the vocabulary as well as how to find factors. Once they have mastered finding factors of numbers 1 to 100, they can easily determine which are prime and

composite numbers. Check that all learners are able to list the factors of numbers 1 to 100 as well as answer whether the numbers are prime or composite.

Collect and review all the work learners have completed to ensure that they understand factors, prime numbers and composite numbers.

8. Answers

Exercise 1

(LB page 37)

Learners' own work

Exercise 2

(LB page 39)

1.
 - a) 2; 3; 5; 7
 - b) 11; 13; 17; 19
 - c) 23; 29; 31; 37
 - d) 41; 43; 47; 53; 59
 - e) 61; 67; 71; 73; 79
 - f) 83; 89; 97

2.
 - a) $1 \times 9 = 9$
 $3 \times 3 = 9$
Factors of 9: 1; 3; 9
Prime factor of 9: 3
 - b) $1 \times 8 = 8$
 $2 \times 4 = 8$
Factors of 8: 1; 4; 8; 2
Prime factor of 8: 2
 - c) $1 \times 10 = 10$
 $2 \times 5 = 10$
Factors of 10: 1; 2; 5; 10
Prime factors of 10: 2 and 5
 - d) $1 \times 25 = 25$
 $5 \times 5 = 25$
Factors of 25: 1; 5; 25
Prime factor of 25: 5

3.

Number	Factors	Number of factors
Example: 1	1	1
2	1; 2	2
3	1; 3	2
4	1; 2; 4	3
5	1; 5	2
10	1; 2; 5; 10	4
15	1; 3; 5; 15	4
25	1; 5; 25	3
39	1; 3; 13; 39	4
48	1; 2; 3; 4; 6; 8; 12; 16; 24; 48	10
52	1; 2; 4; 13; 26; 52	6
56	1; 2; 4; 7; 8; 14; 28; 56	8
74	1; 2; 37; 74	4
100	1; 2; 4; 5; 10; 20; 25; 50; 100	9

Indicator

B5.1.1.3.3 Identify even and odd numbers between 1 and 100 as numbers that can be arrayed in twos arrays and those which cannot

1. Learning expectations

Learners need to be able to:

- explain the difference between an odd and an even number
- solve problems involving odd and even numbers.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 20–21
- 100-number chart
- Counters
- Arrays

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities,

you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

By now, most learners should have a pretty good idea of odd and even numbers. However, check learners' understanding by doing the following activity:

- Ask for 10 learner volunteers to come to the front of the class.
- Count these learners together as a class – they should count to 10.
- Next, ask each learner of the 10 to find a partner among each other. Because there are 10 learners, everyone will have a partner. Explain that 10 is an even number because each of the 10 learners has a partner. Write 10 on the board under the word 'even'.
- Ask two learners to sit down. This will leave eight standing. Repeat the process until you have written 8, 6, 4 and 2 under the word 'even' on the board.
- Next, ask learners what they think would happen if there were nine learners standing. Would everyone have a partner? Repeat for 7, 5, 3 and 1.
- Learners should be able to tell you that one learner will be left without a partner for 9, 7, 5, 3 and 1. Explain that these numbers are odd numbers.
- Then move on to higher numbers between 1 and 100. Ask learners what they notice about a number such as 44 or a number like 87. They should notice that all even numbers end in 0, 2, 4, 6 and 8; and that all odd numbers end in 1, 3, 5, 7 and 9.

Work through the example on page 40 of the Learner's Book. Give learners a 100-number chart and ask them to colour all the odd numbers green and all the even numbers yellow. Learners can also tell their partners about any other patterns they notice on the chart.

6. Homework

Learners complete the Exercise 1 on page 20 of the Workbook.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 41)

- 22; 24; 26; 28; 30; 32; 34; 36; 38; 40
 - 72; 74; 76; 78; 80; 82; 84; 86; 88; 90
 - 100; 102; 104; 106; 108; 110; 112; 114; 116; 118
 - 252; 254; 256; 258; 260; 262; 264; 266; 268; 270
 - 962; 964; 966; 968; 970; 972; 974; 976; 980
 - 1,042; 1,044; 1,046; 1,048; 1,050; 1,052; 1,054; 1,056; 1,058; 1,060
- 21; 23; 25; 27; 29; 31; 33; 35; 37; 39
 - 71; 73; 75; 77; 79; 81; 83; 85; 87; 89
 - 99; 101; 103; 105; 107; 109; 111; 113; 115; 117
 - 351; 353; 355; 357; 359; 361; 363; 365; 367; 369
 - 841; 843; 845; 847; 849; 851; 853; 855; 857; 859
 - 1,011; 1,013; 1,015; 1,017; 1,019; 1,021; 1,023; 1,025; 1,027; 1,029
- They all end in 0, 2, 4, 6, or 8.
- They all end in 1, 3, 5, 7, or 9.
- Odd
 - Even
 - Odd
 - Even
 - Odd
 - Odd
- 59; 61; 63; 65
 - 76; 78; 80; 82; 84; 86

Exercise 2

(LB page 42)

- 18 ... 20
 - 84 ... 86
 - 42 ... 44
 - 98 ... 100
- 17 ... 19
 - 87 ... 89
 - 39 ... 41
 - 89 ... 91
- 36
 - 25
- $46 + 48 + 50 + 52 = 196$
- 40
- 3; 9; 15; 21; 27

B5.1.1.3.4 Determine the highest common factor of any two or three numbers by prime factorisation

1. Learning expectations

Learners need to be able to:

- investigate and determine the highest common factor (HCF) and the lowest common multiple (LCM) of any two or three numbers using prime factorisation methods
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 23–24
- Number chart
- Factor trees

3. Large class teaching

In a large class, learners work best in pairs and groups. These should be collaborative groups in which learners can learn from one another, so differently abled learners should be matched together. Using pair and group work will also ensure that learners are not left out or become bored because of listening to you doing all the talking.

More able learners in the group can help the others to master the concept being taught, but be sure to monitor each group's understanding of the concept. You can use group leaders or monitors who can assist those learners who work at a slower pace than others. Learners need to be encouraged to find creative ways of remembering the concepts taught.

Move around the classroom to see what progress learners are making and to catch any misconceptions that may come up. Give advice, encouragement and extra individual help where it is needed.

4. Support for learners with special needs

Knowing and understanding how to work out the highest common factor (HCF) of any number is a skill that is necessary for a range of problems involving fractions and eventually algebra.

Learners need to have a good understanding of factors and the skill of instant recall of the basic multiplication facts (tables). If learners are still struggling with knowing the times tables, allow them to practise these up to the 12 times table until they are confident with this work. If learners do not know the tables it will effectively shut them out of working with factors and therefore working with the HCF.

5. Teaching methodology

In this section, learners will be taught how to use prime factorisation to find the HCF and the LCM of any two or three numbers. The work done before this is important and learners need to have a firm grip on finding factors and identifying prime numbers.

Finding the HCF of two or three numbers by prime factorisation

Teach learners the following steps:

- Divide each number by simple prime factors, for example 2, 3, etc. They can also use the factor tree method.
- Repeat until the numbers have no more factors.
- Multiply all prime factors common to the two (or three) numbers to find the HCF between the two numbers.
- For example, for the numbers 32 and 56, factorise as follows:

$$\begin{array}{r|l}
 2 & 32 \\
 2 & 16 \\
 2 & 8 \\
 2 & 4 \\
 \hline
 & 2
 \end{array}
 \qquad
 \begin{array}{r|l}
 2 & 56 \\
 2 & 28 \\
 2 & 14 \\
 \hline
 & 7
 \end{array}$$

- List the prime factors of each number as follows and underline the common factors in each number:
 $32 = \underline{2} \times \underline{2} \times \underline{2} \times 2 \times 2$
 $56 = \underline{2} \times \underline{2} \times 2 \times 7$
- To find the HCF, multiply the prime factors that both numbers have in common. In this case:
HCF of 32 and 56 is $2 \times 2 \times 2 = 8$
- If there are no common prime factors for numbers, then the HCF is 1.

Allow learners to practise finding the HCF of different numbers. Once you are happy that learners are adept in this

concept, you can challenge them to move on to finding the HCF of three numbers in the same way.

Finding the LCM of two or three numbers

The procedure is the same as for the HCF up to where the factors are listed. Now:

- Inspect the factors to determine the LCM by underlining the largest number of times each factor appears in each number:

$$32 = \underline{2} \times \underline{2} \times \underline{2} \times \underline{2} \times \underline{2}$$

$$56 = 2 \times 2 \times 2 \times \underline{7}$$

- To find the LCM, multiply these underlined prime factors. In this case:

$$\text{LCM of 32 and 56 is } 2 \times 2 \times 2 \times 2 \times 2 \times 7 = 224$$

Explain to learners how to use Venn diagrams to find the HCF and LCM. Write the steps on the board as you explain. Expand your explanation by going through more examples on the board, including number sets that do not have any common prime factors. In this case, the HCF is 1.

Take your time to work through the content and examples in this sub-strand. Learners who struggle with the concepts taught should be given additional time to practise. Work with them in smaller groups.

6. Homework

Instruct learners to complete Exercise 2 on page 22 and Exercise 3 on page 23 of the Workbook. Once back in class, check the answers with your learners and allow them to correct any mistakes they may have made.

7. Self/Peer assessment

Work through the answers for the activities with the class. Write answers on the board and allow learners to correct their own work. Once complete, ask learners to hand in their books to you and assess the work they have completed. If you find some learners are still struggling to grasp the concept, work with them on an individual basis or in a small group.

8. Answers

Exercise 1

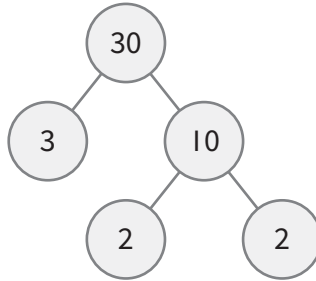
(LB page 44)

1. Prime factors are shown in bold print:
 - a) 1; **7**
 - b) 1; **2**; **3**; 6
 - c) 1; **2**; 4; 8; 16
 - d) 1; **5**
 - e) 1; **2**; **3**; 4; 6; 12
 - f) 1; **11**

- g) 1; 3; 5; 15 h) 1; 2; 7; 14
 i) 1; 2 j) 1; 2; 4
 k) 1; 2; 3; 6; 9; 18 l) 1

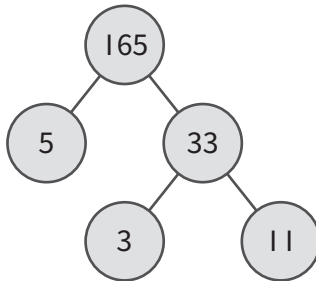
2. a) Multiples of 9: 9; 18; 27; 36
 b) Multiples of 7: 49; 14; 35; 21; 28
 c) Multiples of 8: 16; 24; 32; 40; 56
 d) Multiples of 6: 24; 30; 36; 54; 48; 72

3. a)



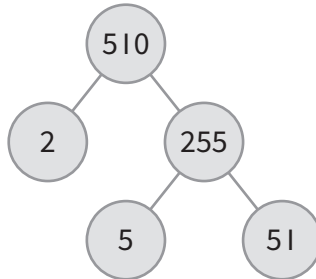
$$30 = 2 \times 3 \times 5$$

b)



$$165 = 3 \times 5 \times 11$$

c)



$$510 = 2 \times 5 \times 51$$

Exercise 2

(LB page 45)

1. $27 = 3 \times 3 \times 3$ 2. $30 = 2 \times 3 \times 5$
 3. $32 = 2 \times 2 \times 2 \times 2 \times 2$ 4. $50 = 2 \times 5 \times 5$
 5. $72 = 2 \times 2 \times 2 \times 3 \times 3$ 6. $24 = 2 \times 2 \times 2 \times 3$
 7. $36 = 2 \times 2 \times 3 \times 3$ 8. $28 = 2 \times 2 \times 7$

LCM using prime factors:

Factors of 12: 1; 2; 2; 3; 12 → Prime factors of
 $12 = \underline{2} \times \underline{2} \times \underline{3}$

Factors of 11: 1; 11 → Prime factors of 11 = $1 \times \underline{11}$

LCM = $2 \times 2 \times 3 \times 11 = 132$

e) LCM using multiples:

Multiples of 9: 9; 18; 27; **36**; 45; 54; ...

Multiples of 12: 12; 24; **36**; 48; 60; ...

LCM = 36

LCM using prime factors:

Factors of 9: 1; 3; 9 → Prime factors of 9 = $\underline{3} \times \underline{3}$

Factors of 12: 1; 2; 2; 3; 12 → Prime factors of
 $12 = \underline{2} \times \underline{2} \times \underline{3}$

LCM = $3 \times 3 \times 2 \times 2 = 36$

f) LCM using multiples:

Multiples of 13: 13; 26; 39; 52; 65; 78; 91; 104;
117; 130; 143; 156; 169; 182; 195; 208; 221;
234; 247; 260; 273; **286**; 299; ...

Multiples of 22: 22; 44; 66; 88; 110; 132;

154; 176; 198; 220; 242; 264; **286**; 308; ...

LCM = 286

LCM using prime factors:

Factors of 13: 1; 13 → Prime factors of 13 = $1 \times \underline{13}$

Factors of 22: 1; 2; 11; 22 → Prime factors of
 $22 = \underline{2} \times \underline{11}$

LCM = $2 \times 11 \times 13 = 286$

g) LCM using multiples:

Multiples of 30: 30; 60; 90; 120; 150; 180; 210;
240; 270; 300; 330; 360; **390**; ...

Multiples of 13: 13; 26; 39; 52; 65; 78; 91; 104;
117; 130; 143; 156; 169; 182; 195; 208; 221;
234; 247; 260; 273; 286; 299; 312; 325; 338;
351; 364; 377; **390**; ...

LCM = 390

LCM using prime factors:

Factors of 30: 1; 2; 3; 5; 30 → Prime factors of
 $30 = \underline{2} \times \underline{3} \times \underline{5}$

Factors of 13: 1, 13 → Prime factors of 13 = $1 \times \underline{13}$

LCM = $2 \times 3 \times 5 \times 13 = 390$

h) LCM using multiples:

Multiples of 11: 11; 22; 33; 44; 55; 66; 77; 88; 99; **110**; 121; ...

Multiples of 10: 10; 20; 30; 40; 50; 60; 70; 80; 90; **110**; ...

LCM = 110

LCM using prime factors:

Factors of 11: 1; 11 → Prime factors of 11 = 1×11

Factors of 10: 1; 2; 5; 10 → Prime factors of
 $10 = 2 \times 5$

LCM = $11 \times 2 \times 5 = 110$

i) LCM using multiples:

Multiples of 13: 13; 26; 39; 52; 65; 78; 91; 104; 117; 130; 143; 156; 169; 182; **195**; ...

Multiples of 15: 15; 30; 45; 60; 75; 90; 105; 120; 135; 150; 165; 180; **195**; ...

LCM = 195

LCM using prime factors:

Factors of 13: 1; 13 → Prime factors of 13 = 1×13

Factors of 15: 1; 3; 5; 15 → Prime factors of
 $15 = 3 \times 5$

LCM = $13 \times 3 \times 5 = 195$

j) LCM using multiples:

Multiples of 12: 12; 24; 36; 48; 60; 72; 84; 96; 108; 120; 132; 144; 156; 168; 180; 192; **204**; ...

Multiples of 17: 17; 34; 51; 68; 85; 102; 119; 136; 153; 170; 187; **204**; ...

LCM = 204

LCM using prime factors:

Factors of 12: 1; 2; 2; 3; 12 → Prime factors of
 $12 = 2 \times 2 \times 3$

Factors of 17: 1; 17 → Prime factors of 17 = 1×17

LCM = $2 \times 2 \times 3 \times 17 = 204$

k) LCM using multiples:

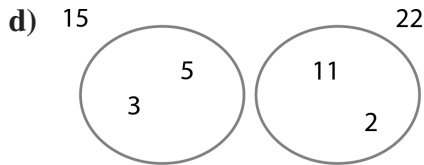
Multiples of 18: **36**; ...

Multiples of 36: **36**; 72; ...

LCM = 36

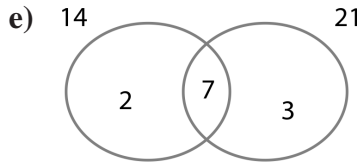
LCM using prime factors:

Factors of 18: 1; 3; 2; 3; 18 → Prime factors of
 $18 = 2 \times 3 \times 3$



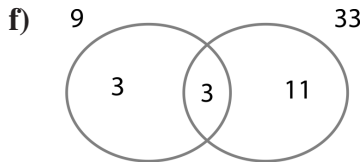
(i) HCF for 15 and 22 = 1

(ii) LCM for 15 and 22 = $3 \times 5 \times 2 \times 11 = 15 \times 22 = 330$



(i) HCF for 14 and 21 = 7

(ii) LCM for 14 and 21 = $2 \times 7 \times 3 = 42$



(i) HCF for 9 and 33 = 3

(ii) LCM for 9 and 33 = $3 \times 3 \times 11 = 99$

4. a) $16 = 2 \times 2 \times 2 \times 2$ b) $27 = 3 \times 3 \times 3$
 c) $40 = 2 \times 2 \times 2 \times 5$ d) $45 = 3 \times 3 \times 5$
 e) $55 = 5 \times 11$ f) $54 = 2 \times 3 \times 3 \times 3$

Exercise 4

(LB page 51)

1. LCM = 16, so 1 pack of 16 pens
(4 packs of pencils \times 4 = 16)
2. LCM = 104, so $104 \div 8 = 13$ packs of daffodils and
 $104 \div 13 = 8$ packs of freesias
3. HCF of 9 and 6 = 3, so she can prepare 3 lunch packs.
(Each lunch pack will contain 3 bottles of water and 2 sandwiches.)
4. HCF of 12 and 20 = 4, so Kisi can create 4 pages.
(She can put 3 photos plus 5 newspaper clippings on each page.)

1. Learning expectations

Learners need to be able to:

- develop attention to precision
- justify their ideas
- understand the commutative and associative properties of multiplication:
 - *Commutative property*: When two numbers are multiplied together, the product is the same regardless of the order of the multiplicands, for example $4 \times 2 = 2 \times 4$.
 - *Associative property*: When three or more numbers are multiplied, the product is the same regardless of the grouping of the factors, for example $(2 \times 3) \times 4 = 2 \times (3 \times 4)$.

2. Resources used in this chapter

- Learner's Book
- 100-number chart
- Counters

3. Large class teaching

To make class time as valuable as possible, both learners and teachers have to work hard at making it a success. Every learner has the right to learn. But every learner also has the responsibility not to deprive others of their right to learn. From the beginning, learners need to understand this dual right and responsibility. They also need to understand that each one of them is accountable for his or her own actions.

4. Support for learners with special needs

Remind learners that each one of them is a good mathematician. Always encourage learners to use different strategies they have learnt to find answers to any problems they are given. Encourage them not to be afraid to fail.

Through failure they begin to understand the importance of doing mathematics in a structured and systematic way.

Allow learners to work in collaborative pairs and groups, but monitor the work that they are doing and be available if they have any questions or need help understanding a concept.

5. Teaching methodology

Give pairs of learners a 100-number chart. Ask pairs to identify a number, for example 8. Now ask them if they can tell you what a multiple of 8 is. Ask them to give you another multiple of 8, until you are happy that they understand the concept of a multiple. Write all the multiples on the board. Now ask them to tell you what the factors of 8 are. Remind them that factors are numbers they can multiply together to get another number. Write the definitions of a factor and a multiple on the board.

Now explain that they will play a game using a 100-number chart. Have a 100-number chart available on the board. Split the class into two groups and explain to them that the aim of the game is to block the other group from choosing a number.

- Choose a number and place an X over it.
- Ask the first group to choose either a multiple or factor of this number. Give them 30 seconds to think about it. They need to justify their answer.
- If they are correct, put an X over the number (use a different colour).
- Ask the next group to choose a factor or multiple of this new number.
- Repeat the process until there are no new numbers to choose.
- Encourage learners to come up with a way to record the number sequence.
- As a class, discuss the strategies each group used.

Reinforce the concept of a multiple and a factor. Ask the class:

- What is a multiple?
- What is a factor?
- Can you use your multiplication facts to help you identify the factors or multiples?
- Do all numbers have the same number of factors?
- Do odd numbers have more factors or even numbers?

- What do you call numbers that have only two factors?
- What do you call numbers that have more than two factors?
- Why are prime numbers special?
- If a number is not a prime, what is it called?
- How are composite numbers created?

6. Diagnostic assessment

As you work through the activity with the whole class, be vigilant and check to see if there are learners who are not participating in the activity. Encourage them by asking them probing questions, but if you find they become withdrawn, rather spend some one-on-one or small group time with them afterwards. Provide enough opportunities for all learners to practise this skill.

7. Answers

Exercise 1

(LB page 54)

1. Odd numbers: Agree; if an odd number is divided by 2, it leaves a remainder.
Even numbers: Agree; if an even number is divided by 2, it leaves no remainder. In other words, it divides evenly into groups of two.
2. a) False. Multiples can be described as a list of numbers, each of which can be completely divided by a given number.
b) True
c) False. A multiple of a number is the product obtained after multiplying that number by an integer.
d) False. The number of factors of a particular number is limited, but the number of multiples of a given number is endless.
e) True

3. a) Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36
 $1 + 2 + 3 + 4 + 6 + 9 + 12 + 18 = 55$ (not 36)
 No; the factors of 36 (excluding 36) do not add up to 36.
- b) Factors of 93: 1, 3, 31, 93
 $1 + 3 + 31 = 35$ (not 93)
 No; the factors of 93 (excluding 93) do not add up to 93.
- c) Factors of 137: 1, 137
 $1 = 1$ (not 137)
 No; the factors of 137 (excluding 137) do not add up to 137.
- d) Factors of 496: 1, 2, 4, 8, 16, 31, 62, 124, 248, 496
 $1 + 2 + 4 + 8 + 16 + 31 + 62 + 124 + 248 = 496$
 Yes; the factors of 496 (excluding 496) add up to 496. So, 496 is a perfect number.
- e) Factors of 2,055: 1, 3, 5, 15, 137, 411, 685, 2,055
 $1 + 3 + 5 + 15 + 137 + 411 + 685 = 1,257$ (not 2,055)
 No; the factors of 2,055 (excluding 2,055) do not add up to 2,055.
- f) Factors of 8,128: 1, 2, 4, 8, 16, 32, 64, 127, 254, 508, 1,016, 2,032, 4,064, 8,128
 $1 + 2 + 4 + 8 + 16 + 32 + 64 + 127 + 254 + 508 + 1,016 + 2,032 + 4,064 = 8,128$
 Yes; the factors of 8,128 (excluding 8,128) add up to 8,128. So, 8,128 is a perfect number.
4. The other perfect number in the first 100 numbers is 28:
 $1 + 2 + 4 + 7 + 14 = 28$

Sub-strand 2: Number operations

Content standard

B5.1.2.1: Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts

Indicator

B5.1.2.1.1 Apply mental mathematics strategies and number properties, such as skip counting from a known fact, using doubling or halving, using patterns in the 9s facts and using repeated doubling or halving to determine answers for basic multiplication facts to 81 and related division facts

1. Learning expectations

Learners need to be able to:

- investigate the relationship between different strategies in problem solving
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 25–28
- Number lines
- 100-number chart
- Place value charts

3. Large class teaching

Mental mathematics and problem solving are important aspects of doing mathematics. It gives learners a context and link to everyday life activities and helps them make sense of the mathematics they are learning. Problems can be used to introduce new concepts and extend previously learned knowledge.

Remember, however, that problem solving is not an isolated activity. It is a skill that favours every Mathematics

lesson and is about finding a solution when a method to find a solution is not obvious.

Problem solving does not just involve solving one-step word problems, but features authentic purposes, risk tasks and multiple ways for a problem to be solved. Solving problems is the act of finding a solution when a method for solution is not obvious. It relies on thinking and making sense of problems in different contexts. Remind learners that they can use the following techniques to solve problems: skip counting from a known fact, using doubling or halving, using patterns in the 9s facts or using repeated doubling or halving to determine answers for basic multiplication facts to 81 and related division facts.

Allow learners to work together in collaborative pairs and groups, but monitor their work throughout the lesson. Assist learners as needed.

4. Support for learners with special needs

Problem solving and mental mathematics rely on reading, thinking and comprehending the posed problem and then using the context to make sense of the problem in order to solve it. Assess learners' abilities to read and comprehend, and if you find there are learners who are struggling with the comprehension of a passage, spend some time working with them.

Remember that teaching learners to look for key words in text can sometimes be misleading. For example, in the following problem learners would see the key word 'left' and assume that it is a subtraction problem: There were 105 jerseys left after school on Monday and 98 jerseys left after school on Tuesday. How many jerseys were left at school? 'Left' in this problem does not mean subtract.

Some problems also have no key words, for example, How many wheels do 70 bicycles have? So, instead of teaching learners to look for key words, teach them how to solve problems with multiple steps including addition, subtraction, multiplication and division.

Focus on the steps and procedures for analysing the problems. The most commonly used problem-solving model is George Polya's four-step model:

- understanding the problem

- making a plan to solve the problem
- carrying out the plan to solve the problem
- looking back to check the results.

Work through the different strategies as a whole class, reminding learners of what they have learned in previous grades.

5. Teaching methodology

Learners have worked with these techniques since Grade 4, but just because they know the strategies does not mean they will engage in the appropriate strategies. It is thus important to provide opportunities where learners can explicitly practise learning how, when and why to use which strategies effectively so that they can become self-directed learners.

It is important to create a classroom environment in which learners are problem solvers. This helps to tie struggles to strategies so that the learners will not only see value in working harder but in working smarter by trying new and different strategies and revising their processes. In doing so, they will become more confident and successful as they progress in their mathematical journeys.

As learners work through the different strategies, ask them how their strategies work. Take the time to go through the strategies with the whole class. Be sure to be explicit in your explanations. Perhaps a way of showing that one strategy might be preferable over another is to use a strategy, for example doubling or halving, with a problem that would not benefit from using this strategy. This will show learners how inefficient strategies for a particular problem might cause more confusion than benefits.

Make a distinction between the models learners use to understand the relationship of the numbers in the problem and the techniques to solve the computation in the problem. Those two things work in tandem but are very different. Models are the visual ways problems are represented. Techniques are the ways a learner solves a problem, putting together and taking apart the numbers. The most important thing about models is to move away from them. Move learners toward efficiency.

Work through the examples provided in the Learner's

Book, giving learners ample opportunities to practise using the different strategies to solve problems.

6. Homework

For each strategy taught, you can allow learners to complete the Exercises in class. If there is not enough time to complete all the questions, assign these as homework. You may also assign exercises from page 25 to page 28 of the Workbook as homework.

7. Teacher assessment

Ask learners to hand in their work for assessment. Make sure to check which learners are struggling with different strategies for calculations and then spend some extra time with them.

8. Answers

Exercise 1

(LB page 56)

1. Learners' own work
2. $25 + 25 + 25 + 25 + 25 + 25 = 6 \times 25 = 150$

Exercise 2

(LB page 57)

1.
 - a) $6 \times 18 = 12 \times 9 = 108$
 - b) $3 \times 24 = 6 \times 12 = 72$
 - c) $5 \times 16 = 10 \times 8 = 80$
 - d) $28 \times 5 = 14 \times 10 = 140$
 - e) $4 \times 32 = 2 \times 64 = 128$
 - f) $68 \times 5 = 34 \times 10 = 340$
 - g) $14 \times 8 = 28 \times 4 = 112$
 - h) $26 \times 4 = 13 \times 8 = 104$
2.
 - a) 2×24 is made easier because 1×48 is easy to calculate.
 - b) 6×27 is not made easier as you will be using a decimal if you double 6 and halve 27.
 - c) 8×25 is made easier because 4×50 is easy to calculate.
 - d) 5×125 is made easier as you will double 5 to 10, but it could be difficult because you have to work with a decimal when you halve 125.

Exercise 3

(LB page 58)

1.
 - a) 4×8 , think $4 \times 10 = 40$, then subtract two 4s from 40 to get to 32
 - b) 8×9 , think $8 \times 10 = 80$, then subtract one 8 from 80 to get 72
 - c) 7×8 , think $7 \times 10 = 70$, then subtract two 7s from 70 to get to 56
 - d) 9×6 , think $10 \times 6 = 60$, then subtract one 6 from 60 to get to 54
2. Learners' own work

Exercise 4

(LB page 59)

1. Learners' own work Check that they have used the strategies correctly.
2. Learners' own work
3.
 - a) $9 \times 8 = 72$
 - b) $8 \times 4 = 32$
 - c) $8 \times 7 = 56$
 - d) $81 = 9 \times 9$
 - e) $10 = 10 \times 1$
 - f) $2 \times 6 = 12$
 - g) $25 \div 5 = 5$
 - h) $30 \div 6 = 5$
 - i) $81 = 9 \div 9$
 - j) $44 \div 11 = 4$
4.
 - a) If $4 \times 8 = 32$, then $32 \div 8 = 4$
 - b) If $6 \times 12 = 72$, then $72 \div 12 = 6$
 - c) If $9 \times 6 = 54$, then $54 \div 9 = 6$
5. Learners' own work

Indicator

B5.1.2.1.2 Apply mental mathematics strategies for multiplication, such as annexing then adding zero, halving and doubling and using the distributive property

1. Learning expectations

Learners need to be able to:

- investigate the strategies used in multiplication problems
- understand the distributive, commutative and associative properties of multiplication
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 25–28
- Different counters
- Different coins
- Number lines
- Number grids

3. Large class teaching

Allow learners to work together in collaborative pairs and groups, but monitor their work throughout the lesson. Assist learners as needed.

In this section, learners will use multiplication and the related division facts to solve number problems in context and explain their solutions to problems involving multiplication with answers up to 81. Give pairs or groups of learners a set of counters or other manipulatives to create number sentences.

Say a number sentence and ask the learners to create the model. Choose addends of the number sentences to be within the range that we are working in (i.e. up to 81). Switch from saying the number sentence to creating a model and let learners write the number sentence. Encourage the learners to share their strategies with each other.

4. Support for learners with special needs

Encourage the learners to work with a partner or someone in their group to solve and share strategies with each other including drawing and building models using manipulatives.

Working with partners or in a group of three, the learners take turns going back and forth as the builder using the manipulatives and as the writer recording the number sentences. Learners could also use a spinner or a die to determine the different number of addends to use for each multiplication sentence. Using a die creates an element of chance and eliminates the building of a pattern. The learners record their sentences in their classwork books and solve the problems together.

Learners explain which groups are easier and which are more difficult to solve for multiplication and explain their reasoning. The learners working in pairs/groups show and explain how they solved two of the multiplication problems they completed. Learners can use manipulatives, drawings, or verbal explanations. This allows the learners to use what is most comfortable for them. Other learners are allowed to ask questions about their strategy, so they are encouraged to explain the strategy they are most confident in using.

5. Teaching methodology

Difficulties arise when learners have equal groups as their only strategy for solving multiplication problems and only see the operation as a shortcut for repeated addition. Learners need to understand that multiplication and division also apply in situations of multiplicative comparison and they need to learn to interpret multiplication and division through these situations.

The commutative and associative properties of addition also extend to multiplication, but many times these properties are only stated as rules rather than being taught in context to assist learners in mental maths calculations.

Multiplication tends to be more challenging to learners than their previous encounters with addition and subtraction. Learners may be able to memorise their multiplication facts with ease, but when they are asked to find the product of two or more values or to simplify more complicated expressions, errors often arise.

Show learners how to draw pictures to help them visualise a multiplication problem that is set in a context. Spend time discussing and modelling the different strategies taught in the Learner's Book.

Work through the different strategies and examples listed in the Learner's Book. Provide opportunities for learners to work together in pairs and/or groups and to discuss the strategies. It helps some learners to reinforce concepts when they talk about these strategies. As the learners work together in their groups, listen to their discussions and guide them in their learning. Correct any misconceptions that may arise immediately.

6. Homework

For each strategy taught, you can allow learners to complete the Exercises in class. If there is not enough time to complete all the questions, assign these as homework. You may also assign exercises from page 25 to page 28 of the Workbook as homework.

7. Diagnostic assessment

To assess whether your learners have a sound understanding of multiplication and division, you can ask them to write their own word problem that could be represented by an expression. Solving an expression, such as 14×10 , is a low-level task in terms of cognitive demand for learners in Grade 5. However, when asking them to create a word problem, it can give you insight into whether learners actually understand working with multiplication and division.

8. Answers

Exercise 1

(LB page 61)

1. a) 5×30 : $5 \times 3 = 15$, add 1 zero, so $5 \times 30 = 150$
- b) 8×90 : $8 \times 9 = 72$, add 1 zero, so $8 \times 90 = 720$
- c) 70×5 : $7 \times 5 = 35$, add 1 zero, so $70 \times 5 = 350$
- d) 9×800 : $9 \times 8 = 72$, add 2 zeros, so $9 \times 800 = 7,200$
- e) $7 \times 4,000$: $7 \times 4 = 28$, add 3 zeros, so $7 \times 4,000 = 28,000$
- f) 12×900 : $12 \times 9 = 108$, add 2 zeros, so $12 \times 900 = 10,800$

- g) $5,000 \times 9$: $5 \times 9 = 45$, add 3 zeros, so $5,000 \times 9 = 45,000$
- h) 6×700 : $6 \times 7 = 42$, add 2 zeros, so $6 \times 700 = 4,200$
- i) $4 \times 3,000$: $4 \times 3 = 12$, add 3 zeros, so $4 \times 3,000 = 12,000$
- j) $8 \times 6,000$: $8 \times 6 = 48$, add 3 zeros, so $8 \times 6,000 = 48,000$

2. Learners' own work. Accept all reasonable answers.

Exercise 2

(LB page 62)

1. a) $4 + 4 + 4 = 12$ $3 \times 4 = 12$
 $4 + 4 = 8$ $2 \times 4 = 8$
 $4 = 4$ $1 \times 4 = 4$
 $0 = 0$ $0 \times 4 = 0$
- b) $5 + 5 + 5 + 5 = 20$ $4 \times 5 = 20$
 $5 + 5 + 5 = 15$ $3 \times 5 = 15$
 $5 + 5 = 10$ $2 \times 5 = 10$
 $5 = 5$ $1 \times 5 = 5$
 $0 = 0$ $0 \times 5 = 0$
2. a) $6 \times 5 = 30$
 $6 \times 4 = 24$
 $6 \times 3 = 18$
 $6 \times 2 = 12$
 $6 \times 1 = 6$
 $6 \times 0 = 0$
- b) $8 \times 5 = 40$
 $8 \times 4 = 32$
 $8 \times 3 = 24$
 $8 \times 2 = 16$
 $8 \times 1 = 8$
 $8 \times 0 = 0$
- c) $7 \times 5 = 35$
 $7 \times 4 = 28$
 $7 \times 3 = 21$
 $7 \times 2 = 14$
 $7 \times 1 = 7$
 $7 \times 0 = 0$

$$\begin{aligned} \text{d) } 9 \times 5 &= 45 \\ 9 \times 4 &= 36 \\ 9 \times 3 &= 27 \\ 9 \times 2 &= 18 \\ 9 \times 1 &= 9 \\ 9 \times 0 &= 0 \end{aligned}$$

3. a) When you multiply a number by 0, the answer is 0.
 b) When you multiply a number by 1, the value stays the same.

Exercise 3

(LB page 63)

$$\begin{aligned} \text{1. a) } 8 \times 12 &= 8 \times (10 + 2) \\ &= (8 \times 10) + (8 \times 2) \\ &= 80 + 16 \\ &= 96 \end{aligned}$$

$$\begin{aligned} \text{b) } 5 \times 24 &= 5 \times (20 + 4) \\ &= (5 \times 20) + (5 \times 4) \\ &= 100 + 20 \\ &= 120 \end{aligned}$$

$$\begin{aligned} \text{c) } 32 \times 9 &= 9 \times 32 = 9 \times (30 + 2) \\ &= (9 \times 30) + (9 \times 2) \\ &= 270 + 18 \\ &= 288 \end{aligned}$$

$$\begin{aligned} \text{d) } 54 \times 6 &= 6 \times 54 = 6 \times (50 + 4) \\ &= (6 \times 50) + (6 \times 4) \\ &= 300 + 24 \\ &= 324 \end{aligned}$$

2. Learners' own work. Check that they have used their chosen strategies correctly.

a) 69	b) 192
c) 400	d) 105
e) 15	f) 6

3. a) $6 \times 24 = 144$ b) $6 \times 24 = 12 \times 12 = 144$

Content standard

B5.1.2.2: Demonstrate an understanding of multiplication of a 2 or 3-digit number by a 2 or 3-digit number

Indicator

B5.1.2.2.1 Multiply multidigit numbers by 2-digit numbers efficiently

1. Learning expectations

Learners need to be able to:

- investigate the strategies used in multiplication problems
- develop problem-solving skills and critical thinking
- understand the distributive property of multiplication
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 29–32

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Teaching multiplication can be a difficult concept for teachers to teach and for learners to understand. Many mathematics programs jump too quickly to focussing on the recall and memorisation of times tables rather than teaching a range of multiplicative strategies.

This means that when the memory fails and a fact cannot be recalled, learners have nothing to fall back on. They cannot use multiplicative strategies to help them to arrive at a solution because they have not been taught them.

In this sub-strand, encourage learners to help one another by talking about the numbers that they are working with. If, for example, there are learners who have a visual impairment, other learners can help them by telling them what they are doing in each step of the work. Encourage learners to find creative ways of helping their peers learn the concepts being taught. Through helping other learners, they will also be helping their own understanding of the concept.

5. Teaching methodology

Explain to the learners that in the **expand-and-box method of multiplication**, the single, complicated multiplication problem is broken up into four easier multiplication problems. The four resulting products are then added to get the final answer. You can expand on the explanation of multiplying a 3-digit number by a 1-digit number given in the Learner's Book by showing them how to use this method to multiply by a 2-digit number.

Multiplying 12 by 35 would look like this:

12×35	10	2
30	$10 \times 30 = 300$	$2 \times 30 = 60$
5	$10 \times 5 = 50$	$2 \times 5 = 10$

$$300 + 60 + 50 + 10 = 420$$

After one or two practice problems, most learners can skip writing the multiplication steps and the box method would look like this:

12×35	10	2
30	300	60
5	50	10

$$300 + 60 + 50 + 10 = 420$$

However, if learners need to continue doing the problem step-by-step, do not discourage it. Let them work as they feel comfortable.

The learners also need to be able to use the **column or vertical method of multiplication** to multiply multidigit

numbers by 2-digit numbers. Spend time discussing the column or vertical method of multiplication explained in the Learner's Book. This method is also known as long multiplication.

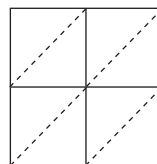
Another multiplication method learners need to understand and use is the multiplication of whole numbers using the **distributive property**. Revise what they learnt about using the distributive property of multiplication for calculations. Guide learners how to use this for multiplication calculations with the aid of the Learner's Book. Expand your explanation by going through more examples on the board.

Lattice multiplication is another method learners can use for multiplication. Learners need a firm understanding of place value in order to work with this method successfully. So begin by revising what learners already know about place value and reinforce any concepts they may be struggling with.

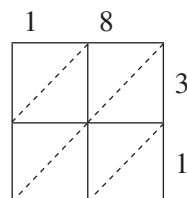
Lattice multiplication uses a grid to keep numbers organised. This is especially helpful when it comes to regrouping, as the numbers that are carried are also written at the appropriate diagonal to make the adding easier.

Explain these steps for teaching the lattice method:

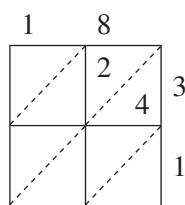
Step 1: Draw a grid. The number of rows and columns will depend on the number of digits in the factors. For example, if you are multiplying a 2-digit number by 2-digit number, your grid will have two rows and two columns.



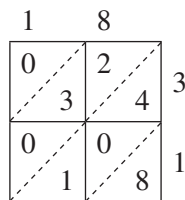
Step 2: Arrange the factors along the top and right side of the grid. Multiplying 18 by 31 would look like this:



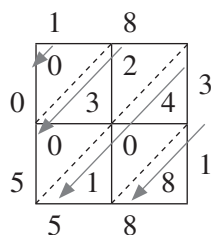
Step 3: Multiply the numbers that meet in each space on the grid. For example, in the top right corner, you are multiplying 8×3 to make 24. The tens and ones are split on either side of the diagonal line.



Step 4: Continue multiplying for each space on the grid.



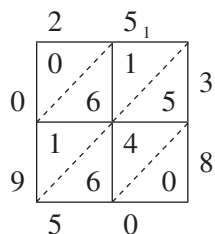
Step 5: Add using diagonal rows and write the sum of each diagonal row along the left side and bottom of the grid.



$$18 \times 31 = 558$$

When you need to regroup, simply carry the tens digit to the next diagonal row, as in this example of 25×38 .

First add the diagonal row in the bottom right, to make 0. Then add the next diagonal row. The sum is 15, so write the ones digit (5) and carry the tens (1) to the next diagonal row. When you add that diagonal row, add that carried digit as well.



$$25 \times 38 = 950$$

6. Homework

Ask learners to complete the exercise in the Workbook on pages 29–32.

7. Self/Peer assessment

As learners work together, they can assist each other by assessing their work. When learners are completing the activities in this section, make sure they understand what is required of them for each activity. Once they are done, write the answers on the board and ask learners to swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 65)

1. Learners' own work

2. a)

×	400	20	6
2	800	40	12

$$\begin{aligned}426 \times 2 &= (400 \times 2) + (20 \times 2) + (6 \times 2) \\ &= 800 + 40 + 12 \\ &= 852\end{aligned}$$

b)

×	600	20	1
4	2,400	80	4

$$\begin{aligned}621 \times 4 &= (600 \times 4) + (20 \times 4) + (1 \times 4) \\ &= 2,400 + 80 + 4 \\ &= 2,484\end{aligned}$$

c)

×	200	30	4
3	600	90	12

$$\begin{aligned}234 \times 3 &= (200 \times 3) + (30 \times 3) + (4 \times 3) \\ &= 600 + 90 + 12 \\ &= 702\end{aligned}$$

d)

×	900	20	7
5	4,500	100	35

$$\begin{aligned}927 \times 5 &= (900 \times 5) + (20 \times 5) + (7 \times 5) \\ &= 4,500 + 100 + 35 \\ &= 4,635\end{aligned}$$

Exercise 2

(LB page 66)

1. a)	b)	c)	d)
$\begin{array}{r} 34 \\ \times 15 \\ \hline 170 \\ + 340 \\ \hline 510 \end{array}$	$\begin{array}{r} 23 \\ \times 12 \\ \hline 46 \\ + 230 \\ \hline 276 \end{array}$	$\begin{array}{r} 45 \\ \times 18 \\ \hline 360 \\ + 450 \\ \hline 810 \end{array}$	$\begin{array}{r} 72 \\ \times 28 \\ \hline 576 \\ + 1,440 \\ \hline 2,016 \end{array}$

2. Learners' own work

3. a)	b)
$\begin{array}{r} 123 \\ \times 16 \\ \hline 738 \\ + 1,230 \\ \hline 1,968 \end{array}$	$\begin{array}{r} 274 \\ \times 23 \\ \hline 822 \\ + 5,480 \\ \hline 6,302 \end{array}$

Exercise 3

(LB page 70)

1. a) $23 \times 12 = (20 \times 12) + (3 \times 12)$
 $= 240 + 36$
 $= 276$

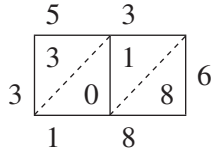
b) $45 \times 15 = (40 \times 15) + (5 \times 15)$
 $= 600 + 75$
 $= 675$

c) $28 \times 32 = 32 \times 28$
 $= (30 \times 28) + (2 \times 28)$
 $= 840 + 56$
 $= 896$

d) $34 \times 45 = 45 \times 34$
 $= (40 \times 34) + (5 \times 34)$
 $= 1,360 + 170$
 $= 1,530$

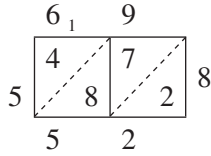
2. Lattice method:

a)



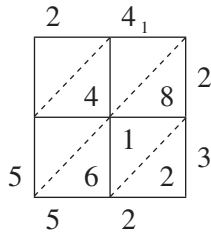
So, $53 \times 6 = 318$

b)



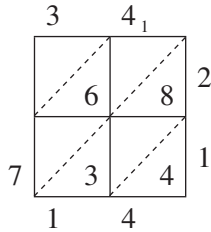
So, $69 \times 8 = 552$

c)



So, $24 \times 23 = 552$

d)



So, $34 \times 21 = 714$

Content standard

B5.1.2.3: Recall basic division facts up to 100

Indicator

B5.1.2.3.1 Determine basic division facts up to 81

1. Learning expectations

Learners need to be able to:

- investigate the relationship between numbers that are multiples of 3, 4, 6, 8 and 9
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 33–36

3. Large class teaching

To make class time as valuable as possible, both learners and teachers have to work hard at making it a success. Every learner has the right to learn. But every learner also has the responsibility not to deprive others of their right to learn. From the beginning, learners need to understand this dual right and responsibility. They also need to understand that each one of them is accountable for his or her own actions.

4. Support for learners with special needs

Long division is a difficult mathematical concept to teach and learn. One of the biggest reasons attributed to this is that finding an answer to a long division problem depends on a series of memorised steps – divide, multiply, subtract, bring down. If one step is done incorrectly, there is a very high chance that you will end up with an incorrect answer.

Instead of teaching an algorithm, teach your learners strategies that will lead them to real understanding and success. They need to understand that there could be more than one way to come up with the correct answer. For learners with special needs, the focus has to be on understanding instead of memorisation of a series of steps. Therefore, work carefully through the different strategies for division instead of trying to cover a lot of work with no understanding.

5. Teaching methodology

In this section, learners draw on a range of strategies that have been developed in earlier grades. Many of the strategies rely on what learners know about multiplication, which is the inverse operation of division. Encourage learners to ‘see’ the connection between multiplication and division. Learners need to understand, however, that dividing ‘undoes’ what multiplication does and multiplying ‘undoes’ what division does. They should know that multiplication tables are important to know if they do division and they should know that they can check their division using multiplication. Guide learners in how they can use the multiplication and division chart in various ways.

Remind learners that drawing pictures can help them to solve problems. Remind them also about the key terms we use in division – divisor, quotient, remainder, and so on.

6. Homework

Ask learners to complete questions 1 to 3 on pages 33 and 34 of the Workbook. Once back in class, check the answers and allow learners to correct any mistakes they may have made.

7. Diagnostic assessment

As you work through the activity with the whole class, be vigilant and check to see if there are learners who are not participating in the activity. Provide enough opportunities for all learners to practise this skill.

8. Answers

Exercise 1

(LB page 72)

- 2; 4; 6; 8; 10; 12; 14; 16; 18; 20
 - 3; 6; 9; 12; 15; 18; 21; 24; 27; 30
 - 5; 10; 15; 20; 25; 30; 35; 40; 45; 50
 - 6; 12; 18; 24; 30; 36; 42; 48; 54; 60
 - 7; 14; 21; 28; 35; 42; 49; 56; 63; 70
 - 8; 16; 24; 32; 40; 48; 56; 64; 72; 80
- Yes, because 2 divides into all the numbers without a remainder.
- 81 is not a multiple of 7 because 7 does not divide into 81 without a remainder.

Content standard

B5.1.2.4: Demonstrate an understanding of division of a 2- or 3-digit number by a 1- or 2-digit number

Indicator

B5.1.2.4.1 Divide 3-digit numbers by 1-digit numbers efficiently

1. Learning expectations

Learners need to be able to:

- investigate and demonstrate their understanding of the usage of the long division method
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 37–39

3. Large class teaching

In a large class, learners work best in pairs and groups. These should be collaborative groups in which learners can learn from one another, so differently abled learners should be matched together. Using pair and group work will also ensure that learners are not left out or become bored because of listening to you doing all the talking.

More able learners in the group can help the others to master the concept being taught, but be sure to monitor each group's understanding of the concept. You can use group leaders or monitors who can assist those learners who work at a slower pace than others. Learners need to be encouraged to find creative ways of remembering the concepts taught.

Move around the classroom to see what progress learners are making and to catch any misconceptions that may come up. Give advice, encouragement and extra individual help where it is needed.

4. Support for learners with special needs

Learners should be familiar with the vocabulary of multiplication and division by now. However, you can

provide translations, definitions and/or examples of unfamiliar vocabulary words to those learners who struggle to grasp this concept. Allow learners to work with carefully selected partners, so that all learners will have the opportunity for success. If learners with special needs have a peer they feel comfortable working with, allow them to work with the same person. Also allow extra time for these learners to complete any independent work they need to do.

If you see that learners are still struggling with a problem, rather reduce the number of questions they need to answer. It is better for the learner to gain understanding when they are working with only one or two problems, than to have them struggling to complete many.

All concepts in mathematics require learners to continually practise what they have learnt. Reinforce this habit in learners at an early age, but do not put unnecessary pressure on learners with special needs.

5. Teaching methodology

In Grade 5, learners need to master dividing 3-digit numbers by a 1-digit number efficiently by using the long-division method. Explain division as a way of repeatedly subtracting a divisor number from a given bigger number (the dividend) until there is none left and then determining whether the divisor divided equally into the dividend or whether there is a remainder.

Division tends to be more challenging for learners than their previous encounters with addition and subtraction. Explain several examples of long division on the board. Learners may be able to memorise multiplication facts with ease, but when they are asked to find the quotient of two or more values, errors often arise.

Show learners how to draw pictures to help them visualise a division problem that is set in a context. Spend time discussing and modelling the long-division strategy explained in the Learner's Book. Start with small numbers as divisors and gradually move on to larger numbers.

Work through the examples given in the Learner's Book, carefully working through each step with your learners. If there are learners who are struggling with this concept, work with them in a small group while the rest of the class continues with the exercises.

6. Homework

Ask learners to complete Exercise 2 on page 38 of the Workbook and to hand their work in to you for assessment.

7. Teacher assessment

Work carefully through the answers for the different activities on the board. Ask learners to check their work and then hand it in to you for assessment. Check if there are learners who are struggling with this concept. Then work with them in small groups or one-on-one basis before moving on to new concepts.

8. Answers

Exercise 1

(LB page 75)

1. a)

$$\begin{array}{r} 29 \\ 5 \overline{) 145} \\ \underline{10} \\ 45 \\ \underline{45} \\ 0 \end{array}$$

Answer: 29

b)

$$\begin{array}{r} 90 \\ 3 \overline{) 272} \\ \underline{27} \\ 2 \end{array}$$

Answer: 90 rem 2

c)

$$\begin{array}{r} 41 \\ 9 \overline{) 369} \\ \underline{36} \\ 9 \\ \underline{9} \\ 0 \end{array}$$

Answer: 41

d)

$$\begin{array}{r} 76 \\ 6 \overline{) 458} \\ \underline{42} \\ 38 \\ \underline{36} \\ 2 \end{array}$$

Answer: 76 rem 2

2. Learners' own work

3. 2×9 equals 18, not 10.

$$\begin{array}{r} 28 \\ 9 \overline{) 258} \\ \underline{18} \\ 78 \\ \underline{72} \\ 6 \end{array}$$

Answer should be 28 rem 6.

Content standard

B5.1.2.5: Translate word problems into mathematical sentences and solve

Indicator

B5.1.2.5.1 Solve multistep word problems involving the four basic operations

1. Learning expectations

Learners need to be able to:

- investigate the relationship between different strategies in problem solving
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 40–43
- Number lines
- 100-number chart
- Place value charts

3. Large class teaching

Problem solving is an important aspect of doing mathematics. It gives learners a context and link to everyday life activities and helps them make sense of the mathematics they are learning. Problems can be used to introduce new concepts and extend previously learned knowledge.

Remember, however, that problem solving is not an isolated activity. It is a skill that favours every Mathematics lesson and is about finding a solution when a method to find a solution is not obvious.

Problem solving does not just involve solving one-step word problems, but features authentic purposes, risk tasks and multiple ways for a problem to be solved. Solving problems is the act of finding a solution when a method for solution is not obvious. It relies on thinking and making sense of problems in different contexts. Remind learners that they can use the following techniques to solve problems: skip

counting from a known fact, using doubling or halving, using patterns in the 9s facts or using repeated doubling or halving to determine answers for basic multiplication facts to 81 and related division facts.

Allow learners to work together in collaborative pairs and groups, but monitor their work throughout the lesson. Assist learners as needed.

4. Support for learners with special needs

Problem solving relies on reading, thinking and comprehending the posed problem and then using the context to make sense of the problem in order to solve it. Assess learners' abilities to read and comprehend problems and if you find there are learners who are struggling with the comprehension of a passage, spend some time working with them.

Focus on the steps and procedures for analysing the problems. The most commonly used problem-solving model is George Polya's four-step model:

- understanding the problem
- making a plan to solve the problem
- carrying out the plan to solve the problem
- looking back to check the results.

Work through the different strategies as a whole class, reminding learners of what they have learned in previous grades.

5. Teaching methodology

It is important to create a classroom environment in which learners are problem solvers. This helps to tie struggles to strategies so that the learners will not only see value in working harder, but in working smarter by trying new and different strategies and revising their processes. In doing so, they will become more confident and successful as they progress in their mathematical journeys.

As learners work through the different strategies, ask them how their strategies work. Take the time to go through the strategies with the whole class. Be sure to be explicit in your explanations. Perhaps a way of showing that one strategy might be preferable over another is to use a strategy,

for example doubling or halving with a problem that would not benefit from using this strategy. This will show learners how inefficient strategies for a particular problem might cause more confusion than benefits.

Make a distinction between the models learners use to understand the relationship of the numbers in the problem and the techniques to solve the computation in the problem. Those two things work in tandem but are very different. Models are the visual ways problems are represented. Techniques are the ways a learner solves a problem, putting together and taking apart the numbers. The most important thing about models is to move away from them. Move learners toward efficiency.

6. Homework

Assign exercises from page 40 to 43 of the Workbook to learners to complete as homework. Ask learners to hand their work in to you for assessment.

7. Teacher assessment

Ask learners to hand in their work for assessment. Make sure to check which learners are struggling with different strategies for calculations and then spend some extra time with them.

8. Answers

Exercise 1

(LB page 76)

1. $36 \times 3 = 108$
2. $48 \div 6 = 8$ days
3.
 - a) $54 \times 15 = 810$
 - b) $810 - 358 = 452$
 - c) $452 \div 7 = 64$ and 4 will be left over
4.
 - a) $756 \div 7 = 108$
 - b) Double 756 = $756 \times 2 = 1,512$
 - c) $756 \div 9 = 84$
 - d) $756 \div 8 = 94.5$ but you cannot have half a person, so they cannot be split equally among 8 planes.

Content standard

B5.1.2.6: Demonstrate understanding of integers

Indicator

B5.1.2.6.1 Solve simple addition and subtraction problems involving integers

1. Learning expectations

Learners need to be able to:

- critically investigate the relationship between addition and subtraction of integers
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 44–46
- Number lines
- Counters
- Pictures or articles showing integer numbers

3. Large class teaching

Allow learners to work in pairs or small collaborative groups. As this concept may not make sense in the beginning, make sure misconceptions are not introduced as learners discuss the work in this section.

Monitor the work done in the groups and intervene where you find learners are struggling to work with this concept. Allow learners to use number lines and use as many examples as possible from everyday life.

Some learners may also struggle to understand that a number like -5 is smaller than a number like 2 . Use a number line to explain why 2 is larger than -5 and provide as many examples as possible. Also remember to compare two negative numbers, such as -5 and -25 . Even though 25 is larger than 5 ; -5 is larger than -25 .

4. Support for learners with special needs

Learners need many opportunities to pose and solve problems in adding and subtracting integers. The curriculum focuses on developing a range of mental strategies and recording methods for addition and subtraction. The exercises in this section aim to assist learners in making connections between counting and addition and subtraction strategies and provide learners with opportunities to demonstrate their understanding of integers and how these numbers can be added and subtracted.

Learners who struggle to understand integers need extra support and should be given real-life examples to work with. Ask them to think about times when they have seen numbers like -1 . These could be in lifts or related to temperatures or thermometers. Show them as many examples as you can and explain what the numbers mean.

5. Teaching methodology

Present the addition of integers using a number line. On the number line, numbers move as many times either to the right or to the left. Explain to your learners that the first number in the expression is their ‘starting point’. To add a positive integer, they need to move to the right by the number given. To add a negative integer, they need to move to the left by the number given.

You can also use a change in temperature to show learners how integers work. For example, $25^{\circ} - 9^{\circ}$ means the temperature was 25° and drops by 9° to 16° , or $(-2^{\circ}) - 4^{\circ}$ means the temperature is -2° and then drops by 4° to -6° .

Remind your learners that $5 - 2$ denotes the difference between 5 and 2, which is 3. They should begin to think of the difference as the distance between the two numbers on a number line. Remind them to start with the big number first, otherwise their answers will be incorrect.

Work through the text and examples in the Learner’s Book. If necessary, provide additional examples for learners to work through. Learners complete Exercise 1 on their own or with a partner.

6. Homework

Assign exercise 1 on page 44 of the Workbook for learners to complete.

7. Self/Peer assessment

Work through the answers with the class by writing the correct answers on the board. Ask learners to swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 79)

1.
 - a) Smaller. The further you move to the left, the smaller the numbers get.
 - b) Bigger. The further you move to the right, the bigger the numbers get.
2.
 - a) $-20 < -12$
 - b) $18 = \text{eighteen}$
 - c) $-203 < 0$
 - d) three hundred and fifty-eight = $300 + 50 + 8$
 - e) $59 > -59$
 - f) False. Zero is neither positive nor negative.
3. 7 floors
4.

a) $-19 + 10 = -9$	b) $209 + (-72) = 137$
c) $214 - (-58) = 272$	d) $598 - (+98) = 500$

Sub-strand 3: Number: Fractions

Content standard

B5.1.3.1: Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions

Indicator

B5.1.3.1.1 Determine equivalent fractions of given fractions

1. Learning expectations

Learners need to be able to:

- find equivalent fractions.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 47–49
- Fraction strips
- Various counters
- Various fraction models

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Some learners find fractions very difficult. You need to facilitate this carefully, making fractions a more accessible topic in mathematics and by showing learners that a fraction is a number that we can use to describe a part of a whole.

Review the different fractional parts with the learners by giving them concrete folding activities to do. You also need to bring fractions to life by showing learners how they use fractions when sharing with their friends/family, etc. Use as many examples as you need in order to reinforce this concept.

5. Teaching methodology

Fractions can be learners' most – or least – favourite mathematics topic. Too often, learners learn rules for manipulating written fractions before they have developed an understanding of fraction concepts. Always use manipulative models when teaching fractions.

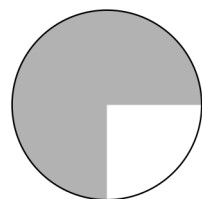
There are three main kinds of fraction models, and it is best if learners gain experience with all three:

Length models, such as paper strips or Cuisenaire® rods, are easily connected to ideas about fractions on a number line.

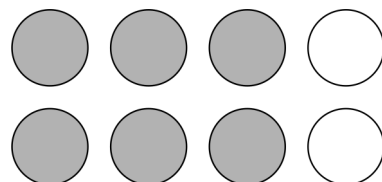


Area models are usually portions of rectangles or circles (these are also known as pie fractions or pizza fractions). Learners respond to area models, which work especially well for the purpose of modeling operations with fractions. Geoboards also make excellent area models. Follow this link for instructions on how to make a Geoboard:

<https://www.youtube.com/watch?v=FthoWKXE1pE>



Set models, such as coloured chips or counters. These can be the most confusing, but work very well for developing algorithms later on.



6. Homework

Assign Exercise 1 on pages 47–49 of the Workbook as homework.

7. Diagnostic assessment

Assess the learners' work by asking them to hand in their completed tasks to you. Check to see if the learners have a firm grasp on the concepts being taught.

If you find that some learners are still struggling, work with them on a one-to-one basis or as part of a small group.

8. Answers

Exercise 1

(LB page 84)

1.
 - a) $\frac{1}{2} = \frac{6}{12}$
 - b) $\frac{6}{8} = \frac{9}{12}$
 - c) $\frac{1}{4} = \frac{2}{8}$
 - d) $\frac{1}{2} = \frac{3}{6}$
 - e) $\frac{3}{4} = \frac{9}{12}$
 - f) $\frac{5}{10} = \frac{3}{6}$
 - g) $\frac{5}{5} = \frac{3}{3}$
 - h) $\frac{2}{6} = \frac{4}{12}$
 - i) $\frac{10}{10} = \text{one whole}$
 - j) $\frac{4}{5} = \frac{8}{10}$
2. $\frac{3}{6}$ and $\frac{6}{12}$
3. $\frac{2}{6}$ and $\frac{4}{12}$
4. $\frac{2}{8}$ and $\frac{3}{12}$

1. Learning expectations

Learners need to be able to:

- convert mixed fractions
- compare and order fractions.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 47–49
- Fraction strips
- Various counters
- Various fraction models

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

It will probably not be possible for you to give individual feedback to all the learners in your class. Therefore, teach learners the importance of peer-to-peer feedback as well as self-reflection. It might be difficult in the beginning, but with more practice, your learners will become adept at this and begin to accept it as part of their teaching and learning experience.

Another obstacle for teaching this concept might be a lack of resources. Use resources available in and around the school.

4. Support for learners with special needs

When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have visually impaired learners, you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

Explain to your learners that they will practise comparing and ordering fractions. To compare and order fractions, you can continue using models so that learners can physically work with and manipulate the different fractions.

Ask a volunteer to explain to the rest of the class what the words ‘compare’ and ‘order’ mean. Remind learners what it means to see if one fraction is the same as, smaller than or bigger than another fraction. Give opportunities for learners to compare different fractions using the words equal, greater than or smaller than. Then move on to using the symbols. Provide ample time for practice.

Learners will also need to understand how to convert fractions from one form to another. Here we cover converting fractions so that they have the same denominator, converting fractions to percentages, and converting fractions to decimals. Take your time to teach learners the different conversion techniques shown in the Learner’s Book.

Learners can complete the following Exercises in class:

- Exercise 1
- question 1 of Exercise 2
- Exercise 3. You may allow them to work in pairs to complete their work.

6. Homework

Assign the following as homework:

- questions 2–4 of Exercise 2
- Exercise 4. Once back in class, provide the correct answers for the exercises and ask learners to correct any mistakes they may have made.

7. Self/Peer assessment

Work through the answers to the activities with the class. Write them on the board. Ask learners to correct their own work or to swap books and mark each other’s work.

8. Answers

Exercise 1

(LB page 86)

- $\frac{5}{5}$; $\frac{3}{4}$; $\frac{2}{3}$; $\frac{1}{3}$
- $\frac{3}{5}$; $\frac{5}{10}$; $\frac{1}{4}$; $\frac{1}{8}$
- $\frac{4}{8}$; $\frac{2}{7}$; $\frac{2}{9}$; $\frac{1}{6}$
- $\frac{7}{7}$; $\frac{3}{4}$; $\frac{3}{6}$; $\frac{1}{10}$

Exercise 2

(LB page 86)

- | | | |
|-------------|-------------|-------------|
| a) > | b) > | c) < |
| d) > | e) > | f) = |
| g) < | h) < | i) < |
- | | |
|--|--|
| a) $\frac{1}{8}$; $\frac{1}{7}$; $\frac{1}{5}$; $\frac{1}{4}$; $\frac{1}{3}$ | b) $\frac{1}{10}$; $\frac{1}{9}$; $\frac{1}{7}$; $\frac{1}{6}$; $\frac{1}{2}$ |
| c) $\frac{2}{10}$; $\frac{1}{3}$; $\frac{5}{9}$; $\frac{4}{5}$; $\frac{7}{8}$ | d) $\frac{3}{5}$; $\frac{3}{6}$; $\frac{2}{3}$; $\frac{5}{7}$; $\frac{9}{10}$ |
| e) $\frac{3}{10}$; $\frac{4}{9}$; $\frac{1}{2}$; $\frac{3}{4}$; $\frac{5}{6}$ | f) $\frac{1}{5}$; $\frac{3}{10}$; $\frac{5}{8}$; $\frac{2}{3}$; $\frac{4}{5}$ |
- | | |
|-------------------------|-------------------------|
| a) $\frac{1}{2}$ | b) $\frac{3}{4}$ |
|-------------------------|-------------------------|
- | | |
|--------------------------|-------------------------|
| a) $\frac{7}{10}$ | b) $\frac{3}{9}$ |
| c) $\frac{1}{4}$ | d) $\frac{1}{6}$ |

Exercise 3

(LB page 88)

- | | |
|----------------|--------------------------|
| a) 0.7 | b) $0.375 = 0.38$ |
| c) 4.4 | d) 11.44 |
| e) 0.75 | |

- 0.38; 0.7; 0.75; 4.4; 11.44

Exercise 4

(LB page 88)

- | | |
|---------------------------|----------------------------|
| a) 0.7; 0.42; 0.5 | b) 0.4; 0.4; 0.23 |
| c) 0.95; 0.9; 0.99 | d) 0.6; 0.58; 0.63 |
| e) 0.25; 0.38; 0.7 | f) 0.1; 0.11; 0.4 |
| g) 0.8; 0.83; 0.75 | h) 0.67; 0.63; 0.83 |
| i) 0.75; 0.7; 0.8 | j) 0.88; 0.8; 0.67 |
- | | |
|---------------------------|----------------------------|
| a) 0.7; 0.5; 0.42 | b) 0.4; 0.4; 0.23 |
| c) 0.99; 0.95; 0.9 | d) 0.63; 0.6; 0.58 |
| e) 0.7; 0.38; 0.25 | f) 0.4; 0.11; 0.1 |
| g) 0.83; 0.8; 0.75 | h) 0.83; 0.67; 0.63 |
| i) 0.8; 0.75; 0.7 | j) 0.88; 0.8; 0.67 |

Indicator

B5.1.3.1.3 Use the concept of equivalent fractions in changing fractions to the same denominator for addition and subtraction of like fractions (one denominator being a multiple of the other)

1. Learning expectations

Learners need to be able to:

- convert fractions
- add and subtract fractions.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 49–51
- Fraction walls
- Fraction strips

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

It will probably not be possible for you to give individual feedback to all the learners in your class. Therefore, teach learners the importance of peer-to-peer feedback as well as self-reflection. It might be difficult in the beginning, but with more practice, your learners will become adept at this and begin to accept it as part of their teaching and learning experience.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

In this sub-strand, encourage learners to help one another by talking about the fractions that they are working with. If, for example, there are learners who have a visual impairment,

other learners can tell them what the fraction is and ask them different questions to test their understanding. Encourage learners to find creative ways of helping their peers learn the concepts being taught. Through helping other learners, they will also be helping their own understanding of the concept.

5. Teaching methodology

Remember to use several contexts for fractions. Learners need to understand that fractions can be used in everyday contexts such as food, money, and so on. When you are explaining fractions to your learners, you need to be cognisant of the examples you use. For example, you cannot use a circle to show sharing GH¢1 into equal parts because you cannot cut up the money as it will then be worthless.

Make sure that learners understand that fractions are a part of a whole, that they know how to name them and are able to use the vocabulary associated with fractions. If there are still learners who are struggling, revise the work on fractions before moving on to new concepts.

In this section, learners will add and subtract fractions with different denominators. Begin by working practically with the learners using fraction strips, and so on, and not only with symbols.

Encourage the discovery of how learners can add and subtract unlike fractions by converting them into like fractions.

6. Homework

Choose exercises from pages 49 to 51 of the Workbook to assign as homework.

7. Self/Peer assessment

Work through the answers with the class. Write them on the board and ask learners to swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 91)

1. a) $\frac{1}{5} + \frac{3}{10} = \frac{2+3}{10} = \frac{5}{10} = \frac{1}{2}$
b) $\frac{2}{3} + \frac{1}{6} = \frac{4+1}{6} = \frac{5}{6}$
c) $\frac{5}{6} + \frac{3}{8} = \frac{20+9}{24} = \frac{29}{24} = 1\frac{5}{24}$
d) $\frac{7}{8} + \frac{3}{5} = \frac{35+24}{40} = \frac{59}{40} = 1\frac{19}{40}$
e) $\frac{3}{7} + \frac{4}{5} = \frac{15+28}{35} = \frac{43}{35} = 1\frac{8}{35}$
f) $\frac{5}{8} + \frac{3}{9} = \frac{45+24}{72} = \frac{69}{72} = \frac{23}{24}$
g) $\frac{6}{9} + \frac{7}{11} = \frac{66+63}{99} = \frac{129}{99} = 1\frac{30}{99} = 1\frac{10}{33}$
h) $\frac{7}{10} + \frac{5}{9} = \frac{63+50}{90} = \frac{113}{90} = 1\frac{23}{90}$
2. Tomatoes: $\frac{3}{7}$
Whole garden: $\frac{4}{5}$
Carrots: $\frac{5}{6}$
3. $\frac{7}{8} - \frac{2}{3} = \frac{21-16}{24} = \frac{5}{24}$
4. $\frac{2}{10} + \frac{2}{5} = \frac{2+4}{10} = \frac{6}{10} = \frac{3}{5}$
5. a) $\frac{5}{8} - \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$
b) $\frac{7}{9} - \frac{2}{9} = \frac{5}{9}$
c) $\frac{9}{10} - \frac{7}{10} = \frac{2}{10} = \frac{1}{5}$
d) $\frac{7}{12} - \frac{3}{20} = \frac{35-9}{60} = \frac{26}{60} = \frac{13}{30}$
e) $\frac{2}{3} - \frac{2}{5} = \frac{10-6}{15} = \frac{4}{15}$
f) $\frac{6}{8} - \frac{1}{9} = \frac{54-8}{72} = \frac{46}{72} = \frac{23}{36}$

Indicator

B5.1.3.1.4 Use the concept of equivalent fractions for addition and subtraction of fractions greater than one (improper and mixed fractions)

1. Learning expectations

Learners need to be able to:

- convert fractions
- add and subtract fractions.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 49–51
- Fraction walls
- Fraction strips

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities, you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

Remind your learners that the term ‘improper fraction’ means that the numerator (the top number of the fraction) is bigger than the denominator (the bottom number of the fraction).

Explain that the process for adding improper fractions works exactly the same as the process for adding proper fractions. Teach them the following steps:

- Make sure that both fractions have the same denominator. If the denominators are different, you will have to convert one or both fractions so that they have the same denominator.
- Then simply add the numerators and write the answer over the same denominator.
- Simplify if needed. You can also convert your answer to a mixed number (if you are able to).

Explain that the process for subtracting improper fractions works exactly the same as the process for adding proper fractions. Teach them the following steps:

- Make sure that both fractions have the same denominator. If the denominators are different, you will have to convert one or both fractions so that they have the same denominator.
- Then simply subtract the numerators and write the answer over the same denominator.
- Simplify if needed. You can also convert your answer to a mixed number (if you are able to).

To add or subtract mixed numbers, convert the mixed number into a fraction. Then follow the same steps as for addition and subtraction described above.

6. Diagnostic assessment

Be aware not to gloss over this section quickly as there may be some learners who struggle with addition and subtraction, finding the LCD and converting. Make sure all the learners in your class are at the same level before moving on. If there are still learners who are struggling, work with them on a one-to-one basis or in a small group.

This importance of finding factors and multiples is again highlighted here. Therefore, continue working with factors and multiples of numbers throughout the course of the year.

7. Answers

Exercise 1

(LB page 96)

1. a) $3\frac{1}{4} + 4\frac{1}{2} = 7\frac{1+2}{4} = 7\frac{3}{4}$
 - b) $6\frac{1}{6} + 3\frac{2}{3} = 9\frac{1+4}{6} = 9\frac{5}{6}$
 - c) $7\frac{2}{5} + 4\frac{1}{10} = 11\frac{4+1}{10} = 11\frac{5}{10} = 11\frac{1}{2}$
 - d) $7\frac{6}{7} + 5\frac{4}{5} = 12\frac{30+28}{35} = 12\frac{58}{35} = 13\frac{23}{35}$
 - e) $\frac{4}{5} + 4\frac{5}{6} = 4\frac{20+25}{30} = 4\frac{45}{30} = 5\frac{15}{30} = 5\frac{1}{2}$
 - f) $9\frac{3}{8} + 5 = 14\frac{3}{8}$
 - g) $3\frac{4}{5} + \frac{4}{9} = 3\frac{36+20}{45} = 3\frac{56}{45} = 4\frac{11}{45}$
 - h) $8\frac{7}{8} + 4\frac{11}{24} = 12\frac{21+11}{24} = 12\frac{32}{24} = 13\frac{8}{24} = 13\frac{1}{3}$
2. a) $9\frac{4}{5} - 2\frac{3}{5} = 7\frac{1}{5}$
 - b) $5\frac{9}{10} - 1\frac{7}{10} = 4\frac{2}{10} = 4\frac{1}{5}$
 - c) $4\frac{7}{8} - 2\frac{1}{8} = 2\frac{6}{8} = 2\frac{3}{4}$
 - d) $4\frac{7}{8} - 3\frac{1}{12} = 1\frac{21-2}{24} = 1\frac{19}{24}$
 - e) $4\frac{3}{8} - 1\frac{3}{4} = \frac{35}{8} - \frac{7}{4} = \frac{35-14}{8} = \frac{21}{8} = 2\frac{5}{8}$
 - f) $6\frac{2}{5} - 3\frac{2}{3} = \frac{32}{5} - \frac{11}{3} = \frac{96-55}{15} = \frac{41}{15} = 2\frac{11}{15}$

Exercise 2

(LB page 97)

1. $3\frac{2}{3} - 1\frac{1}{3} = 2\frac{1}{3}$
2. $4\frac{5}{6} - 1\frac{3}{4} = 3\frac{20-18}{24} = 3\frac{2}{24} = 3\frac{1}{12}$
3. $15\frac{3}{4} - 5\frac{1}{2} = 10\frac{3-2}{4} = 10\frac{1}{4}$
4. $50\frac{1}{2} - 48\frac{2}{5} = 2\frac{5-4}{10} = 2\frac{1}{10}$
5. $\frac{1}{3} - \frac{1}{5} = \frac{5-3}{15} = \frac{2}{15}$

1. Learning expectations

Learners need to be able to:

- use their understanding of strategies to explain the multiplication and division of fractions
- develop problem-solving skills and critical thinking
- justify their ideas.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 51–52
- Fraction walls
- Fraction strips

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

Another obstacle for teaching this concept might be a lack of resources. Use resources available in and around the school. Ask learners to bring old newspapers, brown paper bags, scrap paper, and so on, to school. You can use these to make fraction strips and other manipulatives.

4. Support for learners with special needs

The main point of this section is showing learners in a practical way that fractions with different names have the same value if the whole is the same. The more parts the whole is divided into, the smaller each part gets.

Ask learners to work with one another and to help learners in their groups that may be struggling with spatial perception barriers. Encourage them to help, but not to overshadow the other learner, but instead to give them the space to explore the fractions themselves, while letting them know they are there to assist them if necessary.

5. Teaching methodology

In this section of the work on fractions, it is useful for learners to work practically by folding and manipulating different fractions and wholes. Manipulatives give learners a concrete way of understanding the work with fractions and is a good basis for reinforcing what they already know about fractions.

When using the manipulatives to explore the idea of fractions, allow learners to 'see' how the individual parts fit together to make a whole. They can also use the manipulatives to compare different fractions. Using manipulatives, ask learners to show a fraction. Then ask them to show you an equivalent fraction next to their original fraction. When placed side by side, learners will see that the fractions are the same.

You can also help learners to understand which fractions are bigger or smaller by comparing their relative sizes.

6. Homework

Ask learners to complete Exercise 3 on page 101 of the Learner's Book and Exercise 4 on pages 51 and 52 of the Workbook.

7. Diagnostic assessment

As learners work with their manipulatives, assess their work by observing their comparison of fractions, addition and subtraction of fractions, finding equivalent fractions, and so on.

Take note of the learners who are struggling with the concept and answer any queries learners may have.

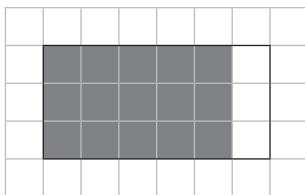
8. Answers

Exercise 1

(LB page 100)

- $\frac{4}{5} \times 15 = 12$
 - $\frac{4}{7} \times 21 = 12$
 - $\frac{1}{8} \times 24 = 3$

2.



$$\frac{5}{6} \times 18 = 15$$

3. a) $\frac{1}{3}$ of 18 = 6

b) $\frac{2}{9}$ of 18 = 4

c) $\frac{2}{6}$ of 18 = 6

d) $\frac{1}{6}$ of 18 = 3

e) $\frac{2}{3}$ of 18 = 12

4. a) $\frac{1}{4}$ of 24 = 6

b) $\frac{3}{4}$ of 24 = 18

c) $\frac{1}{8}$ of 24 = 3

d) $\frac{2}{25}$ of 50 = 4

e) $\frac{7}{15}$ of 45 = 21

f) $\frac{9}{20}$ of 100 = 45

Exercise 2

(LB page 101)

1. $\frac{2}{3} \times 24 = 16$

2. $\frac{5}{9} \times 180 = 5 \times 20 = 100$

3. a) Learners' own work

b) $\frac{3}{4} \times 1 \times 8 = \frac{3}{4} \times 8$

c) 6 m

4. 15

5. 3

6. a) $\frac{3}{5} \times 30 = 18$

b) $\frac{25}{30} = \frac{5}{6}$

c) $\frac{5}{30} = \frac{1}{6}$

Exercise 3

(LB page 102)

1. $7 \times 4\frac{8}{9} = \frac{7}{1} \times \frac{44}{9} = \frac{308}{9} = 34\frac{2}{9}$

2. $11\frac{15}{16} \times 31 = \frac{191}{16} \times \frac{31}{1} = \frac{5,921}{16} = 370\frac{1}{16}$

3. $23 \times 8\frac{9}{15} = \frac{23}{1} \times \frac{129}{15} = \frac{2,967}{15} = 197\frac{12}{15} = 197\frac{4}{5}$

4. $9 \times 12\frac{3}{4} = \frac{9}{1} \times \frac{51}{4} = \frac{459}{4} = 114\frac{3}{4}$

Sub-strand 4: Number: Decimals

Content standard

B5.1.4.1: Demonstrate understanding of decimals and strategies for comparing, adding and subtracting decimals

Indicator

B5.1.4.1.1 Describe and represent decimals (up to the thousandths) concretely, pictorially and symbolically and relate them to fractions

1. Learning expectations

Learners need to be able to:

- describe decimals
- show decimals using models and symbols.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 53–56
- Base-ten blocks
- place value charts/mats

3. Large class teaching

To teach large classes, it is useful to work in collaborative peer groups. This will enable struggling learners as they learn from their peers. Using hands-on and visual manipulatives, such as base-ten blocks, enables learners to build decimal numbers. Remember that each block can represent different amounts – it all depends on how they are being used. You need to explain this to your learners and make sure that all groups understand the meaning of the blocks before trying to answer any questions in the activities.

You can also create simple place value charts for each group to use. These place value charts will teach groups to mimic the way a number is written from left to right.

4. Support for learners with special needs

Encourage your learners to assist those learners who may require additional help in their groups because of a special need. They need to be sensitive to the needs of all the learners in their group and learn to work with differently abled people.

5. Teaching methodology

Understanding place value is an important skill for learners to grasp as it builds on their mathematical understanding. It is important for learners to begin working at the concrete level. So, base-ten blocks work well because they are sized according to their value. Learners need to understand that each place to the left is 10 times the size of the place to the right.

When you introduce decimals to your learners, use the single cubes to represent tens, the flats to represent ones, the rods for tenths and the units for hundredths. You can create a place value mat by means of which learners can become cognisant of the numbers represented by each model. While learners are working in groups, introduce each piece and explain how it represents a particular decimal place value.

Then guide your learners to represent a given number using the base-ten blocks. Begin by writing a decimal in standard form on the board. Then ask learners to work with their peers to ‘build’ the number. Remember that expanded form is particularly difficult for learners when representing decimals, so using base-ten blocks will help them visualise the number more easily. Check each group’s representation of the given number and help groups who may have made errors.

Provide as many practice activities as you can before asking learners to complete the activities in the Learner’s Book.

6. Homework

Learners can complete the following exercises as homework:

- Exercise 3 on page 106 of the Learner's Book
- Exercise 1 on page 53 of the Workbook
- Exercise 2 on page 55 of the Workbook

7. Diagnostic assessment

As learners work together in their groups, monitor their work and assess which learners are grasping the concept and which learners may still be struggling. Assist any groups that you find are not agreeing on how to represent the decimal numbers.

8. Answers

Exercise 1

(LB page 104)

- 1.01 m; 1.02 m; 1.03 m; **1.04 m**; **1.05 m**; **1.06 m**; **1.07 m**; 1.08 m; **1.09 m**; **1.10 m**
 - 0.97m; 0.98 m; **0.99 m**; **1.00 m**; **1.01 m**; **1.02 m**; **1.03 m**; 1.04 m; 1.05 m
- A = 1.001 km or 1,001 m
 - B = 1.006 km or 1,006 m
 - C = 1.009 km or 1,009 m
 - D = 1.011 km or 1,011 m
- 2.594 km; 2.595 km; 2.596 km; **2.597 km**; **2.598 km**; **2.599 km**; **2.600 km**; **2.601 km**
 - 5.997 km; 5.998 km; **5.999 km**; **6.000 km**; **6.001 km**; 6.002 km; 6.003 km

Exercise 2

(LB page 105)

- $\frac{14}{100}$; 0.14
 - $\frac{49}{100}$; 0.49
 - $\frac{63}{100}$; 0.63
 - $\frac{81}{100}$; 0.81
- $0.045 = \frac{4}{100} + \frac{5}{1,000}$
 - $0.208 = \frac{2}{10} + \frac{8}{1,000}$
 - $3.39 = 3 \text{ units} + \frac{3}{10} + \frac{9}{100}$
 - $10.155 = 1 \text{ ten} + \frac{1}{10} + \frac{5}{100} + \frac{5}{1,000}$
 - $521.967 =$
 $5 \text{ hundreds} + 2 \text{ tens} + 1 \text{ unit} + \frac{9}{10} + \frac{6}{100} + \frac{7}{1,000}$
- $38.619 = 30 + 8 + 0.6 + 0.01 + 0.009$
 - $59.037 = 50 + 9 + 0.03 + 0.007$
 - $0.001 = 0.001$
 - $6.95 = 6 + 0.9 + 0.05$
 - $974.216 = 900 + 70 + 4 + 0.2 + 0.01 + 0.006$

Exercise 3

(LB page 106)

1. a) 9 b) 0.9 c) 0.04 d) 30
e) 0.007 f) 100 g) 0.02 h) 20
2. a) 30 b) 0.003 c) 0.03 d) 0.003
e) 0.3 f) 0.3 g) 3 h) 0.03
3. a) 0.6; 6 tenths b) 0.004; 4 thousandths
c) 0.03; 3 hundredths d) 0.7; 7 tenths
e) 0.09; 9 hundredths f) 1.255; 5 thousandths
g) 42.7; 7 tenths h) 6.14; 4 hundredths

Exercise 4

(LB page 109)

1. a) $\frac{3}{6} = \frac{1}{2}$ b) $\frac{5}{10}$ c) 0.5
2. a) $\frac{6}{8} = \frac{3}{4}$ b) $\frac{75}{100}$ c) 0.75
3. a) $\frac{9}{12} = \frac{3}{4}$ b) $\frac{75}{100}$ c) 0.75
4. a) $\frac{8}{20} = \frac{2}{5}$ b) $\frac{4}{10}$ c) 0.4
5. a) $\frac{12}{20} = \frac{3}{5}$ b) $\frac{6}{10}$ c) 0.6
6. a) $\frac{5}{25} = \frac{1}{5}$ b) $\frac{2}{10}$ c) 0.2
7. a) $\frac{10}{25} = \frac{2}{5}$ b) $\frac{4}{10}$ c) 0.4
8. a) $\frac{5}{50} = \frac{1}{10}$ b) $\frac{1}{10}$ c) 0.1
9. a) $\frac{20}{80} = \frac{1}{4}$ b) $\frac{25}{100}$ c) 0.25
10. a) $\frac{15}{40} = \frac{3}{8}$ b) $\frac{375}{1,000}$ c) 0.375

Exercise 5

(LB page 109)

1. $0.2 = \frac{2}{10} = \frac{1}{5}$ 2. $0.5 = \frac{5}{10} = \frac{1}{2}$
3. $0.3 = \frac{3}{10}$ 4. $0.6 = \frac{6}{10} = \frac{3}{5}$
5. $0.45 = \frac{45}{100} = \frac{9}{20}$ 6. $0.68 = \frac{68}{100} = \frac{17}{25}$
7. $0.125 = \frac{125}{1,000} = \frac{1}{8}$ 8. $0.625 = \frac{625}{1,000} = \frac{5}{8}$

Indicator

B5.1.4.1.2 Compare and order decimals and a mixture of common fractions and decimals (up to the thousandths) using the symbols $<$, $>$, or $=$

1. Learning expectations

Learners need to be able to:

- compare decimals
- order decimals.

2. Resources used in this chapter

- Learner's Book
- Base-ten blocks
- place value charts/mats

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

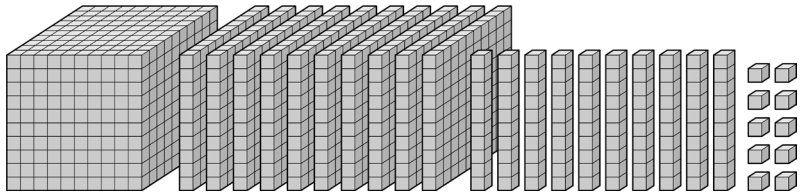
When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities, you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

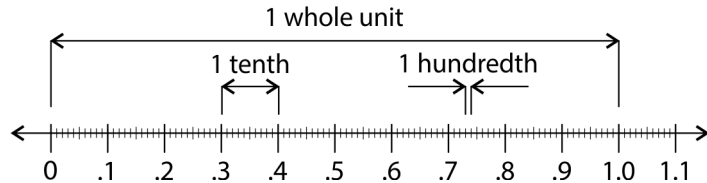
5. Teaching methodology

When teaching learners how to compare and order decimals, remind them that decimals use a continuation of the place values that show whole numbers. However, for decimals, each place value is ten times less as you move to the right.

Continue using the base-ten blocks so learners can visualise the decimal numbers. Show one whole unit as a single cube. Explain that this can be divided into ten equal parts (tenths). The tenths can be further divided into ten equal parts (hundredths). And the hundredths can be further divided into ten equal parts (thousandths).



You can also move to using a number line to show learners how one whole unit is divided into tenths and then divided into hundredths.



Many learners struggle to compare decimals for size when the number of digits given is different, for example if they have to compare 0.3 and 0.27. Learners need to be guided to move away from thinking of decimal numbers as whole numbers. One way of doing this is by getting them to write the decimals in columns. This will provide a clearer picture for them as they compare their decimal numbers.

For example:

	.	Tenths	Hundredths	Thousandths
0.3	.	3	0	0
0.27	.	2	7	0

Explain to learners that as they begin comparing decimal numbers for size, they need to start by looking at the digit in the tenths place. The decimal number with the greater value there is the biggest. If the tenths place for two numbers is the same, they then need to move to comparing the digits in the hundredths place. This comparison will continue until they find a digit that is greater, smaller or equal.

Examples:

$0.57 > 0.49$	Only go as far as the tenths place.
$0.78 < 0.79$	The tenths are the same, so compare the hundredths.
$0.9 > 0.39$	Look at the tenths to see that 0.9 is greater than 0.39.
$0.2 < 0.23$	The tenths are the same, so compare the hundredths to see that 0.2 is less than 0.23.
$0.232 > 0.231$	The tenths and the hundredths are the same, so compare the thousandths.
$0.404 < 0.440$	The tenths are the same, so compare the hundredths.
$0.30 = 0.3$	The tenths are the same. The zero to the right can be ignored.

Once learners have grasped the concept of comparing decimal numbers, then ordering decimal numbers will flow fairly naturally after this. However, monitor their work to ensure that overconfidence does not lead to unnecessary errors. Encourage them to continue using the column method to check their work, so that they can be sure they have worked correctly.

Instruct learners to complete question 1 of Exercise 1 with a partner.

6. Homework

Assign question 2 of Exercise as homework. Once back in class, write the answers on the chalkboard and ask the learners to check and correct their work.

7. Peer assessment

Work through the answers with the class and write them on the board. Ask learners to swap their books and mark each other's work.

8. Answers

Exercise 1

(LB page 112)

1.
 - a) $0.48 < 0.53$
 - b) $0.609 < 0.690$
 - c) 0.9 is a greater fraction than 0.7
 - d) $0.7 = 0.700$
2.
 - a) 98%; 0.75; $\frac{1}{3}$; $\frac{20}{100}$; 0.07
 - b) $\frac{3}{4}$; 0.7; $\frac{8}{12}$; 0.56; 50%; 0.01
 - c) 99%; 0.9; $\frac{5}{8}$; $\frac{50}{100}$; 0.20; $\frac{12}{144}$

1. Learning expectations

Learners need to be able to:

- round decimals to the nearest tenth and hundredth.

2. Resources used in this chapter

- Learner's Book
- Base-ten blocks
- Place value charts/mats

3. Large class teaching

The best way to work with large classes is to get to know your learners. Check which of your learners are comfortable speaking in front of the whole class and which learners are comfortable speaking in smaller groups. As the learners work in groups, monitor their progress closely.

You can use all sorts of tips and tricks to teach rounding numbers. Ask learners to come up with chants or songs about rounding decimal numbers in their small groups. Ask learners to write instruction cards or make a poster on how to round decimal numbers. Make sure the whole group is involved in coming up with the 'fun' way of remembering. In this way, all the group members will remember their 'trick' for rounding decimal numbers.

4. Support for learners with special needs

Teaching rounding by using 'tricks' is a short-term solution. Once all the learners in the groups are comfortable with their strategy on rounding decimal numbers, explain to them that to be successful in rounding decimal numbers, they need to understand and be comfortable working with place value. If you find that there are still learners struggling with place value concepts, work with them in smaller break-away groups. Be especially aware of learners with special needs and guide them using visual or auditory cues.

5. Teaching methodology

Remind your learners that when they are rounding off a number, they are expressing the number as a rounded number rather than an exact number.

To round off decimal numbers, they can follow these steps:

- Find the place value you want (the 'rounding' digit) and look at the digit just to the right of it.
- If that digit is less than 5, do not change the rounding digit but drop all digits to the right of it.
- If that digit is greater than or equal to five, add one to the rounding digit and drop all digits to the right of it.

Instruct learners to complete question 1 of Exercise 1 with a partner.

6. Homework

Assign question 2 of Exercise as homework. Once back in class, write the answers on the chalkboard and ask the learners to check and correct their work.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 113)

1.

Number	Rounded off to the nearest tenth	Rounded off to the nearest hundredth
1.642	1.6	1.64
2.457	2.5	2.46
8.153	8.2	8.15
9.876	9.9	9.88
3.522	3.5	3.52

2. a) 0.75 (i) 0.8 (ii) 0.75
b) 0.206 (i) 0.2 (ii) 0.21
c) 8.9 (i) 8.9 (ii) 8.90
d) 12.23 (i) 12.2 (ii) 12.23
e) 0.5 (i) 0.5 (ii) 0.50

Indicator

B5.1.4.1.4 Use models to explain the result of addition and subtraction of decimals (up to the thousandths)

1. Learning expectations

Learners need to be able to:

- add decimals using models and symbols
- subtract decimals using models and symbols.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 56–58
- Base-ten blocks
- Place value charts/mats

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

It will probably not be possible for you to give individual feedback to all the learners in your class. Therefore, teach learners the importance of peer-to-peer feedback as well as self-reflection. It might be difficult in the beginning, but with more practice, your learners will become adept at this and begin to accept it as part of their teaching and learning experience.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

In this sub-strand, encourage learners to help one another by talking about the decimal number that they are working with. If, for example, there are learners who have a visual impairment, other learners can tell them what the decimal

number is and ask them different questions to test their understanding. Encourage learners to find creative ways of helping their peers learn the concepts being taught. Through helping other learners, they will also be helping their own understanding of the concept.

5. Teaching methodology

Explain to your learners that adding and subtracting decimal numbers works in exactly the same way as adding and subtracting whole numbers. The important thing to remember is that they need to line up the numbers and make sure that all the decimal points line up below one another.

Teach learners to be systematic in the way they work. They can follow the steps below to add and subtract decimals.

To add decimal numbers:

- Arrange the numbers in a vertical column.
- Align the decimal points.
- Add each column of digits, starting on the right and working left.
- If the sum of a column is more than ten, ‘carry’ digits to the next place value column on the left.
- Place the decimal point in the answer directly below the other decimal points.
- Check your answer.

To subtract decimal numbers:

- Place the numbers in a vertical column.
- Align the decimal points.
- Subtract each column, starting on the right and working left.
- If the digit being subtracted in a column is larger than the digit above it, ‘borrow’ a digit from the next column to the left.
- Place the decimal point in the answer directly below the other decimal points.
- Check your answer.

Instruct learners to complete Exercise 1 and Exercise 2 with a partner.

6. Homework

Assign the following exercises for homework:

- Exercise 3 on page 117 of the Learner's Book
- Exercise 3 on page 56 of the Workbook

Once back in class, write the answers on the chalkboard and ask the learners to check and correct their work.

7. Teacher assessment

Ask learners to hand in their work for assessment. Make sure to check which learners are struggling with different strategies for calculations. Then spend some extra time with them.

8. Answers

Exercise 1

(LB page 116)

1. $2.4 + 0.6 = 3$
2. $3 - 1.5 = 1.5$
3. $1.4 - 0.7 = 0.7$
4. $1.8 + 0.2 = 2.0$
5. $2.2 - 1.1 = 1.1$
6. $1.6 - 0.8 = 0.8$
7. $0.9 + 0.9 = 1.8$
8. $3.1 + 0.6 = 3.7$
9. $0.25 + 0.13 = 0.38$
10. $1.35 + 0.24 = 1.59$
11. $2.25 + 1.42 = 3.67$
12. $8.14 - 2.06 = 6.08$

Exercise 2

(LB page 116)

1. $2.4 + 2.6 = 5$; $2.3 + 2.7 = 5$; $1.6 + 3.4 = 5$;
 $0.5 + 4.5 = 5$; $0.9 + 4.1 = 5$
2. a) $3.45 - 2.4 = 1.05$ b) $2.37 - 0.26 = 2.11$
c) $1.63 - 0.52 = 1.11$
3. a) A = 2.59 B = 1.44

$$\begin{aligned} \text{b) } & (2 + \frac{3}{10} + \frac{29}{100}) - (1 + \frac{2}{10} + \frac{24}{100}) \\ & = (2 + \frac{30}{100} + \frac{29}{100}) - (1 + \frac{20}{100} + \frac{24}{100}) \\ & = (2 + \frac{59}{100}) - (1 + \frac{44}{100}) && 2.59 \\ & = 1\frac{15}{100} && - 1.44 \\ & = 1.15 && \underline{\quad 1.15} \end{aligned}$$

Exercise 3

(LB page 117)

1. a) 1.343 b) 1.129 c) 2.450 d) 50.202
2. a) 0.417 b) 0.654 c) 5.361 d) 27.770
3. a) 36.17 km b) 34.527 km
c) Town C to Town E d) 1.06 km
4. $1.45\% + 2.38\% = 3.83\%$
5. 46.07
6. a) 25.07 b) 1.83
7. 19.04

Indicator

B5.1.4.1.5 Use models to explain the result of multiplying a decimal (up to the thousandths) by a whole number

1. Learning expectations

Learners need to be able to:

- multiply a decimal by a whole number.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 58–61
- Base-ten blocks
- Place value charts/mats

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Teaching multiplication can be a difficult concept for teachers to teach and for learners to understand. Many mathematics programs jump too quickly to focussing on the recall and memorisation of times tables rather than teaching a range of multiplicative strategies. This means that when the memory fails and a fact cannot be recalled, learners have nothing to fall back on. They cannot use multiplicative strategies to help them to arrive at a solution because they have not been taught them.

Plan your lessons and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities, you can work with these learners in a small group to teach them, while a co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

Teaching learners the correct way of multiplying decimals by a whole number is an important skill for them to learn. Explain to them that working with decimals is the same as working with whole numbers, except they need to know where the decimal point goes.

Explain the steps below to your learners for multiplying decimals by whole numbers.

To multiply decimal numbers by whole numbers:

- First ignore the decimal point and multiply both numbers as whole numbers.
- Count the number of decimal places.
- Place the decimal point in the product accordingly.
- Keep all zeros in the product when placing the decimal point. This can be deleted afterwards when they write the final answer.
- If the number of decimal places is greater than the number of digits in the product, insert zeros in front of the product.

Work through the examples on pages 119 and 120 of the Learner's Book. Make sure your learners understand how the answers are found in each example.

Instruct learners to work in pairs to complete Exercises 1 and 2.

6. Homework

Assign the following exercises for homework:

- Exercise 3 on page 122 of the Learner's Book
- Exercise 4 on page 58 of the Workbook.

Once back in class, write the answers on the chalkboard and ask the learners to check and correct their work

7. Teacher assessment

Use the Answers section to assess learners' work. If you find there are still learners struggling with this concept, work with them one-to-one or in a small group away from the rest of the class.

8. Answers

Exercise 1

(LB page 121)

- | | |
|------------------------------------|---------------------------------|
| a) $2.3 \times 10 = 23$ | b) $46.81 \times 10 = 468.1$ |
| c) $4.5 \times 100 = 450$ | d) $169.75 \times 10 = 1,697.5$ |
| e) $255.936 \times 100 = 25,593.6$ | |
| f) $20.8 \times 10 = 208$ | |
- | | |
|-----------------------------|-----------------------------|
| a) $0.05 \times 20 = 1$ | b) $0.22 \times 30 = 6.6$ |
| c) $1.11 \times 40 = 44.4$ | d) $9.31 \times 20 = 186.2$ |
| e) $4.32 \times 30 = 129.6$ | f) $2.15 \times 50 = 107.5$ |

Exercise 2

(LB page 121)

- | | |
|----------------------------|----------------------------|
| a) $2.5 \times 5 = 12.5$ | b) $15.6 \times 8 = 124.8$ |
| c) $3.84 \times 6 = 23.04$ | d) $4.37 \times 8 = 34.96$ |
| e) $6.09 \times 9 = 54.81$ | f) $7.51 \times 7 = 52.57$ |
- | | | |
|----------|-----------|-------------|
| a) 147.6 | b) 144.75 | c) 17.82 |
| d) 30.66 | e) 53.25 | f) 1,068.08 |
| g) 164.8 | h) 483.70 | |
- | | | | |
|--------|------|------|--------|
| a) 3.9 | b) 4 | c) 3 | d) 3.2 |
|--------|------|------|--------|

Exercise 3

(LB page 122)

- $6.15 \times 6 = 36.9$ m
- $7.25 \times 3 = 21.75$
- $0.45 \times 6 = 2.7$ m
- | | | | |
|------|------|------|------|
| a) B | b) D | c) A | d) C |
|------|------|------|------|
- $46 \times 2.4 = 110.4 + 13.75 = 124.15 \times 1.5 = 186.225 - 46.225 = 140 \times 0.25 = 35$

Sub-strand 5: Number: Percentage

Content standard

B5.1.5.1: Demonstrate understanding of percentage of a given number

Indicator

B5.1.5.1.1 Determine the percentage of a given quantity (limit to 2-digit whole number) and vice versa

1. Learning expectations

Learners need to be able to:

- calculate the percentage of a given number.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 62–64

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

It will probably not be possible for you to give individual feedback to all the learners in your class. Therefore, teach learners the importance of peer-to-peer feedback as well as self-reflection. It might be difficult in the beginning, but with more practice, your learners will become adept at this and begin to accept it as part of their teaching and learning experience.

4. Support for learners with special needs

The term 'learners with special needs' can refer to learners who are either physically or mentally challenged, or both. In order to provide quality instruction to learners with special needs, provide more intensive, individualised attention to the learners who most need it.

Forming small groups of two or three learners within the class is one way of making sure all learners will learn the skills being taught. You can teach general concepts to the whole group, but then pair it with individual instruction for those learners who need it. Remember to always have additional content available for more advanced learners. You could also rotate the lessons within the different groups, introduce new material to one group, while only having to check in on others who are doing more independent activities.

5. Teaching methodology

When teaching learners about percentage, explain the importance of knowing how to work with percentage and percentage calculations. Learning is improved when learners understand why they are doing something.

It is important that learners understand that percent means ‘for every 100’ or ‘out of 100’. The percentage symbol is a quick way to write a fraction with a denominator of 100. For example, instead of saying that ‘Najla got 74 out of 100’ for her Mathematics exam, you can say ‘Najla got 74% for her Mathematics exam.’

Be careful not to teach percentage as parts of a larger whole. Learners may think that they need to divide to find a percentage of something instead of multiply. Understanding percentage also allows learners to check and estimate a reasonable answer.

Another important aspect of percentage is:

- percentages can be written as decimal numbers by moving the decimal point two places to the left
- decimals can be written as a percentages by moving the decimal point two places to the right.

To find a certain percentage of a given quantity, convert the percentage to a fraction with a denominator of 100. Then multiply this fraction by the given quantity, for example:

What is 30% of 40?

$$\begin{aligned} 30\% \text{ of } 40 &= \frac{30}{100} \times \frac{40}{1} \\ &= 12 \end{aligned}$$

Instruct learners to complete the following activities in class:

- Exercise 1 on page 124 of the Learner's Book
- Exercise 2 on page 127 of the Learner's Book
- Exercise 4 on page 130 of the Learner's Book

6. Homework

Instruct learners to complete the following activities as homework:

- Exercise 3 on page 128 of the Learner's Book
- Question 1–3 of Exercise 1 on page 62 of the Workbook.

7. Teacher assessment

Use the Answers section to assess learners' work. If you find there are still learners struggling with this concept, work with them one-to-one or in a small group away from the rest of the class.

8. Answers

Exercise 1

(LB page 124)

- | | | | |
|------|------|------|------|
| 1. E | 2. D | 3. H | 4. F |
| 5. C | 6. B | 7. A | 8. G |

Exercise 2

(LB page 127)

- | | |
|---|---|
| 1. a) 0.25; 25% | b) 0.4; 40% |
| c) 0.75; 75% | d) 0.4; 40% |
| e) 0.6; 60% | f) 0.26; 26% |
| g) 0.3; 30% | h) 0.2; 20% |
| i) 0.8; 80% | j) 0.07; 7% |
| 2. a) $\frac{2}{10}$; 20% | b) $\frac{8}{10}$; 80% |
| c) $\frac{25}{100}$; 25% | d) $\frac{75}{100}$; 75% |
| e) $\frac{1}{100}$; 1% | f) $\frac{70}{100}$; 70% |
| g) $\frac{11}{100}$; 11% | h) $\frac{6}{10}$; 60% |
| 3. a) 0.8; $\frac{8}{10}$ | b) 0.24; $\frac{24}{100} = \frac{6}{25}$ |
| c) 0.62; $\frac{62}{100} = \frac{31}{50}$ | d) 0.96; $\frac{96}{100} = \frac{24}{25}$ |
| e) 0.05; $\frac{5}{100} = \frac{1}{20}$ | f) 0.33; $\frac{33}{100}$ |
| g) 0.55; $\frac{55}{100} = \frac{11}{20}$ | h) 0.20; $\frac{20}{100} = \frac{1}{5}$ |

B5.1.5.1.2 Determine the benchmark percentages from their common fractions and use these to estimate percentages of quantities

1. Learning expectations

Learners need to be able to:

- understand and work with benchmark percentages.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 62–64
- Percentage chart with benchmark percentages and examples

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Remind learners that when they are working with percentage, they need to think of it as a value 'out of 100'.

Learners benefit from using strip diagrams to help them show the relationship of the percent to the part and whole. This conceptual understanding helps learners to visualise the benchmark percentages (10%, 25%, 50% and 75%) easily and assists them to estimate their answers.

5. Teaching methodology

The most commonly used or 'benchmark' percentages are 0%, 10%, 25%, 50%, 75% and 100%. These benchmark percentages are sometimes used when estimating a solution involving percentages, for example, if you see there is an 8% discount on an item at a store, you can use the benchmark of 10% to mentally estimate how much the discount would be.

You can copy the chart in the Learner's Book to make a large reference chart that learners can refer to when working with benchmark percentages. Leave it up on your classroom wall and refer to it often throughout the year. A reference chart can help those learners who are struggling.

Instruct learners to complete the following activities in class:

- Exercise 1 on page 132 of the Learner's Book

6. Homework

Instruct learners to complete the following activities as homework:

- Exercise 2 on page 134 of the Learner's Book
- Questions 4–5 of Exercise 1 on page 63 of the Workbook.

7. Teacher assessment

Ask learners to hand in their work for assessment. Make sure to check which learners are struggling with different strategies for calculations. Then spend some extra time with them.

8. Answers

Exercise 1

(LB page 132)

- a) GH¢15 b) GH¢30 c) GH¢45
- a) 8.3% b) 16.7% c) 33.3%

d) 66.7% e) 83.3% f) 91.7%
- a) 65 g

b) (i) 69.2% (ii) 23.1% (iii) 7.7%
- a) 12.5% b) 11.1%

c) Adomako's Electronics
- a) 40 b) 40%

c) True. There are 25% coconut chocolates and 20% hazelnut chocolates.

d) 35%

Exercise 2

(LB page 134)

1. a) 6 b) 22 c) 16
 d) 36 e) 18 f) 30
2. 85.7%
3. 6
4. a) 90% b) 5
5. 25% of 48 litres = 12 litres
 48 litres – 12 litres = 36 litres

Indicator

B5.1.5.1.3 Identify and describe percentage from real-life contexts and solve problems using percentage

1. Learning expectations

Learners need to be able to:

- use percentage in everyday, real-life contexts.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 64–68

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Remind learners that when they are working with percentage, they need to think of it as a value 'out of 100'.

Learners benefit from using strip diagrams to help them show the relationship of the percent to the part and whole. This conceptual understanding helps learners to visualise the benchmark percentages (10%, 25%, 50% and 75%) easily and assists them to estimate their answers. They can also refer to the benchmark percentage chart.

5. Teaching methodology

Continue working with percentages and explain to your learners that percentages are an important part of our everyday lives.

Here are some examples:

- When shops advertise discounts on products, they use percentages, for example, 10% off marked prices.
- The commission for a salesperson can be a percentage of the value of the sales made, for example, 20% commission on the price of a house they sold.
- Farm equipment, cars, televisions, and so on, usually decrease in value by a certain percentage each year.
- Your cellphone battery shows how much percentage battery life is left before you need to charge it.

Ask learners to come up with their own examples of where they have seen percentages used in real life.

Instruct learners to complete the following activities in class:

- Exercise 1 on page 137 of the Learner's Book

6. Homework

Instruct learners to complete the following activities as homework:

- Exercise 2 on page 64 of the Workbook.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 137)

1. 16.7%
2. 20%
3. 16.7%
4. 11.04 m
5. 1 kg apples GH¢184.80
1 kg oranges GH¢210
1 kg tomatoes GH¢175
6. a) 37.5% b) 46% c) 66.3%

7. a) Sleeping $\frac{8}{24} = \frac{1}{3}$
 Playing with friends $\frac{6}{24} = \frac{1}{4}$
 Playing sport $\frac{4}{24} = \frac{1}{6}$
 Eating/drinking $\frac{3}{24} = \frac{1}{8}$
 Watching TV $\frac{2}{24} = \frac{1}{12}$
 Showering/washing $\frac{1}{24}$
- b) Sleeping 0.33
 Playing with friends 0.25
 Playing sport 0.17
 Eating/drinking 0.13
 Watching TV 0.08
 Showering/washing 0.04
- c) Sleeping 33%
 Playing with friends 25%
 Playing sport 17%
 Eating/drinking 13%
 Watching TV 8%
 Showering/washing 4%

8. Learners' own work

**Sub-strand 1:
Patterns and relationships****Content standard**

B5.2.1.1: Determine the pattern rule to make predictions about subsequent elements.

Indicator

B5.2.1.1.1 Extend a given pattern with and without concrete materials, and explain how each element differs from the preceding one

1. Learning expectations

Learners need to be able to:

- extend a given pattern.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 69–71
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.

3. Large class teaching

Patterns are everywhere! There are plenty of examples found in nature, such as stripes on a zebra or the arrangement of petals on a flower. Encourage your learners to explore the world around them and see mathematics in unexpected places.

Learning about patterns is a great way to introduce and develop algebraic thinking. Encourage your learners to work in groups and/or pairs to build patterns and experiment in different ways by using shapes, colours, sounds, or movements. Challenge your learners to find patterns all around them, in their surroundings, on their clothes, or even in music.

4. Support for learners with special needs

This section begins to explore algebraic thinking by encouraging learners to find, describe and use patterns. Learners benefit from being provided with multiple experiences, on an ongoing basis, to work with repeating, growing and shrinking patterns in a variety of forms. Such experiences should include reading pattern stories, using concrete materials to build patterns, discussing geometric patterns in fabrics and in art, and examining numeric patterns on a calendar (for example, examining number patterns in the columns of a calendar).

Show them examples of various types of growing or shrinking patterns. Encourage groups to discuss strategies for finding how a growing or shrinking pattern changes from term to term. Provide the groups or pairs in your class with opportunities to create patterns. You can begin with patterns that have two attributes (for example, shape and colour). Let them explore making and extending both growing and shrinking patterns, and to justify how they extended the patterns.

5. Teaching methodology

Remind learners that a pattern is something that repeats over and over again. Patterns can use colours, shapes, sizes, sounds and movements (as in dance routines). Show different examples of patterns and encourage your learners to find them on their own. To get your learners involved in making their own patterns, do jumping jacks and alternate with one hop. Make sound patterns together by stomping, clapping, snapping and tapping. Then present a simple pattern to your learners and ask: What comes next? Guide learners to look for the individual unit first, then to figure out what comes next.

Draw or use shapes to create a pattern, but leave one shape out. Ask your learners to continue the pattern. Practise this a few types with different patterns.

Have your learners practise creating patterns using a variety of materials and challenge them to break the patterns into individual units. Then, ask them to begin patterns for someone else to continue. They can use pattern blocks, different-coloured marbles or counters, or other small objects.

They can also draw pictures or draw or paint objects of different colours. This activity promotes algebraic thinking and problem-solving skills.

You can introduce number patterns to them by making use of the chart on page 72 of the Learner's Book.

6. Homework

Instruct learners to complete Exercise 1 on page 69 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Work through the answers with the class. Write them on the board. Ask learners to correct their own work/swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 142)

1. a) 50; 100; 150; **200; 250; 300;** 350; 400; **450; 500**
b) **380; 400;** 420; 440; 460; **480;** 500; **520;**
540; **560**
c) 1,550; 2,050; 2,550; **3,050;** 3,550; 4,050; **4,550;**
5,050; 5,550; 6,050
d) 10,300; **10,400; 10,500;** 10,600; 10,700; **10,800;**
10,900; 11,000; **11,100**
2. a) 50s b) 20s c) 500s d) 100s
3. a) 1,997; 2,997; **3,997; 4,997; 5,997; 6,997; 7,997;**
8,997; 9,997; 10,997; 11,997; 12,997
b) 87,807; 88,807; **89,807; 90,807; 91,807; 92,807;**
93,807; 94,807; 95,807; 96,807; 97,807; 97,997
c) 90,315; 91,315; **92,315; 93,315; 94,315; 95,315;**
96,315; **97,315; 98,315; 99,315; 100,315**
d) **980,000; 980,200; 980,400; 980,600; 980,800;**
990,000; 990,200; 990,400; **990,600;** 990,800;
1,000,000

4. a) Skip count forwards in 2s / even numbers.
 b) Skip count forwards in 100s.
 c) Skip count backwards in 5s.
 d) Skip count forwards in 500s.
5. a) A = 19; B = 25; C = 43; D = 49; E = 11; F = 14;
 G = 17; H = 20

	1	2	3	4	7	8	11	14	17	20
+6	7	13	19	25	43	49	67	85	93	111

- b) A = 28; B = 56; C = 448; D = 14; E = 15; F = 16

	7	8	9	10	11	12	14	15	16
Double	14	28	56	112	224	448	1,792	3,584	7,168

- c) A = 1,170; B = 1,130; C = 1,010; D = 970;
 E = 10; F = 13; G = 18

	1	2	3	4	7	8	10	13	18
-40	1,250	1,210	1,170	1,130	1,010	970	890	770	570

Indicator

B5.2.1.1.2 Describe, orally or in writing, a given pattern, using mathematical language, such as one more, one less, five more, one more than or less than twice, etc.

1. Learning expectations

Learners need to be able to:

- describe a given problem orally
- describe a given problem in writing
- describe a given problem using mathematical language.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 69–73
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.

3. Large class teaching

Learners continue working with number patterns. They build on what they have already learnt by communicating their understanding, and representing number patterns. Learners should verbalise and communicate rules to help them understand the predictability of a pattern. Remember that these patterning concepts are the basis for further algebraic thinking and will be extended in later grades.

4. Support for learners with special needs

Learners should be able to identify a repeating pattern; build simple number patterns; continue simple number patterns and determine missing elements. They should be able to recognise patterns, apply the commutative property and relate addition and subtraction facts.

At this stage, learners need to start building their understanding of patterns for individual numbers and be able to list all possible combinations. Knowledge of number combinations is the foundation for seeing numbers as flexible. This understanding has strong links to addition and subtraction and can be applied to develop strategies such as bridging to ten, using related number facts, jump and split

strategies and counting on and off the decade (respectively meaning counting in 10s starting at a multiple of 10, and counting in 10s starting at a number other than a multiple of ten, for example $32 + 10$ is 42).

If you find that there are still learners in your class that are struggling to recognise, write and describe number patterns, work with them in a small group or one-to-one.

5. Teaching methodology

At this stage, learners need to be able to express their ideas and understanding by communicating and providing reasons for their thinking. Learners are required to be able to generate number patterns, describe and record the patterns using diagrams, words or symbols.

The mathematical language required needs to be modelled and learners need to be provided with opportunities to talk through their thinking. For example, learners describing the pattern 3, 6, 9, 12 ... may say, 'It goes up by threes', or, 'It looks like the three times table'. At this stage, encourage learners to refer to this pattern as showing the 'multiples of three'. This wider classification will help learners when they are required to find solutions to problems involving higher terms, for example, if they have to find the 10th term in a pattern.

Playing games like 'guess my rule' (for example 1, 4, 7 ... what is my rule?) will provide learners with the chance to talk about patterns and to apply their knowledge. You also want learners to make connections between the patterns they are creating and describing them with addition and multiplication facts.

Use a 'think aloud' strategy to explicitly teach learners the steps to identify the next number in a pattern. This strategy focuses on explaining the thinking process while completing a task. Model the thinking process for a subtraction number pattern by talking through these steps. Say:

Look at this pattern. Can you see what has happened to get the next number in the pattern?

$\boxed{58}$, $\boxed{52}$, $\boxed{46}$, $\boxed{40}$

Are the numbers getting bigger? If the numbers are getting smaller, the pattern might be to take away a number. You need to find the difference between two numbers in the pattern. Two of

the numbers are 46 and 40. The difference is 6. Is the difference between 58 and 52, 6? Yes. The difference between 52 and 46 is also 6, so the pattern is going down by 6 each time.

Learners could work in pairs and demonstrate how to use the ‘think aloud’ strategy to find a missing number in a four-digit number pattern involving counting back by 100s.

Provide lots of different examples leading learners through the ‘think aloud’ strategy until they can verbalise the process independently.

6. Homework

Instruct learners to complete Exercise 2 on page 71 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Work through the answers with the class. Write them on the board. Then ask learners to correct their own work or swap books and mark each other’s work.

8. Answers

Exercise 1

(LB page 145)

1. a)

--	--	--	--

b) I added **three** more **matches** to make another **square**.

c)

Shape number	1	2	3	4
Number of matches	4	7	10	13

d) 3

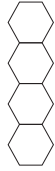
e) 16

2.

Shape number	1	2	3	4	5	6	7	8
Number of matches	4	9	16	25	36	49	64	81

3. a) Learners' own work

b)

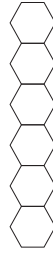


4

c)



5



6

d) Add 5 more matches each time to create the following shapes.

e)

Shape number	1	2	3	4	5	6
Number of matches	6	11	16	21	26	31

4.

Shape number	1	2	3	4	5	6	7	8
Number of matches	5	9	13	17	21	25	29	33

5. a) 1; 3; 6; 10

b) 3

c) 15

d) 45

e) The number of dots increases sequentially by taking the number of dots in the figure and adding the pattern number of the next figure, so $1 + 2 = 3$; then $3 + 3 = 6$; then $6 + 4 = 10$, and so on.

1. Learning expectations

Learners need to be able to:

- predict elements in a pattern.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 74–75
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

5. Teaching methodology

As learners continue to work with patterns or sequences, it is important that they move to understanding more about the pattern presented to them and then using this knowledge to generalise the relationship shown in the pattern.

Learners continue to draw on a number of strategies to make their generalisations. They might look for

multiplication patterns, differences in terms, the nature of the numbers, etc. Finding and working with these generalisations helps learners to identify a pattern's properties. This generalisation is the start for laying the foundation for algebraic thinking.

Learners must write rules for their patterns in their own words. Encourage learners to talk to their peers about the rules they have written so that they can explore how different learners solved the problem. They might find that another learner solved the pattern rule in a different, more efficient way than they did.

Remember that it is important to provide learners with a wide range of patterns, as well as opportunities for them to create their own patterns.

6. Homework

Instruct learners to complete Exercise 3 on page 74 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Peer/group assessment

As learners work together, they can assist each other by assessing their work. When learners are completing the activities in this section, make sure they understand what is required of them for each activity. Once they are done, write the answers on the board and ask learners to swap books and mark each other's work.

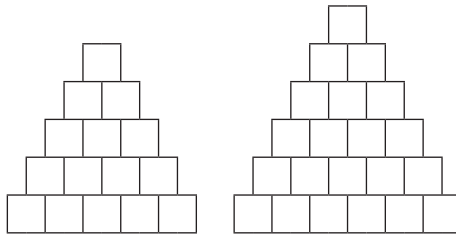
8. Answers

Exercise 1

(LB page 148)

1. a) ... 48; 51 Skip count forwards in 3s.
b) ... 275; 280 Skip count forwards in 5s.
c) ... 16; 8 Skip count backwards in 8s.
d) ... 72; 76 Skip count forwards in 4s.

2. a)



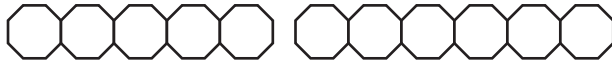
b)

Pattern number	1	2	3	4	5	6
Number of tiles	1	3	6	10	15	21

c) The number of tiles increases by the next pattern number each time.

3

a)

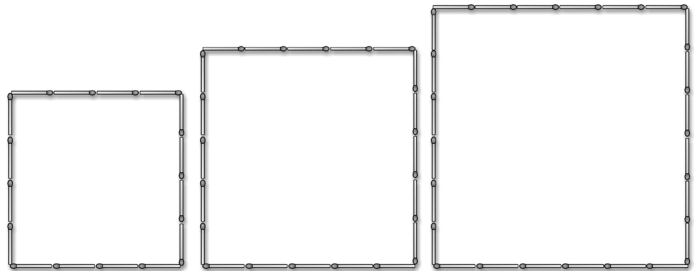


b)

Pattern number	1	2	3	4	5	6
Octagons	1	2	3	4	5	6

c) The number of octagons increases by one each time.

4. a)



b)

Pattern number	1	2	3	4	5	6
Matchsticks	4	8	12	16	20	24

c) The number of matchsticks increases by 4 in each step.

5. Learners' own work

1. Learning expectations

Learners need to be able to:

- draw or represent a given pattern.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 75–76
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

In a large class, learners work best in pairs and groups. These should be collaborative groups in which learners can learn from one another, so differently abled learners should be matched together. Using pair and group work will also ensure that learners are not left out or become bored because of listening to you doing all the talking.

More able learners in the group can help the others to master the concept being taught, but be sure to monitor each group's understanding of the concept. You can use group leaders or monitors who can assist those learners who work at a slower pace than others. Learners need to be encouraged to find creative ways of remembering the concepts taught.

Move around the classroom to see what progress learners are making and to catch any misconceptions that may come up. Give advice, encouragement and extra individual help where it is needed.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

5. Teaching methodology

When learners are presented with a pictorial and practical sequence, they need to be able to work out a rule for the pattern and then make predictions about what will happen if the pattern or sequence is continued.

It is important to provide learners with a variety of structures that become more and more challenging. Before focussing on the rule for a pattern, ask learners to express the patterns in their own words. They can then begin thinking about the rule used to get to the next term in the pattern and begin writing their rules in mathematical terms.

This section builds on the previous work done on patterns, but the emphasis should be on verifying the predictions they make for the patterns they are working with. As learners become more confident in predicting patterns, allow them to make their own patterns.

6. Homework

Instruct learners to complete Exercise 4 on page 75 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Peer/group assessment

As learners work together, they can assist each other by assessing each other's work. When learners are completing the activities in this section, make sure they understand what is required of them for each activity. Once they are done, write the answers on the board and ask learners to swap books and mark each other's work.

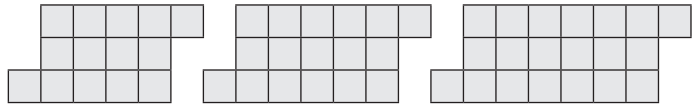
8. Answers

Exercise 1

(LB page 151)

1. a)

Pattern number	1	2	3	4	5	6
Number of tiles	5	8	11	14	17	20



Relationship: The number of tiles increases by 3 in each step.

b)

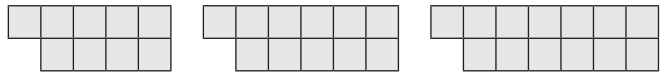
Pattern number	1	2	3	4	5	6	7
Number of counters	1	3	5	7	9	11	13



Relationship: The number of counters increases by 2 in each step.

c)

Pattern number	1	2	3	4	5	6	7
Number of counters	1	3	5	7	9	11	13



Relationship: The number of tiles increases by 2 in each step.

d)

Pattern number	1	2	3	4	5	6
Number of dots	4	7	10	13	16	19



Relationship: The number of dots increases by 3 in each step.

2. Learners' own work
3. Learners' own work

1. Learning expectations

Learners need to be able to:

- use pattern rules to determine elements in a pattern.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 76–78
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

Large classes do not need to be less effective than smaller ones. However, teaching a large class will require you to be more conscious in your lesson planning. Large classes work best when learners are actively involved in their learning and take an active interest in the subject. Allow learners to continue working in the pairs and groups they were working in.

4. Support for learners with special needs

Learners who struggle with finding patterns and solving pattern rules will need additional support. Assess whether there might be a barrier to their learning and understanding. Then work with them independently or as a small group. Provide constant feedback about learners' performance and ask questions to check for understanding.

5. Teaching methodology

Learners continue working with patterns and using tables to represent their patterns. Make sure that learners understand that the top row of the table describes the steps in the pattern and the second row describes the pattern and how it changes.

Encourage learners to use a wide range of strategies in order to make a generalisation. Learners need to compare the

sequence provided with the results they got by testing their rule. Some patterns might appear to follow a certain rule, but then it changes after the initial terms. Thus, it is important that learners test their predictions to see if their rule fits the entire pattern.

Give learners ample opportunities to practise finding rules and using them to solve problems.

6. Homework

Instruct learners to complete Exercise 5 on page 76 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 153)

1. a) Subtract 12s. b) Subtract 15s. c) Subtract 17s.
2. a) A b) C
3. a) C b) C
4. $54,000 \times 2 = 108,000$
5. a) 4,800
b) Yes; Yaaba has 799 more beads than Adjo.

1. Learning expectations

Learners need to be able to:

- find an error in a pattern
- explain why the term is wrong.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 78–79
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

To make class time as valuable as possible, both learners and teachers have to work hard at making it a success. Every learner has the right to learn. But every learner also has the responsibility not to deprive others of their right to learn. From the beginning, learners need to understand this dual right and responsibility. They also need to understand that each one of them is accountable for his or her own actions.

4. Support for learners with special needs

Remind learners that each one of them is a good mathematician. Always encourage learners to use different strategies they have learnt to find answers to any problems they are given. Encourage them not to be afraid to fail; through failure they begin to understand the importance of doing mathematics in a structured and systematic way.

Allow learners to work in collaborative pairs and groups, but monitor the work that they are doing and be available if they have any questions or need help understanding a concept.

5. Teaching methodology

In this section, learners are given patterns and they are challenged to find the 'error' in the rules that they have been given. This is a way of reinforcing the knowledge they have

gained in this section and will help to cement their knowledge of predicting and verifying rules for patterns.

Give learners ample opportunities to practise finding 'errors' in rules and correcting them.

6. Homework

Instruct learners to complete Exercise 6 on page 78 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Diagnostic assessment

As you work through the activity with the whole class, be vigilant and check to see if there are learners who are not participating in the activity. Encourage them by asking them probing questions, but if you find they become withdrawn, rather spend some one-to-one or small group time with them afterwards. Provide enough opportunities for all learners to practise this skill.

8. Answers

Exercise 1

(LB page 157)

1. No. Counting backwards in 2s and $34 - 2 = 32$, not 30
2. Yes. Count backwards in 4s
3. No. Counting backwards in 9s and $52 - 9 = 43$, not 42
4. No. Counting forwards in 9s and $89 + 9 = 98$, not 97
5. No. Counting forwards in 3s and $18 + 3 = 21$, not $17 + 3$
6. No. Counting forwards in 8s and $36 + 8 = 44$, not 45
7. No. Counting forwards in 6s and $46 + 6 = 52$, not 54
8. No. Counting backwards in 3s and $32 - 3 = 29$, not 28
9. Yes. This is the Fibonacci sequence – the next number is found by adding up the two numbers before it.
10. No. The pattern alternates: it multiplies by 10 for the next element, then subtracts 3 for the next element and $6,670 - 3 = 6,667$, not 6,663.

1. Learning expectations

Learners need to be able to:

- write a rule for a pattern in words
- write a rule for a pattern using algebra.

2. Resources used in this chapter

- Learner's Book
- Workbook page 80
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

Allow learners to work together in collaborative pairs and groups, but monitor their work throughout the lesson. Assist learners as needed. Encourage them to solve and share their strategies with each other.

4. Support for learners with special needs

In this section, learners continue working with patterns, but now they will learn to work algebraically. Some learners, especially those who have learning or physical disabilities, may find the switch to using algebra daunting. Encourage learners not to become 'afraid' of working algebraically. It is simply a new/different way of stating mathematical language.

Move gradually from stating the rule of a pattern in words, to giving the stated rule in algebra. Observe the learners as they work in pairs or groups and identify those learners who are struggling to make the switch. Work with them on a one-to-one basis or as a small group.

5. Teaching methodology

Remind learners about what they have learnt about patterns thus far. A pattern is a group of numbers, shapes, or objects

that follow a rule while repeating or changing. They can extend a pattern using a table or a pattern rule. There are different types of patterns. These include recursive patterns, common different patterns, etc.

In this section, they will be taught how to use variables. Explain that a variable is a letter or symbol that is used to show a quantity that can have different values. For example, n is a variable. It can be used to show the number of matchsticks in a growing pattern. Variables are used to make pattern rules easier to write.

6. Homework

Instruct learners to complete Exercise 7 on page 80 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Diagnostic assessment

As learners move from the concrete to the abstract in this section, carefully monitor their work. Working algebraically could be difficult for some learners and thus careful supervision needs to happen during this transitional stage. If there are learners who are struggling with working algebraically, work with them one-to-one or in a small group.

8. Answers

Exercise 1

(LB page 160)

1. a)

	1	2	3	4	n
+1,000	6,000	7,000	8,000	9,000	

Add 1,000 to each term to find the next one.

- b) Multiply each term number by 1,000. You will see you have to add 5,000 to this answer to get the term each time. For example, for term number 2:
 $1,000 \times 2 = 2,000$ and $2,000 + 5,000 = 7,000$.
- c) $T_n = 1,000n + 5,000$
- d) $T_{12} = (1,000 \times 12) + 5,000 = 17,000$

2. a)

	1	2	3	4	n
+9	95	104	113	122	

Add 9 to each term to find the next one.

b) Multiply each term number by 9. You will see you have to add 86 to this answer to get the term each time.

c) $T_n = 9n + 86$

d) $T_{20} = (9 \times 20) + 86 = 266$

3. a)

	1	2	3	4	n
-45	3,545	3,500	3,455	3,410	

Subtract 45 from each term to find the next one.

b) Multiply each term number by -45 , giving a negative answer. You will see you have to add 3,590 to this negative answer to get the term each time. For example, for term number 2: $-45 \times 2 = -90$ and $-90 + 3,590 = 3,500$.

c) $T_n = 3,590 - 45n$

d) $T_{50} = 3,590 - (45 \times 50) = 1,340$

4. a)

114				
55	59			
25	30	29		
12	13	17	12	
7	5	8	9	3

b)

270			
18	15		
6	3	5	
2	3	1	5

1. Learning expectations

Learners need to be able to:

- describe the relationship in a given table or chart
- express the difference between an expression and an equation.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 80–81
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

Teaching a large class can be daunting. Follow these basic tips to help you with teaching a large class:

- To keep learners engaged in their learning, do not, for example, shuffle through your textbook or notes, as learners will become distracted and start misbehaving.
- Establish good routines within the classroom.
- Do not allow learners to distract others in the class. Set ground rules from the beginning and enforce it consistently.
- Always have additional activities available to keep learners busy. If possible, offer rewards to the learners or group whose work is completed first or most accurately.
- Manage your time carefully.
- Plan your seating arrangements carefully.
- Split the class into collaborative pairs or groups.

4. Support for learners with special needs

When teaching learners with special needs, do not be afraid to ask for help from other teachers or peers at school. Other professionals could have extensive experience working with learners with learning and behavioural disabilities. Talk about strategies that might be successful with those learners.

Do not only rely on the work in your textbook. Look for various additional tasks or resources that you could use to complement your teaching. Also, modify activities and assessments where applicable.

5. Teaching methodology

Begin this section by explaining the difference between a mathematical expression and a mathematical equation. Learners need to understand that an expression is a mathematical phrase that can include at least one operation, numbers and/or variables, and no equal sign, for example 3×4 or $24 \div 2m$.

An equation, however, is a mathematical statement that contains a mathematical expression on each side of an equal sign, for example, $6 - x = 3 + y$. The expressions on each side of the equal sign must equal each other.

Once the learners understand the difference between an expression and an equation, continue the work on describing the relationships in tables or charts by means of mathematical expressions.

6. Homework

Instruct learners to complete Exercise 8 on page 80 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 161)

1. a) Add 2 to each term to find the next one. Multiply each term number by 2. You will see you do not have to add anything to this answer to get the term each time. So, just multiply the number of loaves of bread by 2.

- b) $30 = 2n$
 $30 \div 2 = n$
 $n = 15$
 So, he will bake 15 loaves of bread in 30 hours.
- c) Learners' own work
2. a) Add 15,000 to each term to find the next one.
 Multiply each year number by 15,000 and add 15,000 to get the number of people reached.
- b) $150,000 = 15,000n + 15,000$
 $150,000 - 15,000 = 15,000n$
 $135,000 \div 15,000 = n$
 $n = 9$
 It would take the government 9 years to reach 150,000 people.
- c) $300,000 = 15,000n + 15,000$
 $300,000 - 15,000 = 15,000n$
 $n = 19$
 It would take the government 19 years to reach 300,000 people.
3. a) Add 2,733 to each term to find the next one. Multiply each year number by 2,733 and add $12,300 - 2,733 = 9,567$ to get the number of people reached.
- b) Year 6: $T_6 = (2,733 \times 6) + 9,567 = 25,965$
 Year 7: $T_7 = (2,733 \times 7) + 9,567 = 28,698$
 Year 8: $T_8 = (2,733 \times 8) + 9,567 = 31,431$
 Year 9: $T_9 = (2,733 \times 9) + 9,567 = 34,164$
- c) Year 15: $T_{15} = (2,733 \times 15) + 9,567 = 50,562$
 So, 50,562 learners would need to pass by year 15.

Sub-strand 2: Algebraic expressions

Content standard

B5.2.2.1: Demonstrate understanding of algebraic expressions

Indicator

B5.2.2.1.1 Demonstrate understanding of algebraic expressions as mathematical phrases that can contain letters which represent ordinary numbers and operations (like add, subtract, multiply and divide)

1. Learning expectations

Learners need to be able to:

- solve mathematical equations
- use algebra to solve problems.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 82–84
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller, collaborative groups.

4. Support for learners with special needs

Some learners with special needs need to be encouraged to keep working at a skill they need to acquire in order to be successful in their work. These learners can often feel as if they are holding other learners back because they are unable to complete certain tasks. This can cause them frustration and

disappointment. Encourage your other learners to always be supportive and to encourage and reassure them. They should not be afraid to fail at something, but should view the failure as a stepping stone to their mastery of a skill.

Sometimes all that is needed for a learner with special needs to be successful is for you to be a little bit more creative. Allow learners to use drawing or telling stories, and so on, to work towards competence in a skill. All learners with special needs are capable of success, but each one will succeed according to his or her individual ability. Therefore, always focus on your learners' strengths and find ways to support their weaknesses.

5. Teaching methodology

Continue your teaching of using algebraic expressions to represent mathematical phrases.

Explain to your learners that they need to use operation symbols in mathematical expressions. To translate an expression given in words to a mathematical expression, learners can use the following examples to help them:

Operation	Phrase	Expression
Addition	<i>a</i> plus <i>b</i> the sum of <i>a</i> and <i>b</i> <i>a</i> increased by <i>b</i> <i>b</i> more than <i>a</i> the total of <i>a</i> and <i>b</i> <i>b</i> added to <i>a</i>	$a + b$
Subtraction	<i>a</i> minus <i>b</i> the difference between <i>a</i> and <i>b</i> <i>b</i> subtracted from <i>a</i> <i>a</i> decreased by <i>b</i> <i>b</i> less than <i>a</i>	$a - b$
Multiplication	<i>a</i> times <i>b</i> the product of <i>a</i> and <i>b</i>	$a \times b$
Division	<i>a</i> divided by <i>b</i> the quotient of <i>a</i> and <i>b</i> the ratio of <i>a</i> and <i>b</i> <i>b</i> divided into <i>a</i>	$a \div b$

6. Homework

Instruct learners to complete Exercise 1 on page 82 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Go through the answers for each activity with the class. Write them on the board and ask learners to correct their own work or swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 164)

1. $9x - 12$
2. $32 + y$
3. $F - 32$
4. $a(120 - 60)$

Exercise 2

(LB page 167)

1.
 - a) Perimeter = $4x$
 - b) Perimeter = $2(2m + m)$
 - c) Perimeter = $3h + 6$
 - d) Perimeter = $4y + 4$
2.
 - a) $3x + 2y$
 $= 3(9) + 2(4)$
 $= 27 + 8$
 $= 35$
 - b) $6(m - n)$
 $= 6(24 - 12)$
 $= 6(12)$
 $= 72$
 - c) $-12x(x + 2y)$
 $= -12(4)(4 + 2(16))$
 $= -48(4 + 32)$
 $= -48(36)$
 $= -1,728$

Sub-strand 3: Variables and equations

Content standard

B5.2.3.1: Solve problems involving single variable, one-step equations with whole number coefficients

Indicator

B5.2.3.1.1 Express a given problem as an equation where the unknown is represented by a variable

1. Learning expectations

Learners need to be able to:

- solve mathematical equations
- use algebra to solve problems.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 85–86
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

To make class time as valuable as possible, both learners and teachers have to work hard at making it a success. Every learner has the right to learn. But every learner also has the responsibility not to deprive others of their right to learn. From the beginning, learners need to understand this dual right and responsibility. They also need to understand that each one of them is accountable for his or her own actions.

4. Support for learners with special needs

Remind learners that each one of them is a good mathematician. Always encourage learners to use different strategies they have learnt to find answers to any problems they are given. Encourage them not to be afraid to fail;

through failure they begin to understand the importance of doing mathematics in a structured and systematic way.

Allow learners to work in collaborative pairs and groups, but monitor the work that they are doing and be available if they have any questions or need help understanding a concept.

5. Teaching methodology

In this section, learners will work with mathematical equations where an unknown is represented by a letter known as a variable. Remind learners about the differences between an expression and an equation.

For a mathematical equation, both sides of the equation need to balance. That means, one side of the equation must equal the other side of the equation.

Learners need to be reminded that addition and subtraction are opposite; and that multiplication and division are opposites. Work through the examples systematically. Explain that whatever happens on the one side of an equation, must also happen on the other side of the equation – that is, the equation must always be kept in balance.

Work through some examples on the board. Then allow learners to work in pairs or collaborative groups to solve mathematical equations. Monitor the learners' work and make yourself available to answer any questions the learners may have. If you find during your observations that there are learners who are struggling to grasp this concept, work with them on a one-to-one basis or in a small group.

6. Homework

Instruct learners to complete Exercise 1 on page 85 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Go through the answers for each activity with the class. Write them on the board and ask learners to correct their own work or swap books and mark each other's work.

Collect your learners' books and assess their work to ensure all learners are able to work with the concepts taught in this section.

8. Answers

Exercise 1

(LB page 171)

1. $\text{GH}\text{¢}450 - \text{GH}\text{¢}220 = n$
 $\text{GH}\text{¢}230 = n$
So, he spent $\text{GH}\text{¢}230$ on the rides.

2. Learners' own work

3. a)

Hours worked	0	1	2	3	5	7	10
Rate (in GH¢)	50	170	290	410	650	890	1,200

- b) Add 120 to each term to find the next one. Multiply number of hours worked by 120 and add $170 - 120 = 50$ to get the rate for hours worked. Rate = $120n + 50$
- c) Rate for 10 hours worked: $T_{10} = (120 \times 10) + 50 = 1,250$
4. a) 42 km in 6 weeks = 7 km per week

Weeks	1	2	3	4	5	6
Distance (in km)	7	14	21	28	35	42

Add 7 to each term to find the next one. Multiply number of weeks by 7 and add 0 to get the distance covered per week. Rule: Distance to cover per week = $7n$.

- b) No, she needs to increase her distance by 2 km per week.

Indicator

B5.2.3.1.2 Identify the unknown in a problem, represent the problem with an equation and solve the problem concretely, pictorially or symbolically

B5.2.3.1.3 Create a problem for a given equation

1. Learning expectations

Learners need to be able to:

- solve mathematical equations
- work with pictures and symbols to solve given problems.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 86–89
- Counters for building patterns
- Matchsticks/sucker sticks, bottle tops, marbles, etc.
- Number charts

3. Large class teaching

In a large class, learners work best in pairs and groups. These should be collaborative groups in which learners can learn from one another, so differently abled learners should be matched together. Using pair and group work will also ensure that learners are not left out or become bored because of listening to you doing all the talking.

More able learners in the group can help the others to master the concept being taught, but be sure to monitor each group's understanding of the concept. You can use group leaders or monitors who can assist those learners who work at a slower pace than others. Learners need to be encouraged to find creative ways of remembering the concepts taught.

Move around the classroom to see what progress learners are making and to catch any misconceptions that may come up. Give advice, encouragement and extra individual help where it is needed.

4. Support for learners with special needs

Some learners may not be able to work with the abstract concepts represented by symbols. Work with your learners to ensure that they understand that using symbols is just another

way of representing a mathematical expression or equation. They should not be daunted by it but should work step-by-step through the problem.

5. Teaching methodology

This work continues on from the previous section, except now learners will be given pictures or symbols as part of the mathematical equations. If they have a strong foundation in the previous work, then the work in this section should flow logically. If you find there are learners who struggle with this work, go back and review the work done in this strand to establish where the gaps in their knowledge may be.

6. Homework

Instruct learners to complete the following for homework:

- Exercise 2 on page 86 of the Workbook
- Exercise 3 on page 87 of the Workbook
- Exercise 4 on page 88 of the Workbook

Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Work through the answers with the class. Write them on the board. Then ask learners to swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 175)

- | | |
|--|---|
| 1. a) $3b = 15 \text{ kg}$
$b = 15 \div 3 \text{ kg}$
$b = 5 \text{ kg}$ | b) $2b + 3 = 9 \text{ kg}$
$2b = 9 - 3 \text{ kg}$
$2b = 6 \text{ kg}$
$b = 6 \div 2 \text{ kg}$
$b = 3 \text{ kg}$ |
| c) $4b = 12 \text{ kg}$
$b = 12 \div 4 \text{ kg}$
$b = 3 \text{ kg}$ | d) $4b = 12 + b \text{ kg}$
$4b - b = 12 \text{ kg}$
$3b = 12 \text{ kg}$
$b = 12 \div 3 \text{ kg}$
$b = 4 \text{ kg}$ |

- e) $3b + 2 = 8 \text{ kg}$
 $3b = 8 - 2 \text{ kg}$
 $3b = 6 \text{ kg}$
 $b = 6 \div 3 \text{ kg}$
 $b = 2 \text{ kg}$
- f) $5b + 2 = 2b + 8 \text{ kg}$
 $5b - 2b = 8 - 2 \text{ kg}$
 $3b = 6 \text{ kg}$
 $b = 6 \div 3 \text{ kg}$
 $b = 2 \text{ kg}$
2. a) $4p = 100 - 20$
 $4p = 80$
 $p = 20$
- b) $3x = 32 + 4$
 $3x = 36$
 $x = 12$
- c) $5m = 48 - 8$
 $5m = 40$
 $m = 8$
- d) $9a = 73 - 10$
 $9a = 63$
 $a = 7$
- e) $6y = 46 + 8$
 $6y = 54$
 $y = 9$
- f) $8x = 40 + 8$
 $8x = 48$
 $x = 6$
- g) $20m = 100 + 20$
 $20m = 120$
 $m = 6$
- h) $15p = 75 - 15$
 $15p = 60$
 $p = 4$
- i) $6x = 41 - 5$
 $6x = 36$
 $x = 6$
- j) $7y - 11 = 38$
 $7y = 49$
 $y = 7$
- k) $15n + 6 = 51$
 $15n = 51 - 6$
 $15n = 45$
 $n = 3$
- l) $12m + 12 = 156$
 $12m = 156 - 12$
 $12m = 144$
 $m = 12$
- m) $9p - 14 = 76$
 $9p = 76 + 14$
 $9p = 90$
 $p = 10$
- n) $17x - 9 = 59$
 $17x = 59 + 9$
 $17x = 68$
 $x = 4$
- o) $19y + 31 = 50$
 $19y = 50 - 31$
 $19y = 19$
 $y = 1$
- p) $21a + 42 = 168$
 $21a = 168 - 42$
 $21a = 126$
 $a = 6$
- q) $25p - 29 = 221$
 $25p = 221 + 29$
 $25p = 250$
 $p = 10$
- r) $99z + 101 = 200$
 $99z = 200 - 101$
 $99z = 99$
 $z = 1$

Exercise 1

(LB page 178)

1. Learners' own work

2. a) 30 b) A c) B

**Sub-strand 1:
Lines and shapes****Content standard**

B5.3.1.1: Identify and sort quadrilaterals, including rectangles, squares, trapezoids, parallelograms and rhombuses, according to their attributes

Indicator

B5.3.1.1.1 Demonstrate an understanding of the properties (e.g. sides, angles and diagonals) of squares and rectangles

1. Learning expectations

Learners need to be able to:

- show understanding of the properties of squares and rectangles.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 90–92
- Cut-out shapes

3. Large class teaching

Allow learners to work in collaborative groups or pairs.

Learners need to understand the properties of squares and rectangles, so make sure you have a few examples of these available for learners to work with.

4. Support for learners with special needs

Move from the concrete (working hands-on) to discover the different properties of squares and rectangles to the abstract.

Some learners may find it difficult to ‘see’ the properties of these shapes if they are not working with them physically. A 2D presentation of the shapes could hinder the development of knowledge for some learners.

5. Teaching methodology

As learners work with the different shapes, allow them to touch and feel the shapes and explore the different attributes for each one. Even if they do not use the correct mathematical terms to describe the properties yet, encourage them to talk to their peers about what they notice about each shape. Make sure each pair or group has a variety of differently sized shapes, so that they can discover that no matter the size of the shape, its properties will still be the same.

Once learners have spent enough time exploring the shapes, begin to introduce the mathematical language used to describe the properties of these shapes. Begin with a rectangle. Explain that a rectangle is a quadrilateral with all four interior angles equal to exactly 90° , i.e. right angles. The opposite sides of the rectangles are parallel and of the same length (congruent). The diagonals of a rectangle are congruent and they intersect at the midpoint.

Write all the new vocabulary on the board and ask learners to copy their definitions into their books.

Explain that a square is also a quadrilateral that has four right angles but all four sides are the same length. So, a square is a special kind of rectangle. It is important for learners to understand that every square is a rectangle because it is a quadrilateral with all four angles right angles. However, not every rectangle is a square!

6. Homework

Instruct learners to complete Exercise 1 on page 90 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Diagnostic assessment

As learners work with the different squares and rectangles discovering the properties, assess their knowledge as you walk around the classroom. Some of the terms used in this

section of the work should already be familiar to the learners, so check carefully to see who uses the terms correctly and in the correct context.

8. Answers

Exercise 1

(LB page 181)

1.

	The shape has:	Square	Rectangle
b)	four angles	✓	✓
c)	opposite sides equal in length	✓	✓
d)	opposite angles equal in size	✓	✓
e)	opposite sides parallel	✓	✓
f)	diagonal or symmetry lines that cut the shape in half	✓	✓

2. a) square

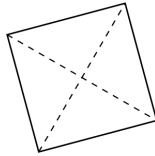
b) rectangle

c) square

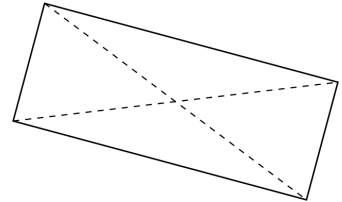
d) rectangle

3. Learners' own work

4. a)



b)



5. 6 squares

5 rectangles

Indicator

B5.3.1.1.2 Use paper folding with cut-out squares and rectangles to investigate the properties in terms of sides, angles and diagonals

1. Learning expectations

Learners need to be able to:

- show understanding of the properties of squares and rectangles.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 92–94
- Cut-out shapes

3. Large class teaching

Allow learners to work in collaborative groups or pairs.

Learners need to understand the properties of squares and rectangles, so make sure you have a few examples of these available for learners to work with.

4. Support for learners with special needs

For learners to discover the different properties of squares and rectangles, move from the concrete (working hands-on) to the abstract. Some learners may find it difficult to 'see' the properties of these shapes if they are not working with them physically. A 2D presentation of the shapes could hinder the development of knowledge for some learners.

5. Teaching methodology

Continue working with squares and rectangles and allow learners to cut out and make their own. You can turn this into a fun activity where learners can build a robot, a ship, a house, etc., using squares and rectangle. They can label which shapes are rectangles and which are squares.

Ask them to hand in their creations for assessment.

6. Homework

Instruct learners to complete Exercise 2 on page 92 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Diagnostic assessment

As learners work with the different squares and rectangles discovering the properties, assess their knowledge as you walk around the classroom. Some of the terms used in this section of the work should already be familiar to the learners, so check carefully to see who uses the terms correctly and in the correct context.

Go through the answers for the activities with the class. Write them on the board and ask learners to correct their own work.

8. Answers

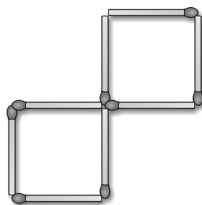
Exercise 1

(LB page 184)

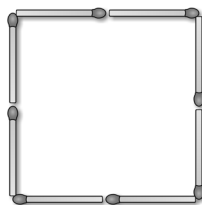
1. Here is the completed table:

Properties	Rectangle	Square
Sides		
All sides are equal in length	No	Yes
Opposite sides are equal in length	Yes	Yes
Opposite sides are parallel	Yes	Yes
Angle		
Opposite angles are equal in size	Yes	Yes
All angles are right angles (90°)	Yes	Yes
Diagonals		
Diagonals bisect each other	Yes	Yes
Diagonals are equal in length	Yes	Yes
Diagonals meet at right angles	No	Yes

2. a)



b)



- c) All sides are equal in length.
Opposite sides are equal in length.
Opposite sides are parallel.
Opposite angles are equal in size.
All angles are right angles (90°).
Diagonals bisect each other.
Diagonals are equal in length.
Diagonals meet at right angles.

3. a) **Squares:** window; window panes; cube at foot end of bed; flat object on desk; picture above bed
Rectangles: bed; pillow; mat; bookshelf; shelf above the bed; box on shelf; toy bus; books; desk; desk drawers; box at bookshelf
- b) **Square:** 4 sides are equal; all angles 90°
Rectangle: 2 opposite sides are equal; all angles 90°

Exercise 2

(LB page 186)

1.

8	3	4
1	5	9
6	7	2

2.

4	9	2
3	5	7
8	1	6

Indicator

B5.3.1.1.3 Prove that a polygon is regular by measuring the sides and angles or by folding and superimposing

1. Learning expectations

Learners need to be able to:

- prove that a polygon is regular.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 95–97
- Regular and irregular polygons of different sizes (can be cut-outs)

3. Large class teaching

Allow learners to work in collaborative groups or pairs.

Learners need to understand the properties of regular and irregular polygons, so make sure you have a few examples of these available for learners to work with.

4. Support for learners with special needs

For learners to discover the different properties of regular and irregular polygons, move from the concrete (working hands-on) to the abstract. Some learners may find it difficult to 'see' the properties of these shapes if they are not working with them physically. A 2D presentation of the shapes could hinder the development of knowledge for some learners.

5. Teaching methodology

Explain to your learners that a polygon can have a certain number of sides, but the sides do not necessarily have to be the same length. However, in a regular polygon all the angles and all the sides have to be congruent.

The learners need to understand that any polygon that does not have all sides congruent is an irregular polygon. Irregular polygons can still be pentagons, hexagons and nonagons, for example, but they do not have congruent angles or equal sides.

Learners need to understand that a regular polygon can always be divided into triangles. Each triangle will have a side that is from the original polygon. These triangles will therefore have one congruent side. Regular polygons also have congruent interior angles, which can be divided in half by angle bisectors.

6. Homework

Instruct learners to complete Exercise 3 on page 95 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Work through the answers to the activities with the class. Write them on the board and ask learners to correct their own work or swap books and mark each other's work.

8. Answers

Exercise 1

(LB page 188)

Properties	Rectangle	Square	Rhombus	Isosceles trapezoid	Parallelogram
Sides					
All sides are equal in length	No	Yes	Yes	No	No
Opposite sides are equal in length	Yes	Yes	Yes	Some	Yes
Opposite sides are parallel	Yes	Yes	Yes	Some	Yes
Angles					
Opposite angles are equal in size	Yes	Yes	Yes	No	Yes
All angles are right angles	Yes	Yes	No	No	No

Properties	Rectangle	Square	Rhombus	Isosceles trapezoid	Parallelogram
Diagonals					
Diagonals bisect each other	Yes	Yes	Yes	No	Yes
Diagonals are equal in length	Yes	Yes	Yes	Yes	Yes
Diagonals meet at right angles	No	Yes	Yes	No	No

Exercise 2

(LB page 189)

- Shape C is a polygon. It is a closed, flat 2D figure without any curves and at least three sides and three internal angles.
- Shape E is not a polygon. It is not a closed figure.
- Shape G is not a polygon. It has curved sides and is not a closed figure.
- Shape H is a polygon. It is a closed, flat 2D figure without any curves and at least three sides and three internal angles.

Exercise 3

(LB page 190)

- The shapes are the same size – their sides are the same length and their angles are the same size.
 - They are oriented in different ways – the first shape is horizontal and the second shape is vertical.
- Learners' own work
- Rhombus
- A and B. Opposite sides equal; opposite sides parallel; opposite angles equal, angles not right angles; diagonals are equal
- No. All angles are not right angles and diagonals do not meet at right angles.

Sub-strand 2: Measurement

Content standard

B5.3.2.1: Estimate and measure perimeter and surface area of 2D shapes using centimetre and metre

Indicator

B5.3.2.1.1 Estimate perimeter using referents for centimetres and metres and calculate the actual perimeter and compare

1. Learning expectations

Learners need to be able to:

- estimate and calculate the perimeter of 2D shapes.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 98–100
- Building blocks

3. Large class teaching

Allow learners to work in small collaborative groups or pairs. Remind them of the class rules and respecting other group members' opinions during discussions.

4. Support for learners with special needs

Talk to learners about their experiences with measuring perimeter, for example, having to build a fence around a vegetable garden, etc. Ask your learners to work in small groups and to share what they did to determine how much fencing was needed.

As learners are busy with their discussions, go around the room and assess their level of understanding of perimeter. Take note of those learners who are not actively engaged in the conversations. These will usually be the learners who might need further support to grasp this concept.

5. Teaching methodology

Working physically with perimeter of different shapes is an important building block to take the abstract algorithm

for perimeter and giving learners the chance to physically manipulate shapes.

Start off by instructing learners that they will use blocks to build a simple shape that is either a rectangle or a square. There should be no empty spaces and every block has to touch another block along its edge. Introduce the vocabulary used when working with perimeter and make sure all the learners understand what you are referring to.

Pass out blocks and allow learners to build their simple shapes. Walk around the room making sure all pairs or groups are creating a shape that can easily be measured along its perimeter.

Note: If you do not have access to blocks, use cut-out squares for each learner and let them build their shapes.

Allow each group a chance to walk around the classroom to find the perimeter of other groups' shapes. If you have a big class, let two or three groups investigate together.

6. Homework

Instruct learners to complete question 2 Exercise 1 on page 99 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Diagnostic assessment

Once all groups have had a chance to find the perimeters of shapes, bring the class together to talk about what they found. Ask the learners the following questions:

- What did you learn about perimeter? You can assess what the learners have gained through having them complete the exercises. Also check to see which learners will need extra support in understanding the concept.
- What did you learn about your own thinking? When learners reflect on their own thinking, they become aware of how they learn.

8. Answers

Exercise 1

(LB page 193)

Learners' own work

Exercise 2

(LB page 194)

Learners' own work

1. Learning expectations

Learners need to be able to:

- calculate perimeter.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 98–100
- Building blocks

3. Large class teaching

Allow learners to work in small collaborative groups or pairs. Remind them of the class rules and respecting other group members' opinions during discussions.

4. Support for learners with special needs

As you move from working concretely to working abstractly, make sure all your learners are able to switch successfully between the two. Some learners may feel intimidated working with shapes drawn in the textbook, so allow them to build the shapes in order to calculate the perimeters.

Learners will also work with the formula for calculating perimeter. Make sure to explain thoroughly what each symbol in the formula means and that all learners understand how to use it.

5. Teaching methodology

Remind learners about the work they did with perimeter in the previous section. Explain that perimeter simply means the distance all the way around the figure.

Remind them that to find the perimeter of a rectangle, they add the lengths of all the sides together. Write down the equation for measuring the perimeter of a rectangle. Remind them not to forget to write down the unit of measurement in their answer.

To find the perimeter of a square, they add the lengths of all the sides together. Because the sides of a square all

have equal lengths, we can use repeated addition – therefore multiplication – to calculate the perimeter. Write down the equation for measuring the perimeter of a square.

When learners move on to more complex shapes, they often become confused as they still want to measure the perimeter of the shapes and then only add them together. Make sure this misconception does not creep in, but remind them of the definition of perimeter – that is, perimeter is the distance all around the shape.

6. Homework

Instruct learners to complete questions 3–5 of Exercise 1 on page 100 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Diagnostic assessment

As learners work with calculating perimeter of different shapes, monitor their work and assess which learners are working fluently in calculating the perimeter of various shapes – either simple or complex.

If you find there are still learners who are struggling to do the calculations and use the equations for their calculations, work with them one-to-one or in a small group.

8. Answers

Exercise 3

(LB page 196)

- Formula: $P = 2(L + B)$
 - 74 cm
 - 214 cm
 - 68 m
 - 146 m
 - 400 m
 - 178 cm
 - 240 cm
- 24 cm
 - 30 cm
- 200 m
- 108 cm
- 480 m

Exercise 4

(LB page 197)

- 17 cm
 - 76 m
 - 472 m
 - 90 cm
 - 132 m
 - 38 m
- 32 m
 - 6 m
 - 226 cm
 - 540 mm
 - 196 m
 - 16 m

1. Learning expectations

Learners need to be able to:

- calculate the area of given shapes.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 101–104
- Graph paper (centimetre-squared paper)
- Ruler, metre rule, metre stick, tape measure

3. Large class teaching

Allow learners to work in collaborative pairs or groups to complete the discussions and activities for this section.

Always supervise the discussions and work and make sure all learners contribute and participate in the activities.

4. Support for learners with special needs

As you move from working concretely to working abstractly, make sure all your learners are able to switch successfully between the two. Some learners may feel intimidated working with shapes drawn in the textbook, so allow them to build the shapes in order to calculate the area.

5. Teaching methodology

Begin this lesson by asking learners to draw various regular shapes on centimetre graph paper and then count the number of squares contained within the drawing. Explain to your learners that the area of a shape is the amount of space inside the boundary of a 2D shape. Ask for a volunteer to say how this is different from a shape's perimeter. Now ask a volunteer to give you the area of any two of the shapes they draw – they should give the area in squares. Explain to your learners that when they count the squares, they are finding the area of the shape.

Give your learners several more examples to do until you are satisfied that they understand how to calculate the area using squares.

Next, learners need to move on to using the formula to calculate the area of different shapes. Start off with a rectangle. To find the area of a rectangle, they need to multiply the length and the breadth together. Write down the equation for measuring the area of a rectangle. Remind them not to forget to write down the unit of measurement in their answer.

To find the area of a square, they multiply two sides. Write down the equation for measuring the area of a square. Remind them not to forget to add the unit of measurement to their answer.

6. Homework

Instruct learners to complete Exercise 2 on page 101 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Continuous assessment

Informally assess how well learners understand area and how to measure area. Use learners' responses to questions you ask in class and their answers to questions in activities to identify areas they do not understand well.

8. Answers

Exercise 1

(LB page 199)

- a) 54 cm^2 b) 48 cm^2 c) 280 cm^2
- None of them will cover her four bedroom walls.
- 20 tiles

Exercise 2

(LB page 201)

- a) $2,255 \text{ m}^2$ b) 4 m^2 c) 52 m^2
- 178 m^2
- a) $(200 \times 200) + (200 \times 200) + (1,200 \times 200) \text{ cm}$
 $= 40,000 + 40,000 + 240,000 \text{ cm}$
 $= 80,000 + 240,000 \text{ cm}$
 $= 320,000 \text{ cm}^2$
b) Learners' own work
c) Learners' own work

Content standard

B5.3.2.2: Demonstrate an understanding of volume of common 3D objects

Indicator

B5.3.2.2.1 Select and justify referents for cm^3 or m^3 units used for volume of 3D objects

1. Learning expectations

Learners need to be able to:

- understand the volume of 3D objects.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 105–107
- Cubes, cuboids

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Some learners find working with volume very difficult. You need to facilitate this carefully, making volume a more accessible topic in Mathematics.

Provide learners with practical experiences to explore the concept of volume. Use as many examples as you need in order to reinforce this concept.

5. Teaching methodology

In this section, learners will be taught how and why we use cm^3 and m^3 to measure volume. Work through the content in the Learner's Book and make sure to give learners ample opportunities to ask questions for clarification.

6. Homework

Instruct learners to complete Exercise 1 on page 105 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

In each lesson, informally assess how well learners understand volume. Use learners' responses to questions you ask in class and their answers to questions in activities to identify areas they do not understand well.

8. Answers

Exercise 1

(LB page 205)

$$1,000 \text{ cm}^3 = 1 \text{ litre}$$

1. Learning expectations

Learners need to be able to:

- calculate the volume of different boxes.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 107–108
- Cubes, cuboids

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

5. Teaching methodology

Explain to your learners that they will be learning about finding the volume of solid figures using cubes. The cubes that you use for any demonstration should be the same size.

Use the cubes to fill a rectangular prism. Make sure there are no gaps or overlaps. Then explain to your learners that the number of cubic blocks inside the rectangular prism gives you its volume. Let the learners count out the cubes that you used to fill the box. Then explain that because you used cubes, the volume must be measured in cubic units.

Show learners several more examples, or if you are able to, let each group work with cubic blocks to determine the volume of different prisms. You can ask learners to build different prisms where they could find the volume. Check to see that the learners have used cubes of the same size with no gaps or overlaps and counted them correctly.

If necessary, provide more practice for learners who need it.

Next, learners need to move on to using the formula to calculate the volume of different 3D objects. Remind them not to forget to write down the cubic units of measurement in their answers.

6. Homework

Instruct learners to complete Exercise 2 on page 107 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Ask your learners to write or draw a picture to show what they know about volume. Collect their drawings and use their responses to assess their knowledge. Adjust your teaching in order to accommodate all learners during the next lessons.

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

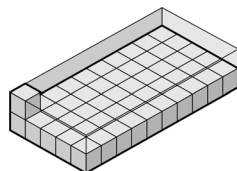
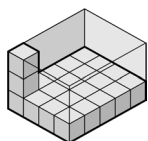
(LB page 207)

1. A 5 B 8 C 6 D 9 E 8
 2. A 5 cm³ B 8 cm³ C 6 cm³ D 9 cm³ E 8 cm³

Exercise 2

(LB page 208)

1. 5 2. 96 3. 480 cm³
 4. 5.



Exercise 3

(LB page 211)

1. a) 216 cm³ b) 240 cm³

1. Learning expectations

Learners need to be able to:

- understand the volume of 3D objects.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 108–109
- Cubes, cuboids

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

5. Teaching methodology

In this section, learners will explore boxes that look different but have the same volume. This should be a practical lesson where learners work hands-on with filling their boxes or building the cubes in different ways.

Give each group 24 cubes and ask them to build boxes in two different ways. Learners can build two boxes, for example, with volumes $3 \times 4 \times 2$ or $2 \times 6 \times 2$. The boxes will look different, but they will have the same volume.

6. Homework

Instruct learners to complete Exercise 3 on page 108 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 213)

1. Dzifa's box:

$$V = L \times B \times H$$

$$= 30 \text{ cm} \times 10 \text{ cm} \times 2 \text{ cm}$$

$$= 600 \text{ cm}^3$$

Yayra's box:

$$V = L \times B \times H$$

$$= 15 \text{ cm} \times 10 \text{ cm} \times 4 \text{ cm}$$

$$= 600 \text{ cm}^3$$

2. Learners' own work

Indicator

B5.3.2.2.4 Demonstrate an understanding of capacity by describing the relationship between capacity and volume as well as litre and 10 cm^3

1. Learning expectations

Learners need to be able to:

- describe the relationship between capacity and volume.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 109–112

3. Large class teaching

Large classes do not need to be less effective than smaller ones. However, teaching a large class will require you to be more conscious in your lesson planning. Large classes work best when learners are actively involved in their learning and take an active interest in the subject.

4. Support for learners with special needs

If you recognise that some learners are struggling to distinguish between volume and capacity, work with them in a separate break-away group. Encourage them not to become frustrated if they cannot grasp the concept the first time around, but to continue learning at their own pace.

5. Teaching methodology

It is important that learners understand the key differences between volume and capacity.

The term 'volume' is used to describe the amount of 3D space occupied by a solid, liquid or gas. The volume of a box can be explained as how many identical cubes of a certain smaller size the box would contain. The volume of an object can be calculated by multiplying its length, width and height. It is measured in three-dimensional units, such as cubic metres, cubic centimetres, etc.

The term 'capacity' is used to describe how much of a substance, whether it is a solid, liquid or a gas, a hollow

container or 3D object can potentially hold. It measures the amount of space available in a container that can be filled with a substance. The substance usually takes on the shape of the container. It is measured in millilitres, litres, kilolitres, gallons, etc.

Here is a list of key differences between volume and capacity:

Volume is the amount of space that a substance takes up.	Capacity is the maximum amount of a substance that an object can hold.
Volume is always measured in cubic centimetres, cubic metres, etc.	Capacity is measured in millilitres, litres, etc.
When an object is solid, it has only volume.	If an object is hollow, it has both volume and capacity.

6. Homework

Instruct learners to complete Exercise 4 on page 109 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 217)

Learners' own work

Exercise 2

(LB page 217)

- | | | |
|---------------|-----------|--------------|
| a) 0.5 ℓ | b) 3.2 ℓ | c) 0.00075 ℓ |
| d) 1.5 ℓ | e) 0.25 ℓ | f) 3 ℓ |
| g) 0.000655 ℓ | h) 5 ℓ | i) 10 ℓ |
- | | | |
|--------------------------|--------------------------|--------------------------|
| a) 400 cm ³ | b) 950 cm ³ | c) 1,000 cm ³ |
| d) 5,000 cm ³ | e) 1,600 cm ³ | f) 4,800 cm ³ |
| g) 2,000 cm ³ | h) 6,000 cm ³ | i) 8,800 cm ³ |
- | | |
|----------------------------|-------------------------|
| a) A = 125 cm ³ | B = 432 cm ³ |
| b) A = 0.125 ℓ | B = 0.432 ℓ |

4. $14 \times b \times 7 = 490$
 $b = 490 \div 98$
 $b = 5 \text{ cm}$
5. $12 \times 5.5 \times h = 1,254$
 $h = 1,254 \div 66$
 $h = 19 \text{ cm}$
6. a) 3 cm one side b) 64 cm^3

Exercise 3

(LB page 219)

1. 38.5 ℓ
2. No. Volume of carton = $787.5 \text{ cm}^3 = 0.787 \text{ ℓ}$
3. Volume of a) is 0.432 ℓ and volume of b) is 0.594 ℓ. So, b) is more suitable.
4. 250 cm^3 or 0.25 ℓ
5. a) 1.5 ℓ b) 3 ℓ
 c) $3,000 \text{ cm}^3$ d) $1,000 \text{ cm}^3$
6. The gauge shows that the tank is a quarter full. So, there are $64 \div 4 = 16 \text{ ℓ}$ left on Sunday evening. He fills up the tank with $64 - 15 = 48 \text{ ℓ}$ on Saturday morning. On Sunday morning Tetteh filled up again with 32 ℓ. Total litres used: $48 + 32 = 80 \text{ ℓ}$.

Sub-strand 3: Measurement: Angles

Content standard

B5.3.3.3: Demonstrate an understanding of angles

Indicator

B5.3.3.3.1 Identify examples of angles in the environment that are equal to, less than or larger than a right angle

1. Learning expectations

Learners need to be able to:

- identify different angles.

2. Resources used in this chapter

- Learner's Book
- Paper circles for folding

3. Large class teaching

Allow learners to work in collaborative pairs and groups as they complete this section. Ensure all group members participate in the activities. Assess the learners' work informally by walking around the classroom and checking learners' understanding as you listen to the discussions in each group.

4. Support for learners with special needs

If there are learners that are differently abled to the rest of the group, remind the groups to take cognisance of these learners and their abilities or restrictions on what they can do. For example, if there is a learner who uses a wheelchair, they might not be able to keep up with the rest of the group members as they explore their environment.

5. Teaching methodology

Begin by revising what learners know about angles. Ask some volunteers to explain to you what a right angle is. Check that they are using the correct vocabulary to describe a right angle – if not, help them to correct their understanding.

Once complete, explain to your learners that they will be exploring the environment in the classroom and on the playground to find angles that are equal to, less than or larger than a right angle. One of the learners from the group needs to make notes of what the groups have found.

Allow about 10 minutes for learners to find examples. Once back in class, ask each group to provide feedback on what they found. Ask them probing questions to ensure they understood the task. Clear up any misconceptions that may have arisen immediately.

Introduce the different names of the angles that the learners have found and provide a brief explanation of each one.

6. Homework

Instruct learners to complete Exercise 1 on page 113 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 222)

1. Learners' own work

Indicator

5.3.3.3.2 Measure given angles with a protractor and classify them according to their measured sizes – right, acute, obtuse and reflex

1. Learning expectations

Learners need to be able to:

- measure angles using a protractor.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 113–119
- Protractors

3. Large class teaching

Large classes do not need to be less effective than smaller ones. However, teaching a large class will require you to be more conscious in your lesson planning.

Large classes work best when learners are actively involved in their learning and take an active interest in the subject. Let learners continue to work in the pairs and groups they were working in.

4. Support for learners with special needs

Learners who struggle with finding and measuring angles will need additional support. Assess whether there might be a barrier to their learning and understanding. Then work with them independently or as a small group. Review how to measure angles using a protractor.

Provide constant feedback about learners' performance and ask questions to check for understanding.

5. Teaching methodology

A protractor is a transparent plastic tool designed to measure angles. They are usually semi-circular. Explain the different parts of the protractor to your learners.

Origin	The point where the 90° vertical line crosses the horizontal baseline at the bottom of the protractor is aligned over the vertex of the angle to be measured.
Baseline	The line along the bottom of the protractor is aligned along one of the angle's legs. Note: It is not the edge of the protractor body itself, but parallel to it.
Scales	The angle of the other leg is read from one of the two scales, whichever is appropriate.

If you do not have protractors available, you can let the learners make their own measuring tool as described in the Workbook on page 114. Learners complete questions 1 and 2 of Exercise 1 in the Workbook.

Allow learners to work in pairs to measure different angles using a protractor. As they work together, be available to assist any pairs that might need your help. Also assess which pairs are using the protractor correctly and help those who may be struggling.

Make sure learners are able to name each angle correctly.

6. Homework

Instruct learners to complete questions 3–5 Exercise 1 on page 115 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

In each lesson, informally assess how well learners understand lines and angles. Use learners' responses to questions you ask in class and their answers to questions in activities to identify areas they do not understand well.

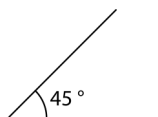
8. Answers

Exercise 1

(LB page 226)

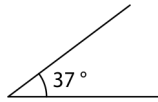
1. An angle of 45°

2.

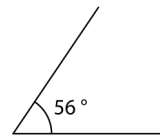


3. a) Right angle b) Acute angle
 c) Reflex angle d) Obtuse angle
 e) Straight angle f) Acute angle
 g) Reflex angle h) Acute angle
 i) Right angle j) Obtuse angle
 k) Straight angle l) Reflex angle
4. a) C b) D c) E d) G
 e) B f) A g) F
5. a) 80 degrees b) 98 degrees c) 83 degrees

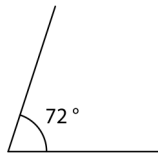
6. a) Acute angle



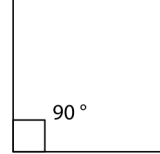
- b) Acute angle



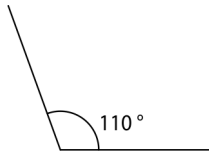
- c) Acute angle



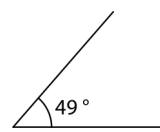
- d) Right angle



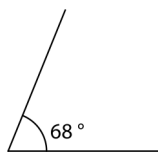
- e) Obtuse angle



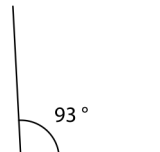
- f) Acute angle



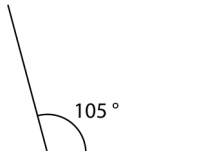
- g) Acute angle



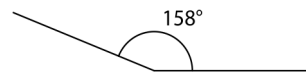
- h) Obtuse angle



- i) Obtuse angle



- j) Obtuse angle



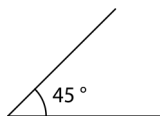
Exercise 2

(LB page 228)

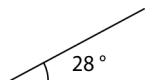
1. a) 55° b) 27° c) 85° d) 118°
e) 55° f) 85° g) 118° h) 27°

2. Learners' own answers.

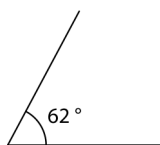
3. a) Acute angle



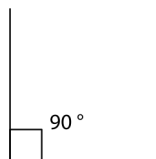
b) Acute angle



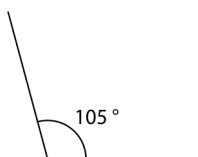
c) Acute angle



d) Right angle



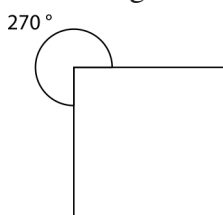
e) Obtuse angle



f) Obtuse angle



g) Reflex angle



Sub-strand 4: Geometric reasoning

Content standard

B5.3.4.1: Describe the position of objects in space using the cardinal points

Indicator

B5.3.4.1.1 Tell the position and motion of objects in space using the cardinal points north, south, east and west

1. Learning expectations

Learners need to be able to:

- use the cardinal points to tell the position of an object.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 120–122
- Cardinal points
- Simple maps

3. Large class teaching

Allow learners to work in pairs or collaborative groups for this section. Remind them to always include all group members in the activities they need to complete.

4. Support for learners with special needs

Remind learners to be aware of learners who may not be able to do certain activities due to their differing abilities. Encourage groups to use activities that are inclusive and that will not leave any learner behind or let any learner feel left out.

5. Teaching methodology

Give pairs or groups of learners a blank piece of paper. Ask them to draw a circle in the centre of the paper, then to draw a horizontal and vertical line through the circle to create a compass rose. Ask learners to fill in the cardinal points (north, south, west and east) on the compass rose.

Ask learners to show you where the sun comes up and where it sets. Tell them the sun comes up in the east and sets in the west. Ask them to pick up their compass rose and align it accordingly. Now ask them to turn in a direction. Discuss why they were, or were not, able to correctly turn towards, for example, north.

Next, ask learners to work in their groups and to use at least two cardinal points to write directions from their classroom to another room in the school. They should not be allowed to use the terms left or right. Once complete, let the groups exchange their directions with another group to follow and see if they end up where they intended to. Learning how to correctly use the cardinal points when giving directions is an important life skill.

As a homework activity, you can ask learners to draw a simple map including a compass rose for directions from their house to a local landmark.

6. Homework

Instruct learners to complete Exercise 1 on page 129 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Work through the answers with the class. Write them on the board and ask learners to correct their own work.

8. Answers

Exercise 1

(LB page 233)

- A is west of B.
 - B is south of C.
 - C is east of D.
 - D is north of A.
- Go 1 square south and 4 squares east (or any other acceptable answer).
 - Go 3 squares south and 6 squares east (or any other acceptable answer).
 - Go 1 square south, 1 square west, 1 square south, 3 squares west, 1 square south, 3 squares west and 1 square south (or any other acceptable answer).

Content standard

B5.3.4.2: Perform a single transformation (i.e. reflection) on a 2D shape

Indicator

B5.3.4.2.1 Identify images of a single transformation (i.e. reflection) of a 2D shape in a plane

1. Learning expectations

Learners need to be able to:

- explain what a reflection is
- identify different reflections of a 2D shape in a plane.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 123–125
- Coordinate grid/grid paper
- Cut-out shapes

3. Large class teaching

To make class time as valuable as possible, both learners and teachers have to work hard at making it a success. Every learner has the right to learn. But every learner also has the responsibility not to deprive others of their right to learn. From the beginning, learners need to understand this dual right and responsibility. They also need to understand that each one of them is accountable for his or her own actions.

4. Support for learners with special needs

Remind learners that each one of them is a good mathematician. Always encourage learners to use different strategies they have learnt to find answers to any problems they are given. Encourage them not to be afraid to fail; through failure they begin to understand the importance of doing mathematics in a structured and systematic way.

Allow learners to work in collaborative pairs and groups, but monitor the work that they are doing and be available if they have any questions or need help understanding a concept.

5. Teaching methodology

Reflection is a complex concept for learners because they need to understand the coordinate system, treat each coordinate separately and in relation to the location of the mirror line.

Start off by discussing familiar contexts of reflection, such as in water, in a mirror, etc. Learners can also use cut-out shapes as they develop the ability to manipulate shapes mentally in a coordinate grid. Encourage learners to discuss their thinking with their peers and to come up with solutions that are mathematically correct. Ask learners to complete the following activity.

Ask learners to draw and label the x - and y -axes at least 20 squares long using grid paper.

- They then put one of their cut-out shapes on the paper so that its corners are on the ‘crosses’ of the grid. Ask them to mark the vertices of their shape, draw the shape and write down the coordinates of each vertex.
- Ask learners to draw a vertical or horizontal mirror line on their grid.
- Then they should draw the reflection of the shape on the other side of the mirror line and write down the coordinates of the reflection.
- Practise using lots of shapes and in different positions so that learners become confident.

6. Homework

Instruct learners to complete Exercise 1 on page 123 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Work through the answers with the class. Work carefully explaining how each reflection can be drawn and named. Ask learners to explain to you how a shape would be reflected on a given plane.

Once complete, ask learners to hand their work in to you. You can use the Answers section to assess learners’ work.

8. Answers

Exercise 1

(LB page 239)

1. a) Image A is a reflection of object **E** over the $x = 0$ mirror line.
- b) Image B is a reflection of object **D** over the $y = 0$ mirror line.
- c) Image C is a reflection of object **H** over the $y = -x$ mirror line.
- d) Image F is a reflection of object **G** over the $y = x$ mirror line.

**Sub-strand 1:
Data collection, organisation, presentation,
interpretation and analysis****Content standard****B5.4.1.1: Differentiate between first-hand and second-hand data****Indicator****B5.4.1.1.1 Explain the difference between first-hand and second-hand data****1. Learning expectations**

Learners need to be able to:

- differentiate between first-hand and second-hand data.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 126–127
- Various sources of first-hand and second-hand data

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

When teaching learners with special needs, it is important to understand what they need when you are working with different topics. Sometimes splitting the class up between other teachers who are teaching the same grade can help you as you work with a certain group. Co-teaching is one of the best ways to support learners with disabilities and encourages teachers to collaborate, plan and learn together.

Plan your lessons together and use the resources available in your classroom to support learners with special needs. For example, if you have learners who have hearing disabilities, you can work with these learners in a small group to teach them, while your co-teacher teaches the lesson to the rest of the group.

5. Teaching methodology

When teaching this section, explain to your learners that the information we collect ourselves is called first-hand data, and information that we get from other sources, such as newspapers, magazines or the Internet, is called second-hand data.

Display a list of statements showing first-hand and second-hand data on the board. Ask learners to say which statement shows first-hand data and which shows second-hand data. Ask them to explain why.

The data learners collect and display can be either first-hand or second-hand data. They need to understand that first-hand data provides information that they have obtained directly by asking questions, measuring, observing, or conducting experiments. For example, first-hand data can be obtained by asking the learners in their class what their favourite food is, or observing how many red cars pass an intersection in the morning.

Second-hand data is useful because it provides information that is readily available. You can extract the data from sources such as newspapers, magazines, the Internet, etc. For example, you can use the school's information for learners' pass rate in Basic 5 over a period of five years.

6. Homework

Instruct learners to complete Exercise 1 on page 126 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Self/Peer assessment

Work through the answers with the class. Write them on the board and ask learners to correct their own work.

8. Answers

Exercise 1

(LB page 242)

1. First-hand data is data that you collect yourself, for example by direct observation, asking questions, measuring or conducting experiments.
2. Second-hand data is data that was collected and organised by somebody else.

Indicator

B5.4.1.1.2 Find examples of second-hand data in print and electronic media, such as newspapers, magazines and the Internet

1. Learning expectations

Learners need to be able to:

- find examples of second-hand data in different media.

2. Resources used in this chapter

- Learner's Book
- Workbook page 128
- Various sources of first-hand and second-hand data

3. Large class teaching

Allow learners to work in collaborative pairs and groups.

Learners work together and decide which resources each of them will contribute.

4. Support for learners with special needs

As learners work through this section, encourage them to help others that may have difficulty accessing the second-hand data from the various sources. If there are specific learners who cannot complete the activities set in the Learner's Book, provide an opportunity for them to, for example, answer the questions verbally.

5. Teaching methodology

This section links directly with the previous one. As a homework activity, ask learners to bring old newspapers or magazines from home.

Ask learners to work in pairs and to find examples of second-hand data in the resources they bring from home. If your school has access to the Internet, allow learners to search online for examples of second-hand data as well.

6. Homework

Instruct learners to complete Exercise 2 on page 128 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 244)

Learners' own work

Exercise 2

(LB page 245)

1.
 - a) Second-hand data
 - b) First-hand data
 - c) Second-hand data
 - d) First-hand data
2. Examples of questions:
 - Who published the data?
 - What is the data showing?
 - How many periods are there in total per week?
 - Which subjects have the most periods per week?
 - Which subjects have the least periods per week?
 - Is the number of periods equal across all grades?

Content standard

B5.4.1.2: Construct and interpret double bar graphs to draw conclusions

Indicator

B5.4.1.2.1 Draw double bar graphs, complete with title, labelled axes, key or legend, to represent data collected (up to 3 pairs of categories of data) and use it to solve problems

1. Learning expectations

Learners need to be able to:

- draw double and triple bar graphs correctly.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 129–131
- Various sources of first-hand and second-hand data
- Various examples of double and triple bar graphs

3. Large class teaching

If you are teaching a large class, engaging learners in peer work, for example working in pairs or in groups, will encourage learners to take greater responsibility for their own learning. However, you need to be available to any learners who will need your help and/or guidance.

Pair and group work might also reduce anxiety and allow learners to speak to their peers and ask questions without feeling intimidated.

4. Support for learners with special needs

Encourage your learners to assist those learners who may require additional help in their groups because of a special need. They need to be sensitive to the needs of all the learners in their group and learn to work with differently abled people.

5. Teaching methodology

Explain to your learners that graphs provide a visual way to display data. It enables you to get an overall picture of the information that has been collected.

Learners should be familiar with pictographs and bar graphs. Revise what they already know about these graphs. In this section, learners will work with double and triple bar graphs. Double and triple bar graphs are useful when we want to compare two (or three) categories of data.

One way of showing discrete data is by means of bar graphs. Discrete data involves observations that are separate and distinct, and that can be counted.

Explain to learners that graphs always need to have a heading and labels on the x - and y -axes. Revise with your learners how to draw and label a bar graph correctly. Explain that they need to be cognisant of the accuracy of their drawings because if they are done incorrectly, the data will be misinterpreted.

6. Homework

Instruct learners to complete Exercise 1 on page 129 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

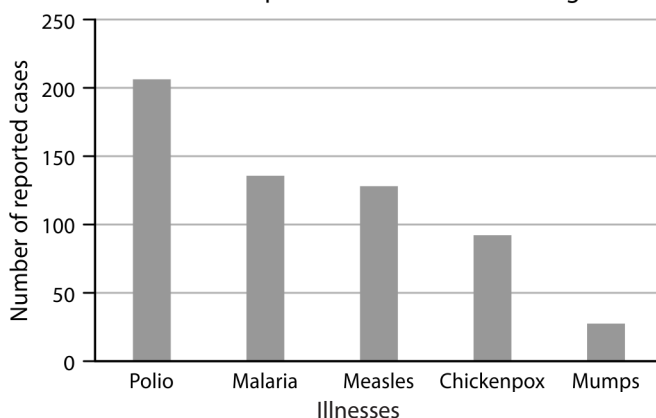
Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 247)

1. Illnesses reported for children under age 5

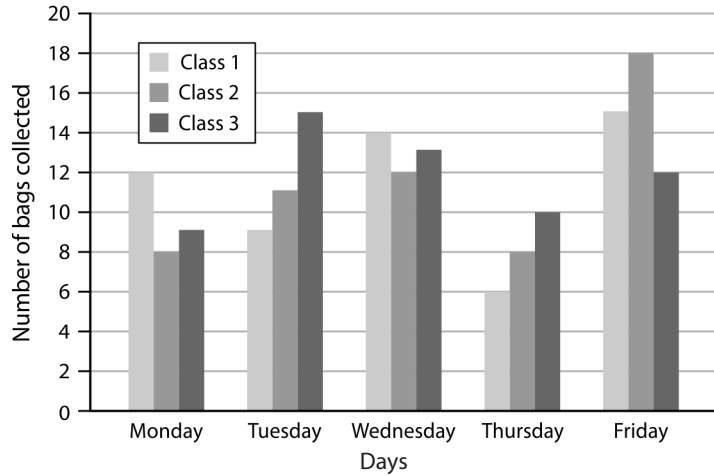


2. a) 135
- b) Polio
- c) Mumps
- d) No
- e) 77
- f) 589

Exercise 2

(LB page 250)

1. Number of bags of recycling collected by 85 classes



2. a) Class 3
- b) Class 1
- c) Class 1
- d) 45 bags
- e) Class 1
- f) 172 bags

B5.4.1.2.2 Identify examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines and the Internet

1. Learning expectations

Learners need to be able to:

- identify examples of double and triple bar graphs in different media.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 132–134
- Various sources of printed and online media
- Various examples of double and triple bar graphs

3. Large class teaching

The best way to work with large classes is to get to know your learners. Check which of your learners are comfortable speaking in front of the whole class and which learners are comfortable speaking in smaller groups. As the learners work in groups, monitor their progress closely.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

5. Teaching methodology

This section links directly with the previous one. Ask learners to work in pairs or in groups and to find examples of double and triple bar graphs in the available resources. If your school has access to the Internet, allow learners to search online for examples of double and triple bar graphs.

First ask learners at least three example questions about a double or triple bar graph. Then ask them to come up with

questions they can give to other groups for answering. Once the other group has completed the answers, they need to hand their answers back for review.

6. Homework

Instruct learners to complete Exercise 2 on page 132 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Use the Answers section to assess learners' work.

8. Answers

Exercise 1

(LB page 252)

1.
 - a) Axim
 - b) Navrongo
 - c) No
1981–1990 (about 1,300 mm rain)
1991–2000 (about 1,800 mm rain)
So, during 1991–2000 the rainfall in Axim was about 500 mm more than during 1981–1990, and 500 mm is only about a quarter of 1,800.
 - d) The lowest rainfall was recorded during 1981–1990, as shown by the blue bars being consistently shorter than the other bars.
2.
 - a) 599,000 or 0.599 million
 - b) Yes – 441 people, which is about a quarter of the population, live outside rural areas.
 - c) 2,547,000 or 2.547 million people live in the large capital city Accra and other urban areas in Greater Accra.
 - d) Combined population is 3,319,000 or 3.319 million – greater than the population of Greater Accra by 413,000 (or 0.413 million) people.
 - e) Learners' own opinions, for example, the fertile soil is good for farming.
 - f) Learners' own work

3. a) $\text{GH}\text{¢}4.29 - \text{GH}\text{¢}4.08 = \text{GH}\text{¢}0.21$
b) July
c) $4.23 - 3.76 = 0.47$ is the difference
d) Scarcity of fuel; the exchange rate
e) Learners' own ideas. Examples:
- Petrol engines have more power than diesel engines.
 - Petrol engines produce less noise than diesel engines.
 - Diesel engines cause more air pollution than petrol engines.
 - Diesel vehicles cost more than similar petrol cars.
 - Maintenance cost is lower for petrol engines.
- f) Learners' own answers. Examples:
- Which month was the petrol and diesel price at its highest?
 - Which month was the price of petrol slightly higher than diesel?
 - What was the difference between the price of petrol and diesel in September?
4. Learners' own work

Sub-strand 2: Chance (Probability)

Content standard

B5.4.2.1: Describe the likelihood of a single outcome occurring using words such as impossible, possible and certain

Indicator

B5.4.2.1.1 Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible, or certain

1. Learning expectations

Learners need to be able to:

- work with probability and come up with their own experiments.

2. Resources used in this chapter

- Learner's Book
- Dice
- The probability scale
- Coins

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

4. Support for learners with special needs

Learners with special needs can refer to learners who are either physically or mentally challenged, or both. In order to provide quality instruction to learners with special needs provide more intensive, individualised attention to the learners who most need it.

Forming small groups of two or three students within the class is one way of making sure all learners will learn the skills being taught. You can teach general concepts to

the whole group, but then pair it with individual instruction for those learners who need it. Remember to always have additional content available for more advanced learners. You could also rotate the lessons within the different groups, introduce new material to one group, while only having to check in on others who are doing more independent activities.

5. Teaching methodology

Inform learners that they will work in groups. Each group must find or draw six pictures, each of which illustrates an event whose likelihood or probability of occurring can be described as impossible, possible (likely or unlikely) or certain. They need to classify each picture according to these probabilities. The events can be ones they create or ones they actually see occurring.

Explain that each group will create picture stories using the pictures they have made and come up with the narrative for the stories. Then ask each group to present their picture stories about the probabilities of events. Encourage learners to be as creative as possible, but they need to demonstrate their understanding of the terms associated with likelihood.

6. Homework

Instruct learners to complete Exercise 1 on page 135 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Assess the groups' picture stories. Take note of how they have used probability and if they have been able to clearly demonstrate their understanding of the terms used when talking about probability.

8. Answers

Exercise 1

(LB page 258)

- Impossible
 - Highly likely/Possible
 - Unlikely/Possible
 - Certain

2.
 - a) Impossible
 - b) Certain
 - c) Possible
 - d) Impossible
 - e) Good chance/Possible
 - f) Certain
 - g) Unlikely
 - h) Possible/Good chance
 - i) Chance/Unlikely
 - j) Unlikely

3.
 - a) Grey – Coblach has more grey socks than any other colour.
 - b) White – He has the same number of white socks as blue socks.

Indicator

B5.4.2.1.2 Design and conduct an experiment in which the likelihood of a single outcome occurring is impossible, possible (likely or unlikely) or certain

1. Learning expectations

Learners need to be able to:

- work with probability and come up with their own experiments.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 135–136
- Dice
- The probability scale
- Coins

3. Large class teaching

With large class numbers there is a diverse range of learning styles and individuals who need feedback. If you feel as if you are neglecting some learners, try to rearrange the desks in your class so that learners are working in smaller groups.

It will probably not be possible for you to give individual feedback to all the learners in your class. Therefore, teach learners the importance of peer-to-peer feedback as well as self-reflection. It might be difficult in the beginning, but with more practice, your learners will become adept at this and begin to accept it as part of their teaching and learning experience.

4. Support for learners with special needs

An inclusive classroom is a classroom that has both able-bodied learners and learners with mild, moderate, or severe disabilities in regular classrooms. It is important that you identify learners with learning disabilities well in advance. Then provide opportunities for them to work with their peers in developing their strengths.

5. Teaching methodology

In this section, learners will design and conduct a likelihood experiment. Explain to learners that they need a firm understanding of the terms used when talking about the likelihood of events.

The groups work together to come up with an experiment. As they work, walk around the classroom, listening to the conversations they are having and informally assess whether they have grasped the concept of likelihood. If there are any groups that need your support, be available to help them and provide guidance.

6. Homework

Instruct learners to complete Exercise 2 on page 136 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Ask learners to present their experiments to you and the rest of the class. Assess whether the groups have a clear understanding of the concept of likelihood and the terms used to describe it.

8. Answers

Exercise 1

(LB page 261)

Learners' own work

B5.4.2.1.3 Conduct a given probability experiment a number of times, recording the outcomes and explaining the results

1. Learning expectations

Learners need to be able to:

- work with probability and come up with their own experiments.

2. Resources used in this chapter

- Learner's Book
- Workbook pages 136–139
- Dice
- The probability scale
- Coins

3. Large class teaching

To make class time as valuable as possible, both learners and teachers have to work hard at making it a success. Every learner has the right to learn. But every learner also has the responsibility not to deprive others of their right to learn. From the beginning, learners need to understand this dual right and responsibility. They also need to understand that each one of them is accountable for his or her own actions.

4. Support for learners with special needs

The concept 'learners with special needs' is a broad concept. It encompasses learners with cognitive, emotional and physical disabilities.

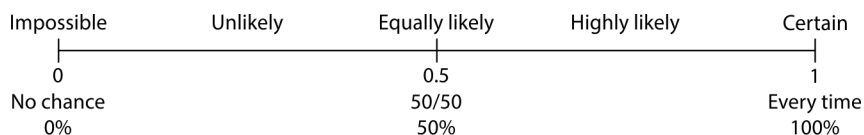
When teaching the concept of probability, you need to focus on mathematical processes, such as problem solving and making connections between mathematics and the real world. Focussing on abstract thinking can be challenging for learners with special needs.

5. Teaching methodology

When teaching probability, it is important that you focus on using words such as certain, likely, possible, unlikely and impossible. Explain to your learners that chance (probability)

refers to the number of times an event might happen compared to the total number of outcomes.

You can draw a large model of a probability number line. Here is an example:



Allow learners to do their own experiments in their peer groups or in pairs so that they can become familiar with the concept of chance (probability). Examples of experiments they can do are tossing a coin, rolling a die, and so on. Probability games can also be used to determine fairness.

6. Homework

Instruct learners to complete Exercise 3 on page 137 of the Workbook. Once back in class, write the answers on the chalkboard and ask learners to check and/or correct their answers.

7. Teacher assessment

Data handling plays an important role within Mathematics education. It encompasses real-world situations and assists in developing critical thinking skills in learners.

Use this topic to assess how well learners can use their problem-solving skills to solve a problem. You can collect learners' books and mark their work to help you identify those learners who may still be struggling to grasp the concepts taught in this sub-strand.

8. Answers

Exercise 1

(LB page 262)

Learners' own work

Revision answers

Strand 1: Number

Sub-strand 1: Counting, representation and cardinality

1. Check that learners have used different colours to show the following:
 - a) $1 \times 100,000$ blocks, $2 \times 10,000$ blocks, $3 \times 1,000$ blocks
 - b) $3 \times 10,000$, $4 \times 1,000$, 5×100 blocks
 - c) $4 \times 100,000$, $2 \times 10,000$, $1 \times 1,000$ blocks
 - d) $6 \times 10,000$, $7 \times 1,000$, 2×100 blocks
2.
 - a) four hundred and five thousand one hundred and nineteen
 - b) forty-five thousand and one
 - c) one hundred and fifteen thousand and ninety-eight
 - d) seven hundred and sixty-six thousand and one
3.

a) 304,631	b) 78,631	c) 17,506
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4.

a) 641,132	b) 101,893	c) 971,076
------------	------------	------------
5.

a) 20	b) 10,000	c) 5,000
d) 900,000	e) 100	f) 4
6.
 - a) $100,000 + 80,000 + 700 + 60 + 1$
 - b) $50,000 + 2,000 + 500 + 90 + 1$
 - c) $700,000 + 1,000 + 900 + 90 + 4$
 - d) $1,000 + 900 + 90 + 8$
7.

a) 56,300	b) 56,600	c) 55,450
d) 66,450	e) 28,225	f) 112,900
8.
 - a) 144,094; 144,499; 144,904; 145,198; 145,990
 - b) 789,809; 789,908; 798,880; 809,789; 890,780
9.
 - a) 619,198; 618,116; 617,981; 617,189; 616,998
 - b) 233,413; 233,313; 232,312; 231,321; 223,331

10. a) $12,098 < 21,908$ b) $76,119 > 67,119$
 c) $45,899 > 45,889$ d) $101,001 < 101,011$
 e) $34,098 = 34,098$ f) $78,245 < 79,245$
11. a) 70,000
 b) 87,431 = eighty-seven thousand four hundred and thirty-one
 c) 97,431
 d) $13,478 = 10,000 + 3,000 + 400 + 70 + 8$
 e) 3,478
12. a) 98,480 b) 98,500
 c) 98,000 d) 100,000
13. a) 15,280; 15,380; 15,480; 15,580; 15,680; 15,780
 b) 28,330; 29,330; 30,330; 31,330; 32,330; 33,330
 c) 73,490; 78,490; 83,490; 88,490; 93,490; 98,490
14. a) 23 b) 39 c) 70 d) 43
15. a) XLVII b) LXXXII c) LXXVII
 d) XCIII e) LXIX
16. a) 16: Learners draw 4×4 and 2×8 arrays.
 Factors: 1; 2; 4; 8; 16
 b) 24: Learners draw 2×12 , 3×8 , 4×6 arrays.
 Factors: 1; 2; 3; 4; 6; 8; 12; 24
 c) 32: Learners draw 2×16 , 4×8 arrays.
 Factors: 1; 2; 4; 8; 16; 32
 d) 48: Learners draw 2×24 , 3×16 , 4×12 ,
 6×8 arrays.
 Factors: 1; 2; 3; 4; 6; 8; 12; 16; 24; 48
 e) 60: Learners draw 2×30 ; 3×20 ; 4×15 ; 5×12 ;
 6×10 arrays.
 Factors: 1; 2; 3; 4; 5; 6; 10; 12; 15; 20; 30; 60
17. a) 17; 19; 23; 29 b) 17; 19; 23
 c) 43; 47; 51; 53; 57; 59
18. a) 8: 1; 2; 4; 8 b) 21: 1; 3; 7; 21
 c) 36: 1; 2; 3; 4; 6; 9; 12; 18; 36
 d) 50: 1; 2; 5; 10; 25; 50
 e) 72: 1; 2; 3; 4; 6; 12; 8; 9; 18; 24; 36; 72

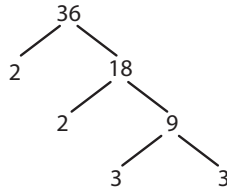
19. a) 56 and 60
c) 28 and 30

- b) 72 and 74
d) 88 and 92

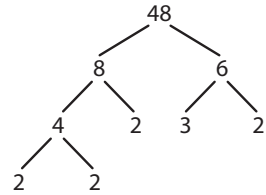
20. a) 77 and 81
c) 55 and 57

- b) 19 and 23
d) 59 and 61

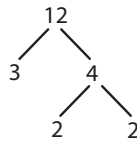
21. a)



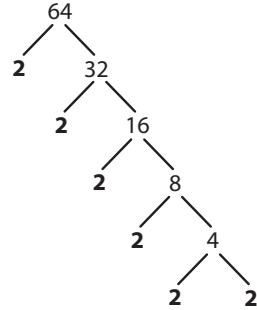
b)



c)



d)



22. a) 8; 16; 24; 32; 40; 48
c) 9; 18; 27; 36; 45; 54

- b) 12; 24; 36; 48; 60; 72
d) 14; 28; 42; 56; 70; 84

23. a) 4

b) 5

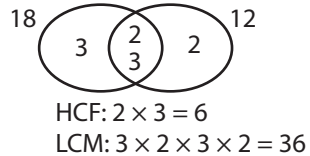
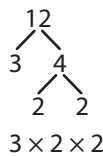
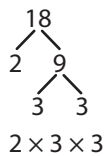
c) 3

24. a) 36

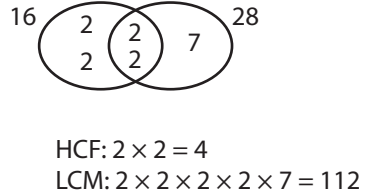
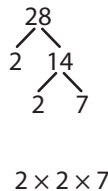
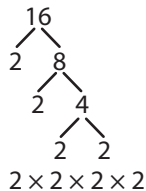
b) 24

c) 40

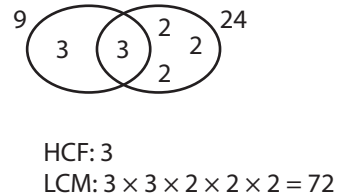
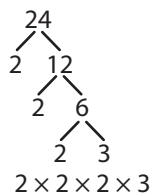
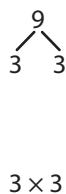
25. a)



b)



c)



Sub-strand 2: Number operations

26. a) 20 b) 72 c) 30 d) 40
 e) 27 f) 49 g) 44 h) 63
 h) 42 i) 24 j) 60 k) 48

27. Check that the learners used doubling and halving correctly:

- a) 128 b) 144 c) 400 d) 288

28. a) 7 b) 7 c) 5

29. a) 320 b) 3,300 c) 25,000 d) 81,000

30. a) 110 b) 176 c) 256 d) 336

31. a) 2,886

×	400	80	1
6	2,400	480	6

- b) 1,440

×	200	80	8
5	1,000	400	40

- c) 1,484

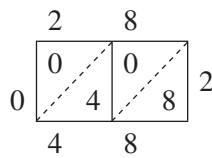
×	300	70	1
4	1,200	280	4

- d) 3,842

×	200	20	6
10	2,000	200	60
7	1,400	140	42
	3,400	340	102

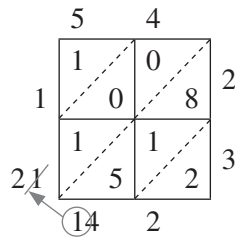
32. a)
$$\begin{array}{r} 44 \\ \times 16 \\ \hline 264 \\ + 440 \\ \hline 704 \end{array}$$
- b)
$$\begin{array}{r} 27 \\ \times 33 \\ \hline 81 \\ + 810 \\ \hline 891 \end{array}$$
- c)
$$\begin{array}{r} 460 \\ \times 23 \\ \hline 1,380 \\ + 9,200 \\ \hline 10,580 \end{array}$$
- d)
$$\begin{array}{r} 222 \\ \times 16 \\ \hline 1,332 \\ + 2,220 \\ \hline 3,552 \end{array}$$

33. a)



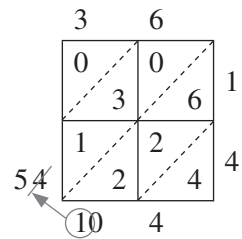
$$28 \times 2 = 48$$

c)



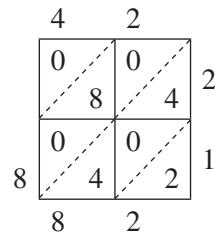
$$54 \times 23 = 1,242$$

b)



$$36 \times 14 = 504$$

d)



$$42 \times 21 = 882$$

34. a) True

b) True

c) False

d) True

e) False

f) True

35. a)

$$\begin{array}{r} 65 \\ 4 \overline{) 260} \\ \underline{24} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

b)

$$\begin{array}{r} 178 \\ 5 \overline{) 890} \\ \underline{5} \\ 39 \\ \underline{35} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

c)

$$\begin{array}{r} 95 \\ 9 \overline{) 855} \\ \underline{81} \\ 45 \\ \underline{45} \\ 0 \end{array}$$

d)

$$\begin{array}{r} 102 \\ 6 \overline{) 612} \\ \underline{6} \\ 12 \\ \underline{12} \\ 0 \end{array}$$

36. $48 \times 3 = 144$

37. $\text{GH}\text{C}2,340 \div 78 = 30 \text{ weeks}$

38. a) $36 \times 200 = 7,200$ books
 b) $7,200 - 468 = 6,732$
 c) 1,122 books per day
39. -18; -12; -9
40. a) $-4 < -12$ b) $13 > -11$ c) $-2 < 16$
41. a) -12; -9; -5; 6; 12 b) -11; -6; 0; 1; 12
42. a) 12; 7; 6; -7; -11 b) 12; 9; -7; -11; -13
43. a) -6 b) 8 c) 8
 d) 16 e) -8 f) -14

Sub-strand 3: Number: Fractions

44. a) $\frac{4}{8}$ b) $\frac{3}{6}$ c) $\frac{7}{20}$
45. a) $\frac{3}{4} < \frac{4}{5}$ b) $\frac{1}{5} = \frac{2}{10}$ c) $\frac{4}{9} > \frac{7}{15}$
46. $\frac{1}{6}$; $\frac{3}{15}$; $\frac{1}{4}$; $\frac{2}{5}$; $\frac{8}{16}$
47. $\frac{5}{8}$; $\frac{7}{12}$; $\frac{1}{2}$; $\frac{6}{14}$; $\frac{1}{3}$
48. a) 0.16 b) 0.42 c) 0.18 d) 0.7
49. a) $\frac{58}{100}$ or $\frac{29}{50}$ b) $\frac{165}{1,000}$ or $\frac{33}{200}$ c) $\frac{3}{10}$
 d) $\frac{56}{100}$ or $\frac{28}{50}$ or $\frac{14}{25}$ e) $\frac{24}{100}$ or $\frac{12}{50}$ or $\frac{6}{25}$
50. a) $\frac{7}{8}$ b) $\frac{8}{9}$ c) $\frac{9}{10}$
51. a) $\frac{7}{12}$ b) $\frac{5}{9}$ c) $\frac{4}{10}$ or $\frac{2}{5}$
52. a) $3\frac{1}{4}$ b) $7\frac{1}{9}$ c) $3\frac{4}{5}$
53. a) 2 b) 12 c) 14 d) 55
54. $4\frac{5}{8} + 3\frac{3}{4} = 8\frac{3}{8}$
55. a) 12 b) 25 c) 4 d) 40

Sub-strand 4: Decimals

56. a) 3.07 cm; 3.09 cm; 3.11 cm; 3.13 cm
 b) 0.91 ml; 0.88 ml; 0.85 ml; 0.82 ml; 0.79 ml

57. a) $46.724 = 40 + 6 + 0.7 + 0.02 + 0.004$
 b) $167.302 = 100 + 60 + 7 + 0.3 + 0.002$
 c) $0.108 = 0.1 + 0.008$
 d) $60.095 = 60 + 0.09 + 0.005$

58. a) 9 b) 300 c) 0.04
 d) 40 e) 0.007 f) 0.1

59. a) 0.45 ; $\frac{3}{4}$; 80% b) 25%; $\frac{2}{5}$; 50%; 0.7

60.

	Decimal	Rounded to nearest 10th	Rounded to nearest unit
$\frac{55}{100}$	0.55	0.6	1
$8\frac{3}{5}$	8.6	8.6	9
$15\frac{7}{50}$	15.14	15.1	15

61. a)
$$\begin{array}{r} 1.05 \\ + 0.341 \\ \hline 1.391 \end{array}$$
 b)
$$\begin{array}{r} 0.108 \\ + 5.814 \\ \hline 5.922 \end{array}$$
 c)
$$\begin{array}{r} 1.815 \\ + 15.065 \\ \hline 16.880 \end{array}$$

62. a)
$$\begin{array}{r} 1.663 \\ - 0.246 \\ \hline 1.417 \end{array}$$
 b)
$$\begin{array}{r} 33.807 \\ - 12.153 \\ \hline 21.654 \end{array}$$
 c)
$$\begin{array}{r} 15.747 \\ - 0.386 \\ \hline 15.361 \end{array}$$

63. a) $(5 \times 4) + (5 \times \frac{4}{10})$
 $= 20 + \frac{20}{10}$
 $= 20 + 2$
 $= 22$
- b) $(3 \times 35) + (3 \times \frac{7}{10})$
 $= 105 + \frac{21}{10}$
 $= 105 + 2\frac{1}{10}$
 $= 107\frac{1}{10} = 107.1$

$$\begin{aligned} \text{c) } & (6 \times 13) + (6 \times \frac{4}{10}) + (6 \times \frac{5}{100}) \\ & = 78 + \frac{24}{10} + \frac{30}{100} \\ & = 78 + 2\frac{4}{10} + \frac{3}{10} \\ & = 80\frac{7}{10} = 80.7 \end{aligned}$$

$$\begin{aligned} \text{d) } & (8 \times 7) + (8 \times \frac{1}{10}) + (8 \times \frac{7}{100}) \\ & = 56 + \frac{8}{10} + \frac{56}{100} \\ & = 56 + \frac{136}{100} \\ & = 56 + 1\frac{36}{100} \\ & = 57\frac{36}{100} = 57.36 \end{aligned}$$

$$\begin{array}{r} \text{64. a) } \quad 11.5 \\ \times \quad 12 \\ \hline 230 \\ + 1150 \\ \hline 138.0 \end{array}$$

$$\begin{array}{r} \text{b) } \quad 8.15 \\ \times \quad 14 \\ \hline 3260 \\ + 8150 \\ \hline 114.10 \end{array}$$

$$\begin{array}{r} \text{c) } \quad 0.98 \\ \times \quad 35 \\ \hline 490 \\ + 2940 \\ \hline 34.30 \end{array}$$

$$\begin{array}{r} \text{d) } \quad 41.08 \\ \times \quad 19 \\ \hline 36972 \\ + 41080 \\ \hline 780.52 \end{array}$$

Sub-strand 5: Percentage

65.

Common fraction	Percentage	Decimal
$\frac{4}{5}$	80%	0.8
$\frac{1}{4}$	25%	0.25
$\frac{13}{20}$	65%	0.65
$\frac{28}{50}$	56%	0.56
$\frac{1}{8}$	12.5%	0.125

66. a) False b) False c) True d) False

67. 75%

68. a) 14.3% b) 8.3% c) 40% d) 20%

69. a) 50 biscuits

b) $\frac{18}{50} = 36\%$

c) False. 5% of 8 is less than 1. There are 2 more coconut biscuits than ginger. $\frac{2}{8} = 25\%$. There are 25% more coconut biscuits than ginger.

d) $14 + 10 = 24$

$\frac{24}{50} = 48\%$

Ameyo will not be able to eat 48% of the box of biscuits.

70. 15% of 24 m = 3.6 m

$24 \text{ m} - 3.6 \text{ m} = 20.4 \text{ m}$

The material is now 20.4 m after it was washed.

71.

Activity	Hours	a) Fraction	b) Decimal	c) Percentage
Sleeping	9	$\frac{9}{24}$ or $\frac{3}{8}$	0.38	38%
Soccer	3	$\frac{3}{24}$ or $\frac{1}{8}$	0.12	12%
Watching TV	4	$\frac{4}{24}$ or $\frac{1}{6}$	0.18	18%
Having meals	3	$\frac{3}{24}$ or $\frac{1}{8}$	0.12	12%
Doing chores	2	$\frac{2}{24}$ or $\frac{1}{12}$	0.08	8%
Hanging with friends	3	$\frac{3}{24}$ or $\frac{1}{8}$	0.12	12%

b)

Pattern number	1	2	3	4	5	6	10
Number of tiles	1	4	7	10	13	16	38

c) Rule: pattern number $\times 3 - 2$

7. Efa is saving GH¢8 per week. Complete the table to 12 weeks.

Week	3	4	5	6	7	8	9	10	11	12
Money in GH¢	24	32	40	48	56	64	72	80	88	96

Efa will have saved GH¢96 by week 12. Her friend is right. The learners can also say $\text{GH¢}8 \times 12 \text{ weeks} = \text{GH¢}96$.

Sub-strand 2: Algebraic expressions

8. a) $5z$ b) $14x$ c) $\frac{c}{6}$
 d) $5\frac{3}{5}y + 4$ e) $6 - x$
 f) $ab - 4$ g) $\frac{m}{3} + 8$
9. a) $10x$ b) $3 - y$ c) $2a + c + 6$
10. a) $3(5) + (5 \times 3) = 15 + 15 = 30$
 b) $2(1) - 1 \times 3 = 2 - 3 = -1$
 c) $\frac{5 \times 1}{5 \times 3} = \frac{5}{15} = \frac{1}{3}$
 d) $3(5) - 4(1) + 5(5) + 2(1) - 3 + 2(3)$
 $= 15 - 4 + 10 + 2 - 3 + 6 = 26$

Sub-strand 3: Variables and equations

11. a) $a = 2$ because $2 + 14 = 16$
 b) $b = -4$, because $-4 + 14 = 10$
 c) $x = 17$ because $17 - 2 = 15$

- 12. a)** $p = 3$ because $8 \times 3 = 24$.
- b)** $16 - 10 = 6$ so, $2b = 16$
 $2b \div 2 = b$ $16 \div 2 = 8$
 $b = 8$
- c)** $3 + 2 = 5$ so, $\frac{1}{4}b = 3$
 $\frac{1}{4}b \times 4 = b$ $3 \times 4 = 12$
 $b = 12$
- d)** $3g - 1 = 8$
 $9 - 1 = 8$ so, $3g = 9$
 $3g \div 3 = g$ $9 \div 3 = 3$
 $g = 3$
- 13.** $8 + 4 = 12$ hours
- 14.** 8 loaves
- 15. a)** GH¢105 **b)** 7 weeks
- 16.** $\text{GH¢}234 \div 3 = \text{GH¢}78$

Strand 3: Geometry and measurement

Sub-strand 1: Lines and shapes

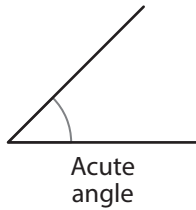
- A rectangle is a 2D shape with four sides.
 - The opposite sides are parallel and equal.
 - A rectangle has four angles.
- A square is a 2D shape with four sides.
 - The four sides are equal in length.
 - All the angles in a square are right angles.
- | | | |
|---|---|---|
| 8 | 1 | 6 |
| 3 | 5 | 7 |
| 4 | 9 | 2 |
 - | | | |
|---|---|----|
| 3 | 2 | 10 |
| 8 | 7 | 0 |
| 4 | 6 | 5 |
- Group A
 - Irregular polygons
 - A: square; B: rhombus; C: hexagon; D: triangle; E: hexagon; F: pentagon; G: rhombus

Sub-strand 2: Measurement

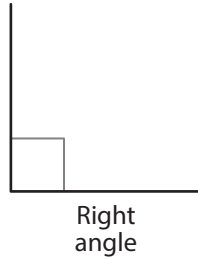
- 24 cm
 - 22 cm
 - 18 cm
 - 25 cm
- 25 cm²
 - 10 cm²
 - $(12 \times 15 \text{ mm}) + (8 \times 5 \text{ mm}) = 180 + 40 = 220 \text{ mm}^2$
- 16 cubes
 - 36 cubes
 - 18 cubes
 - 60 cubes
- 75 cm³
 - 200 cm³
 - 48 cm³
- 1.4 ℓ
 - 3.25 ℓ
 - 0.850 ℓ
 - 25.1 ℓ

10. a) $1,600 \text{ cm}^3$ b) $10,950 \text{ cm}^3$
 c) $6,000 \text{ cm}^3$ d) $8,800 \text{ cm}^3$
11. a) A: 300 ml B: 200 ml C: 80 ml D: 600 ml
 b) A: 500 ml B: 1 ℓ C: 100 ml D: 1 ℓ
 c) 200 ml
 d) 400 ml
 e) 1,180 ml or 1.18 ℓ

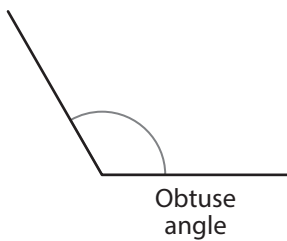
12. a)



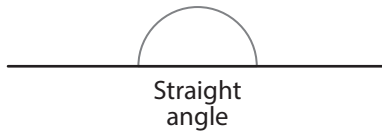
b)



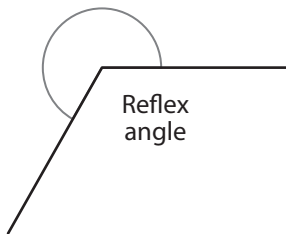
c)



d)



e)



Sub-strand 3: Geometric reasoning

13. a) F2 b) B8 c) H3
 d) Black arrow e) Orange heart f) Red star
14. B

Strand 4: Data

Sub-strand 1: Data collection, organisation, presentation, interpretation and analysis

1. First-hand data is data that you collect yourself.
Second-hand data is data that has been collected and organised by somebody else.
2.
 - a) Horror, Sci-fi, Action
 - b) Romance, Drama
 - c) Animation
 - d) No; 46 girls prefer both romance and action, compared to only 26 boys. It is fairer to choose a movie that the same number of boys and girls would like, such as action, drama or animation.
 - e) 100 boys and 100 girls
 - f) Learners' own answers, for example: How many more boys than girls prefer action movies?
(4 more boys)

Sub-strand 2: Chance (probability)

3.
 - a) 1
 - b) Learners' own answers, depends on weather
 - c) 0.5
 - d) 0
4. Learners' own answers. In theory, the outcome for an even number should be 0.5.

Workbook answers

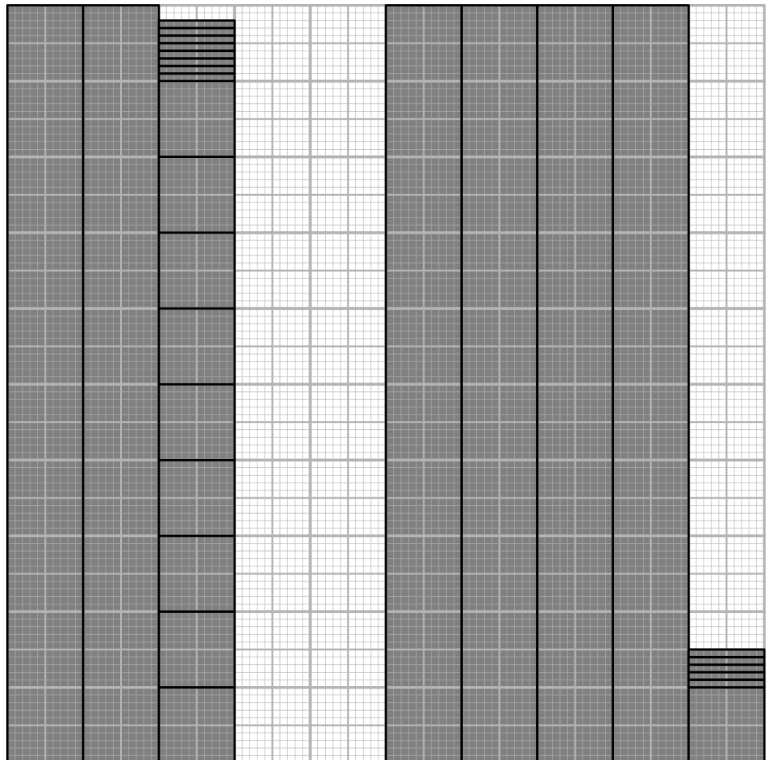
Strand 1: Number

B5.1.1.1 Demonstrate an understanding of quantities and place value for multi-digit numerals up to 1,000,000

Exercise 1 Modelling numbers

WB page 1

1. a) 876 b) 1,549 c) 2,388
 d) 3,476 e) 1,201
2. a) 987,000 b) 169,000 c) 452,000
 d) 354,000 e) 63,000
3. a) 2,980 b) 4,150



4. a)

10,000	11,500	13,000	14,500	16,000	17,500	19,000	20,500
22,000	23,500	25,000	26,500	28,000	29,500	31,000	32,500
34,000	35,500	37,000	38,500	40,000	41,500	43,000	44,500
46,000	47,500	49,000	50,500	52,000	53,500	55,000	56,500
58,000	59,500	61,000	62,500	64,000	65,500	67,000	68,500
70,000	71,500	73,000	74,500	76,000	77,500	79,000	80,500

b) 37,000

c) 77,500

d) 50,500

e) 68,500

Exercise 2 Compare and order numbers

WB page 7

1. a) >

b) >

c) =

d) <

e) <

f) <

g) <

h) >

i) <

j) =

2. a) <

b) >

c) <

d) >

e) <

f) >

g) >

h) <

i) >

j) >

3. a) 209; 330; 385; 492; 508

b) 1,236; 1,394; 1,611; 4,028; 5,138

c) 6; 91; 889; 4,901; 83,112

d) 11,821; 15,821; 17,821; 18,821; 19,821

e) 70,001; 71,936; 72,752; 73,637; 74,124

f) 53,001; 53,169; 53,217; 53,349; 53,463

g) 17,111; 17,423; 17,512; 17,563; 17,842

h) 16,519; 16,559; 16,575; 16,583; 16,598

i) 24,939; 31,981; 43,683; 45,795; 83,137

j) 12,129; 31,617; 52,381; 61,159; 83,493

4. a) 933; 683; 552; 419; 248

b) 3,914; 3,888; 3,490; 3,292; 3,117

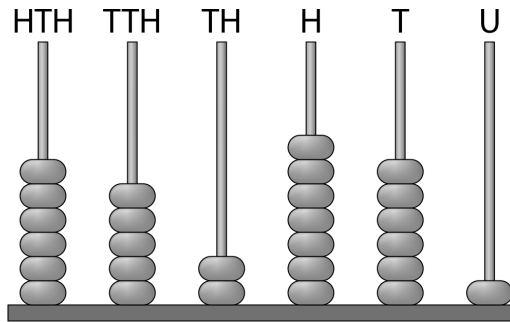
c) 8,346; 7,231; 7,123; 2,863; 2,392

d) 14,862; 14,682; 14,268; 13,172; 12,468

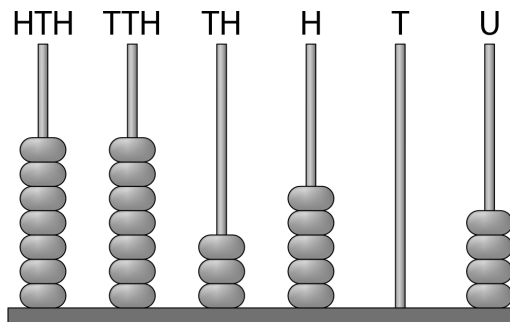
e) 23,822; 22,397; 21,783; 21,372; 21,007

4. a) 902,500 b) 819,400 c) 760,215

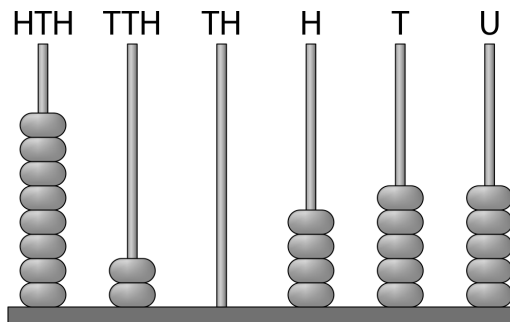
5. a) 652,761



b) 773,504



c) 820,455



Exercise 4 Count in thousands

WB page 14

1. a) 700,000; 600,000; 500,000

b) 100,000; 125,000; 150,000

c) 20,800; 22,000; 23,200

d) 120,000; 140,000; 160,000

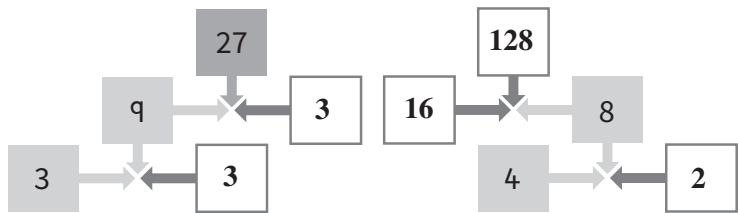
B5.1.1.3

Demonstrate an understanding of factors, multiples of numbers including composite, even, odd and prime numbers from 1 to 100

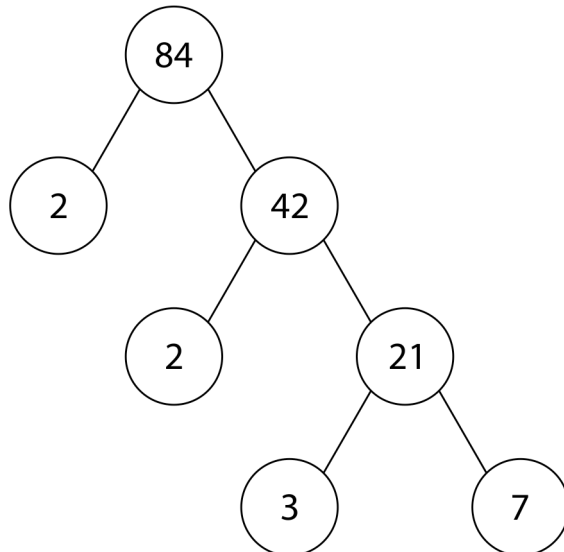
Exercise 1 Factors and prime numbers

WB page 20

- All prime numbers, except 2, are odd numbers.
- 1; 9; 15; 21; 25; 27
- $1 \times 30 = 30$ so 1 and **30** are factors of 30.
 - $2 \times 15 = 30$ so 2 and **15** are factors of 30.
 - $5 \times 6 = 30$ so 5 and **6** are factors of 30.
 - 1; 2; 3; 5; 6; 10; 15
- $25 \rightarrow 5 \times 5$
 - $26 \rightarrow 2 \times 13$
 - $35 \rightarrow 5 \times 7$
- -

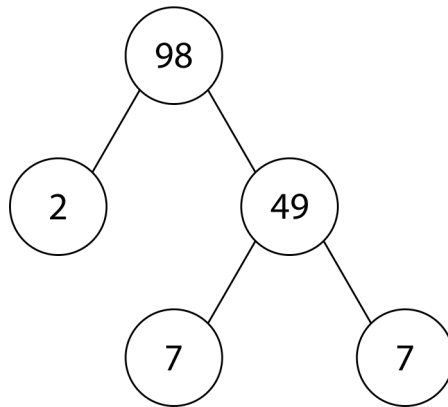


6. a)



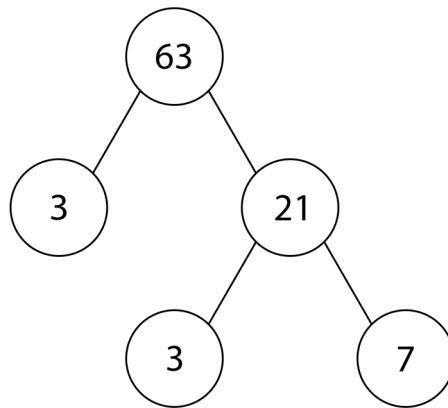
$$84 = 2 \times 2 \times 3 \times 7$$

b)



$$98 = 2 \times 7 \times 7$$

c)



$$63 = 3 \times 3 \times 7$$

Exercise 2 Odd and even numbers

WB page 22

- a) 4 **9** 5 7 **13** 16 **21**

b) **17** 18 **25** 30 **31** 34 **37** 40

c) 50 **53** 56 **55** 58 54 **59** 60
- a) 5 **8** 1 **4** **6** 9 **10** 7

b) **12** 13 15 **20** 19 **22** 21 **24**

c) **34** 35 **36** 37 **38** 39 **40**
- a) 16: even number b) 30: even number

c) 19: odd number d) 28: even number
- a) 60 b) 74

c) **1,001** (odd number) d) $60\frac{1}{2}$

e) $76\frac{1}{2}$ f) $1,004\frac{1}{2}$

5. $2 \times 60 = 120$; $4 \times 30 = 120$; $6 \times 20 = 120$; $10 \times 12 = 120$

6. $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 100$

Exercise 3 LCM and HCF

WB page 23

1. a) 5; 10; 15; 20; 25; 30; 35; 40; 45; 50; 55; 60; 65; 70;
75; 80; 85; 90; 95; 100

b) 15; 30; 45; 60; 75; 90

c) 16; 32; 48; 64; 80; 96

2. a) 15; 30; 45; 60 75; 90

b) 80

3. a) 15

b) 63

4. a) 2

b) 12

5. Thelma's list: $40 \div 14 = 2$ remainder 12

Nana's list: $40 \div 19 = 2$ remainder 2

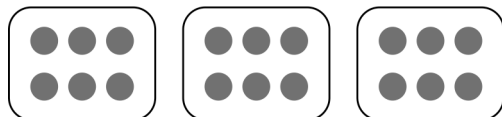
They can create 2 lists.

B5.1.2.1 Describe and apply mental mathematics strategies and number properties to determine answers for basic multiplication facts to 81 and related division facts

Exercise 1 Multiply by zero (0) and one (1)

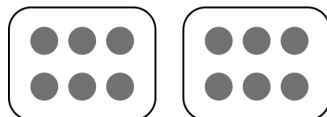
WB page 25

1. a)



$$3 \times 6 = 6 + 6 + 6 = 18$$

b)



$$2 \times 6 = 6 + 6 = 12$$

- h) $25 \times (5 \times 2) = 25 \times 10 = 250$
 i) $7 \times (5 \times 12) = 7 \times 60 = 420$
 j) $10 \times (8 \times 8) = 10 \times 64 = 640$
8. a) $10 \times 30 = 300$ minutes
 $300 \div 60 = 5$ hours
 b) $13 \times 7 = 7 \times (10 + 3) = 70 + 21 = 91$ hours
 c) $740 \times 9 = (700 \times 9) + (40 \times 9) = 6,300 + 360$
 $= 6,660$ kg
 d) $24 \times 20 = 20 \times (20 + 4) = 400 + 80 = 480$ m
 e) $28 \div 7 = 4$ weeks
 $\text{GH}\text{¢}1,450 \times 4 = 4 \times (1,000 + 400 + 50)$
 $= 4,000 + 1,600 + 200 = \text{GH}\text{¢}5,800$
 f) $\text{GH}\text{¢}350 \times 217 = (300 + 50) \times (200 + 10 + 7)$
 $= 60,000 + 3,000 + 2,100 + 10,000 + 500 + 350$
 $= 60,000 + 10,000 + (3,000 + 2,100) + (500 + 350)$
 $= 70,000 + 5,100 + 850$
 $= \text{GH}\text{¢}75,950$
 g) $2,200 \times 4 = 8,800$ ℓ of water

B5.1.2.2 Demonstrate an understanding of multiplication of a 2- or 3-digit number by a 2- or 3-digit number

Exercise 1 Multiply multidigit numbers by 2-digit numbers

WB page 29

1. a)

×	200	70	9
5	1,000	350	45

$$279 \times 5 = (200 \times 5) + (70 \times 5) + (9 \times 5)$$

$$= 1,000 + 350 + 45 = 1,395$$

b)

×	800	50	6
8	6,400	400	48

$$856 \times 8 = (800 \times 8) + (50 \times 8) + (6 \times 8)$$

$$= 6,400 + 400 + 48 = 6,848$$

2. a)

24
× 38
192
+ 720
912
$24 \times 38 = 912$

b)

32
× 33
96
+ 960
1,056
$32 \times 33 = 1,056$

c)

75
× 42
150
+ 3,000
3,150
$75 \times 42 = 3,150$

3. a) $22 \times (50 + 4)$

$$= (22 \times 50) + (22 \times 4)$$

$$= 1,100 + 88$$

$$= 1,188$$

b) $43 \times (70 + 6)$

$$= (43 \times 70) + (43 \times 6)$$

$$= 3,010 + 258$$

$$= 3,268$$

c) $(80 + 2) \times (20 \times 9)$

$$= (80 \times 20) + (80 \times 9) + (2 \times 20) + (2 \times 9)$$

$$= 1,600 + 720 + 40 + 18$$

$$= (1,600 + 720) + (40 + 18)$$

$$= 2,320 + 58$$

$$= 2,378$$

4. a)

	8	5	
	0	0	
1	8	5	1
	3	2	
1	2	0	4
	9	0	

∴ The factory makes 1,190 bricks in 14 hours.

b)

	5	8	
	2	4	
3	5	0	5
	2	4	
1	5	0	5
	9	0	

∴ The train can transport 3,190 people in 55 trips.

c)

	8	7	5	
	1	1	1	
2	6	4	0	2
	6	5	4	
4	4	6	0	8
	5	0	0	

∴ The advocate earns GH¢24,500 if she works 28 days.

5. a) $562 \times 145 = 81,490$ is correct.
 $224 \times 145 = 38,820$ is incorrect:

$$\begin{array}{r}
 224 \\
 \times 145 \\
 \hline
 1,120 \\
 8,960 \\
 + 22,400 \\
 \hline
 32,480
 \end{array}$$

- b) $573 \times 210 = 120,330$ is correct.
 $498 \times 210 = 140,590$ is incorrect.
 $498 \times 210 = 498 \times (100 + 100 + 10)$
 $= 49,800 + 49,800 + 4,980$
 $= 99,600 + 4,980$
 $= 104,580$

B5.1.2.3

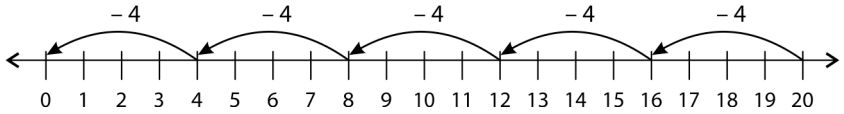
 Recall basic division facts up to 100

Exercise 1 Work with division

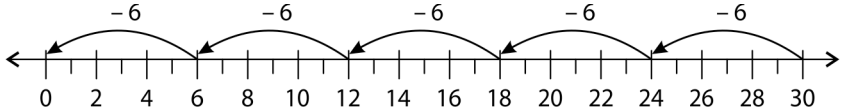
WB page 33

1. a) $13 \div 1 = 13$; $1 \times 13 = 13$
 b) $32 \div 4 = 8$; $4 \times 8 = 32$
 c) $55 \div 5 = 11$; $5 \times 11 = 55$
 d) $18 \div 9 = 2$; $9 \times 2 = 18$
 e) $91 \div 10 = 9$ remainder 1; $10 \times 9 + 1 = 91$
 f) $16 \div 4 = 4$; $4 \times 4 = 16$
 g) $48 \div 12 = 4$; $12 \times 4 = 48$
 h) $49 \div 7 = 7$; $7 \times 7 = 49$
 i) $81 \div 9 = 9$; $9 \times 9 = 81$
 j) $85 \div 5 = 17$; $5 \times 17 = 85$

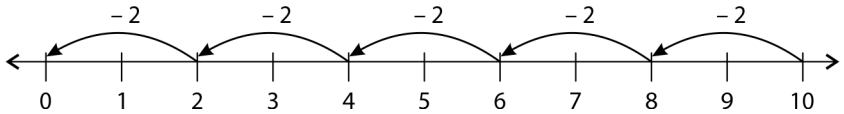
2. a) $20 \div 4 = 5$



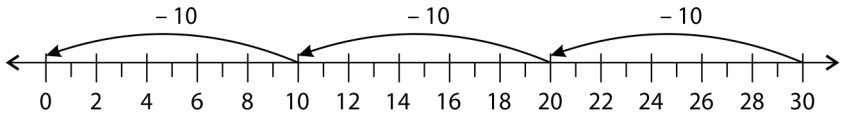
b) $30 \div 6 = 5$



c) $10 \div 2 = 5$



d) $30 \div 10 = 3$



3. a) $15 - 5 \rightarrow 10 - 5 \rightarrow 5 - 5 \rightarrow 0$

① ② ③

So, $15 \div 5 = 3$

b) $24 - 12 \rightarrow 12 - 12 \rightarrow 0$

① ②

So, $24 \div 12 = 2$

c) $18 - 6 \rightarrow 12 - 6 \rightarrow 6 - 6 \rightarrow 0$

① ② ③

So, $18 \div 6 = 3$

d) $12 - 2 \rightarrow 10 - 2 \rightarrow 8 - 2 \rightarrow 6 - 2 \rightarrow 4 - 2 \rightarrow 2 - 2 \rightarrow 0$

① ② ③ ④ ⑤ ⑥

So, $12 \div 2 = 6$

e) $21 - 3 \rightarrow 18 - 3 \rightarrow 15 - 3 \rightarrow 12 - 3 \rightarrow 9 - 3 \rightarrow 6 - 3 \rightarrow 3 - 3 \rightarrow 0$

① ② ③ ④ ⑤ ⑥ ⑦

So, $21 \div 3 = 7$

f) $36 - 12 \rightarrow 24 - 12 \rightarrow 12 - 12 \rightarrow 0$

① ② ③

So, $36 \div 12 = 3$

4. a) $180 \div 10 = 18 \div 1 = 18$ b) $2,100 \div 20 = 210 \div 2 = 105$ c) $750 \div 30 = 75 \div 3 = 25$

d) $7,920 \div 10 = 792 \div 1 = 792$ e) $10,000 \div 50 = 1,000 \div 5 = 200$ f) $9,600 \div 60 = 960 \div 6 = 160$
g) $4,200 \div 40 = 420 \div 4 = 105$ h) $560 \div 20 = 56 \div 2 = 28$ i) $1,500 \div 60 = 150 \div 6 = 25$

5. a) $9,000 \div 100 = 90 \div 1 = 90$ b) $1,000 \div 500 = 10 \div 5 = 2$ c) $2,800 \div 400 = 28 \div 4 = 7$
d) $800 \div 200 = 8 \div 2 = 4$ e) $1,400 \div 700 = 14 \div 7 = 2$ f) $7,500 \div 500 = 75 \div 5 = 15$
g) $4,200 \div 600 = 42 \div 6 = 7$ h) $5,400 \div 900 = 54 \div 9 = 6$ i) $2,000 \div 500 = 20 \div 5 = 4$

6. $500 \div 20 = 50 \div 2 = 25$ l of milk

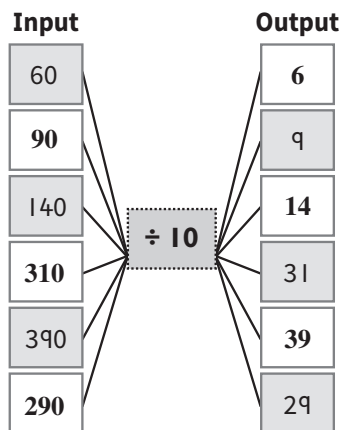
7. $300 \div 10 = 30 \div 1 = 30$ eggs

B5.1.2.4 Demonstrate an understanding of division of a 2- or 3-digit number by a 1- or 2-digit number

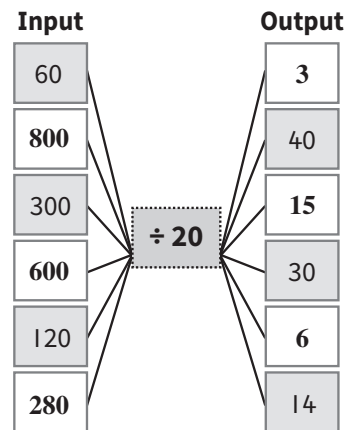
Exercise 1 Divide numbers by multiples of 10

WB page 37

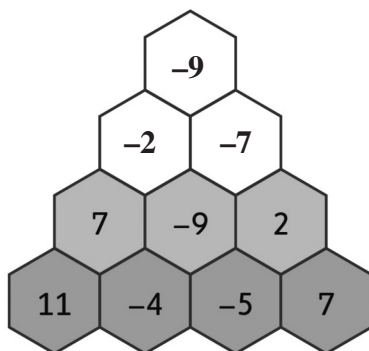
1. a)



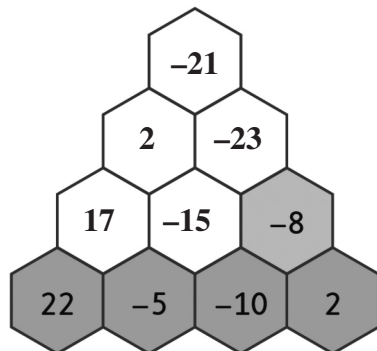
b)



4. a)



b)



5. $7 - (-4) = 11$

The temperature dropped by $11\text{ }^{\circ}\text{C}$.

6. $-5 - \square = -39$; $\square = +34$

The temperature must drop by $34\text{ }^{\circ}\text{C}$ to make mercury freeze.

B5.1.3.1 Demonstrate understanding of strategies for comparing, adding, subtracting and multiplying fractions

Exercise 1 Compare and order fractions

WB page 47

1. a) $\frac{1}{5} + \frac{1}{6}$
 $= \frac{6}{30} + \frac{5}{30}$
 $= \frac{11}{30}$

b) $\frac{2}{4} + \frac{3}{10}$
 $= \frac{10}{20} + \frac{6}{20}$
 $= \frac{16}{20}$ or $\frac{8}{10}$

<p>c) $\frac{11}{20} + \frac{2}{8}$ $= \frac{22}{40} + \frac{15}{40}$ $= \frac{37}{40}$</p>	<p>d) $\frac{4}{9} + \frac{5}{6}$ $= \frac{8}{18} + \frac{15}{18}$ $= \frac{23}{18}$ $= 1\frac{5}{18}$</p>
<p>2. a) $\frac{3}{4} - \frac{1}{3}$ $= \frac{9}{12} - \frac{4}{12}$ $= \frac{5}{12}$</p>	<p>b) $\frac{9}{10} - \frac{5}{8}$ $= \frac{36}{40} - \frac{25}{40}$ $= \frac{11}{40}$</p>
<p>c) $\frac{3}{7} - \frac{3}{8}$ $= \frac{24}{56} - \frac{21}{56}$ $= \frac{3}{56}$</p>	<p>d) $\frac{1}{4} - \frac{1}{6}$ $= \frac{3}{12} - \frac{2}{12}$ $= \frac{1}{12}$</p>
<p>3. a) $\frac{4}{14}$</p>	<p>b) $\frac{5}{10}$</p>
<p>c) $\frac{3}{60}$</p>	<p>d) $\frac{21}{30}$</p>
<p>e) $\frac{20}{24}$</p>	<p>f) $\frac{9}{24}$</p>
<p>4. a) $\frac{4}{36}$</p>	<p>b) $\frac{6}{100}$</p>
<p>c) $\frac{20}{32}$</p>	<p>d) $\frac{10}{25}$</p>
<p>e) $\frac{26}{40}$</p>	<p>f) $\frac{45}{50}$</p>

Exercise 2 Add proper and mixed fractions

WB page 49

1. a) $\frac{35}{84} + \frac{24}{84} = \frac{59}{84}$
 b) $\frac{20}{24} + \frac{21}{24} = \frac{41}{24} = 1\frac{17}{24}$
 c) $\frac{5}{20} + \frac{8}{20} = \frac{13}{20}$
 d) $\frac{8}{14} + \frac{7}{14} = \frac{15}{14} = 1\frac{1}{14}$
 e) $\frac{12}{66} + \frac{55}{66} = \frac{67}{66} = 1\frac{1}{66}$
 f) $\frac{9}{15} + \frac{10}{15} = \frac{19}{15} = 1\frac{4}{15}$

2. a) $\frac{7}{4} + \frac{3}{2} = \frac{7}{4} + \frac{6}{4} = \frac{13}{4} = 3\frac{1}{4}$
 b) $2\frac{20}{30} + 1\frac{6}{30} = 3\frac{26}{30} = 3\frac{13}{15}$
 c) $2\frac{3}{12} + 2\frac{8}{12} = 2\frac{11}{12}$
 d) $1\frac{4}{8} + 1\frac{5}{8} = 1\frac{9}{8} = 2\frac{1}{8}$
 e) $3\frac{5}{15} + \frac{12}{15} = 3\frac{17}{15} = 4\frac{2}{15}$
 f) $5\frac{4}{12} + 1\frac{9}{12} = 6\frac{13}{12} = 7\frac{1}{2}$

$$3. \quad \frac{2}{15} + \frac{1}{10} = \frac{4}{30} + \frac{3}{30} = \frac{7}{30}$$

They have already used $\frac{7}{30}$ of their time.

$$4. \quad \frac{1}{6} + \frac{3}{5} = \frac{5}{30} + \frac{18}{30} = \frac{23}{30}$$

They have used $\frac{23}{30}$ of the time.

Exercise 3 Subtract proper and mixed fractions

WB page 50

$$1. \quad \text{a) } 5\frac{9}{15} - 1\frac{1}{15} = 4\frac{4}{15}$$

$$\text{b) } 12\frac{20}{36} - 2\frac{3}{36} = 10\frac{17}{36}$$

$$\text{c) } 1\frac{3}{4} - \frac{2}{4} = 1\frac{1}{4}$$

$$\text{d) } 3\frac{8}{10} - 1\frac{3}{10} = 2\frac{5}{10} = 2\frac{1}{2}$$

$$2. \quad 3\frac{3}{4} - 1\frac{1}{2}$$

$$= 3\frac{3}{4} - 1\frac{2}{4}$$

$$= 2\frac{1}{4} \text{ kg}$$

$2\frac{1}{4}$ kg grapes are left over.

$$3. \quad 4\frac{4}{5} - 1\frac{2}{3}$$

$$= 4\frac{12}{15} - 1\frac{10}{15}$$

$$= 3\frac{2}{15} \text{ l of milk are left over.}$$

$$4. \quad 3\frac{5}{7} - 1\frac{2}{6} = 3\frac{30}{42} - 1\frac{14}{42} = 2\frac{16}{42} = 2\frac{8}{21}$$

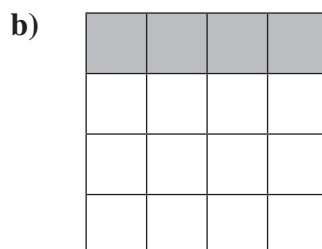
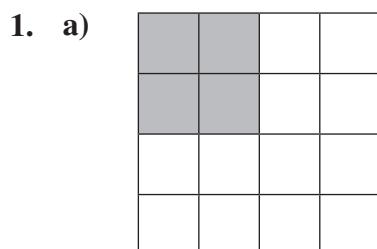
So, $3\frac{5}{7}$ is $2\frac{8}{21}$ more than $1\frac{2}{6}$.

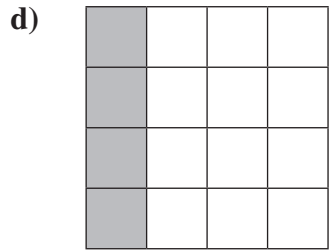
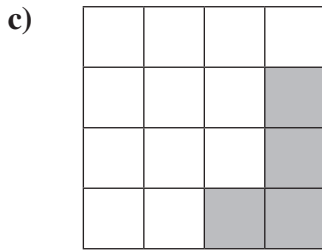
$$5. \quad 7\frac{5}{6} - 4\frac{6}{9} = 7\frac{5}{6} - 4\frac{2}{3} = 7\frac{5}{6} - 4\frac{4}{6} = 3\frac{1}{6}$$

So, you must add $3\frac{1}{6}$ to $4\frac{6}{9}$ to get $7\frac{5}{6}$.

Exercise 4 Find fractions of whole numbers

WB page 51





2. a) $30 \div 6 \times 1 = 5$ b) $60 \div 3 \times 1 = 20$
 c) $42 \div 7 \times 3 = 18$ d) $100 \div 5 \times 4 = 80$
 e) $500 \div 10 \times 7 = 350$ f) $300 \div 3 \times 2 = 200$
3. $\frac{5}{5} - \frac{2}{5} = \frac{3}{5}$ of the learners remained in the classroom.
 $\frac{3}{5}$ of 45 = $45 \div 5 \times 3 = 27$ learners remained in the classroom.
4. $\frac{1}{3}$ of 36 = $36 \div 3 \times 1 = 12$ sweets

B5.1.4.1 Demonstrate understanding of decimal fractions and strategies for comparing, adding and subtracting decimal fractions

Exercise 1 Decimal place value

WB page 53

1. a) $\rightarrow \frac{8}{10}$ or $\frac{4}{5} = 0.8$
 b) $\rightarrow \frac{9}{100} = 0.09$
 c) $\rightarrow \frac{9}{10} = 0.09$
 d) $\rightarrow \frac{1}{1,000} = 0.001$
 e) $\rightarrow \frac{0}{10} = 0.0$
 f) $\rightarrow \frac{8}{1,000} = 0.008$
2. a) $\rightarrow \frac{9}{100} = 0.09$ b) $\rightarrow \frac{9}{10} = 0.9$
 c) $\rightarrow \frac{9}{100} = 0.09$ d) $\rightarrow 9$
 e) $\rightarrow 90$ f) $\rightarrow \frac{9}{1,000} = 0.009$
3. a) 0.23 b) 8.79
 c) 61.0 d) 0.954
 e) 6.384 f) 0.7

$$\text{d)} = \frac{3}{10} = \frac{3}{10} \times \frac{10}{10} = \frac{30}{100} = 30\%$$

$$\text{e)} = \frac{4}{5} = \frac{4}{5} \times \frac{20}{20} = \frac{80}{100} = 80\%$$

$$\text{f)} = \frac{1}{4} = \frac{1}{4} \times \frac{25}{25} = \frac{25}{100} = 25\%$$

Exercise 2 Word problems with percentages

WB page 64

$$1. \quad \frac{375}{500} = \frac{3}{4} = \frac{3}{4} \times \frac{25}{25} = \frac{75}{100} = 75\%$$

So, 75% of learners had chickenpox.

$$2. \quad 260 - 104 = 156 \text{ eggs were not sold.}$$

$$\frac{156}{260} = \frac{3}{5} = \frac{3}{5} \times \frac{20}{20} = \frac{60}{100} = 60\%$$

So, 60% of the eggs were not sold.

$$3. \quad \frac{17,600}{44,000} = \frac{2}{5} = \frac{2}{5} \times \frac{20}{20} = \frac{40}{100} = 40\%$$

So, Town B's population is 40% of Town A's population.

$$4. \quad 105 + 85 + 160 + 75 + 85 + 60 + 30 = 600 \text{ people in the village}$$

$$5. \quad 105 \text{ out of } 600 \text{ people are aged between } 0 \text{ and } 18.$$

$$\therefore \frac{105}{600} = \frac{1,05}{6}$$

$$= 0.175$$

$$= 0.18$$

So, 18% of the people are between 0 and 18 years old.

$$6. \quad \text{a)} = \frac{85}{600} = \frac{0,85}{6} = 0.1416... = 0.14 = 14\%$$

$$\text{b)} = \frac{160}{600} = \frac{1,6}{6} = 0.266... = 0.27 = 27\%$$

$$\text{c)} = \frac{75}{600} = \frac{0,75}{6} = 0.125 = 0.13 = 13\%$$

$$\text{d)} = \frac{85}{600} = \frac{0,85}{6} = 0.1416... = 0.14 = 14\%$$

$$\text{e)} = \frac{60}{600} = \frac{0,60}{6} = 0.10 = 10\%$$

$$\text{f)} = \frac{30}{600} = \frac{0,30}{6} = 0.05 = 5\%$$

$$7. \quad \text{a)} = \frac{75}{150} = \frac{1}{2}$$

$$\frac{1}{2} \times \frac{100}{1} = \frac{100}{2} = 50\%$$

$$\text{b)} = \frac{6}{30} = \frac{1}{5}$$

$$\frac{1}{5} \times \frac{100}{1} = \frac{100}{5} = 20\%$$

$$\text{c)} = \frac{5}{25} = \frac{1}{5}$$

$$\frac{1}{5} \times \frac{100}{1} = \frac{100}{5} = 20\%$$

$$\begin{aligned} \text{d)} &= \frac{25}{75} = \frac{1}{3} \\ &\frac{1}{3} \times \frac{100}{1} = \frac{100}{3} = 33.3\dots = 33\% \\ \text{e)} &= \frac{9}{36} = \frac{1}{4} \\ &\frac{1}{4} \times \frac{100}{1} = \frac{100}{4} = 25\% \\ \text{f)} &= \frac{15}{75} = \frac{3}{15} \\ &\frac{3}{5} \times \frac{100}{1} = \frac{300}{5} = 60\% \end{aligned}$$

8. $21 - 7 = 14$ male hamsters

$$\therefore \frac{14}{21} = \frac{2}{3}$$

$$\frac{2}{3} \times \frac{100}{1} = \frac{200}{3} = 66.66\dots = 67\%$$

So, 67% of the hamsters are male.

9. a) $8 \times 15 = 120$ squares in total

b) 64 white squares

$$\frac{64}{120} = \frac{8}{15}$$

$$\frac{8}{15} \times \frac{100}{1} = \frac{800}{15} = 53.33\dots$$

$\therefore 53\%$ of the poster is white.

c) 10 squares for the head and neck

$$\frac{10}{120} = \frac{1}{12}$$

$$\frac{1}{12} \times \frac{100}{1} = \frac{100}{12} = 8.33\dots$$

$\therefore 8\%$ of poster is used for the robot's head and neck.

d) 14 squares for legs and feet

$$\frac{14}{120} = \frac{7}{60}$$

$$\frac{7}{60} \times \frac{100}{1} = \frac{700}{60} = 11.66\dots$$

$\therefore 12\%$ of the poster is used for the robot's legs and feet.

e) 53% of the poster is white (calculated in b)

Printing costs = GH¢31.50 \times 75:

$$\begin{array}{r} 31.50 \\ \times \quad 75 \\ \hline 15750 \\ 220500 \\ \hline 2,362.50 \end{array}$$

So, it will cost GH¢2,362.50 to print 75 copies

f) Learners' own drawings

Strand 2: Algebra

B5.2.1.1 Determine the pattern rule to make predictions about subsequent elements

Exercise 1 Work with number patterns

WB page 69

- 3,860; 3,960; 4,060; 4,160
 - 375; 400, 425; 450
 - 705; 685; 665; 645
 - 355; 305; 255; 205
 - 1,451; 1,476; 1,501; 1,526

2.

10	20	30	40	50	60	70	80	90	100
110	120	130	140	150	160	170	180	190	200
210	220	230	240	250	260	270	280	290	300
310	320	330	340	350	360	370	380	390	400
410	420	430	440	450	460	470	480	490	500
510	520	530	540	550	560	570	580	590	600
610	620	630	640	650	660	670	680	690	700
710	720	730	740	750	760	770	780	790	800
810	820	830	840	850	860	870	880	890	900
910	920	930	940	950	960	970	980	990	1,000

- The difference between the numbers is 110.
 - The difference between the numbers is 100.
 - The difference between the numbers in the diagonal rows is 110. The difference between the numbers in the columns is 100. The difference between the numbers in the rows is 10.
- 100; 125; 150; 175; 200; 225; 250; 275; 300; 325; 350; 375; 400; 425; 450; 475; 500
 - 1,500; 1,650; 1,800; 1,950; 2,100; 2,250; 2,400; 2,550; 2,700; 2,850; 3,000
 - 10,000; 10,500; 11,000; 11,500; 12,000; 12,500; 13,000; 13,500; 14,000; 14,500; 15,000; 15,500; 16,000; 16,500; 17,000; 17,500; 18,000; 18,500; 19,000; 19,500; 20,000

- d) 9,465; 9,515; 9,565; 9,615; 9,665; 9,715; 9,765; 9,815; 9,865; 9,915; 9,965; 10,015; 10,065; 10,115; 10,165; 10,215; 10,265
- e) 3,800; 3,600; 3,400; 3,200; 3,000; 2,800; 2,600; 2,400; 2,200; 2,000; 1,800
- f) 1,000,000; 950,000; 900,000; 850,000; 800,000; 750,000; 700,000; 650,000; 600,000; 550,000; 500,000

Exercise 2 Work with geometric patterns

WB page 71

1. a) Two squares are added every time to get the next shape.

b)

Shape number	1	2	3	4	5	10	20
Number of squares	1	3	5	7	9	19	39

- c) Start with one square for shape 1. To get the number of squares in the next shape, add the shape number to the previous shape number.

2. a) To create the next shape, 2 matchsticks are added each time.

b)

Shape number	1	2	3	4	5	10	20
Number of matches	3	5	7	9	11	21	41

- c) Multiply the pattern number by 2 and add 1 each time.

3. a) Three squares are added each time to get the next shape.

b)

Shape number	1	2	3	4	5	10	20
Number of squares	3	6	9	12	15	30	60

- c) Multiply the shape number by 3 each time.

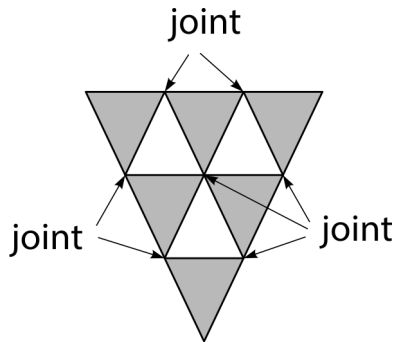
4. a) Each shape consists of as many triangles as the shape number squared.

b)

Shape number	1	2	3	4	5	6	7
Number of triangles	1	4	9	16	25	36	49

c) The number of triangles in every shape is determined by squaring the shape numbers = n^2

d) The first shape (triangle) has no joints. In the following shapes, the number of joints is found by adding 1 to the shape number and then adding the number of joints in the previous shape.



Shape number	1	2	3	4	5	6
Number of joints	0	3	7	12	18	25

Exercise 3 Predict elements in a given pattern

WB page 74

1. a) 550; 600; 650; **700; 750; 800; 850**
 b) 888; 777; 666; **555; 444; 333; 222**
 c) 0; **90; 180; 270; 360; 450; 540**
2. a) 325; 350; 375; **400; 425; 450; 475**
 b) 425; 375; 325; **275; 225; 175; 125**
 c) 1,150; **1,250; 1,350; 1,450; 1,550; 1,650**

3. a) 26; 260; 2,600; **26,000; 260,000; 2,600,000;**
26,000,000
 Rule: Multiply by 10
- b) 111; 100; 89; **78; 67; 56; 45**
 Rule: Subtract 11
- c) 525; 1,100; 2,250; **3,975; 6,275; 9,150; 12,600**
 Rule: Add 575, which is first multiplied by the position number of the previous number in the row
- d) 1,000; 2,025; 4,075; 8,175; **16,375; 32,775; 65,575;**
131,175
 Rule: Start at 1,000 and 2,025. To find the third term (number) and so on, add to each number twice the difference between the number and the previous number.

4.

House shapes	1	2	3	4	5	n
Number of matches	6	11	16	21	26	$5n+1$

Every shape is formed by multiplying the number of the house shape by 5 and adding 1.

$$5n + 1$$

Exercise 4 Find the pattern to verify predictions

WB page 75

1. a) Learners build the pattern with matchsticks.
 b)

Shape number	1	2	3	4	10	20	n
Number of matches	6	11	16	21	51	101	$5n+1$

- c) Every shape is formed by multiplying the number of the shape by 5 and then adding 1.

2. a) Learners build the pattern with matchsticks.

b)

Shape number	1	2	3	4	10	20	n
Number of matches	6	15	27	42	195	690	$3n(\frac{n+3}{2})$

c) The relationship between the shape number and the number of matchsticks used to make the shape, is 3 times the position of the shape, multiplied by the number resulting from $\frac{1}{2}$ of the shape number to which 3 is added. So, $T_n = 3n(\frac{n+3}{2})$.

Exercise 5 Solve pattern problems

WB page 76

1. a) 10; 25; 55; 115; **235; 475; 955**

Rule: Start with 10 and multiply every number in the pattern by 2 and add 5.

b) 0; 100; 1,100; 11,100; **111,100; 1,111,100; 11,111,100**

Rule: Start with 0 and add 102 to get the next number and then 103, 104 and so on.

c) 59,500; 12,000; 2,500; **600; 220; 144**

Rule: To find the next term, subtract $\frac{1}{5}$ of the difference between the previous two terms each time.

d) 0.25; 0.5; 0.75; **1.0; 1.25; 1.5; 1.75**

Rule: Add 0.25 to each term to find the next term.

2. a) 1; 10; 7; 70; 67; 670; **673; 6,730**

Pattern is created as follows: $1; 1 \times 10 = 10;$

$10 - 3 = 7; 7 \times 10 = 70; 70 - 3 = 67,$ etc.

Correct pattern: 1; 10; 7; 70; 67; 670; **667; 6,670**

b) 1,000; 3,010; 9,040; **27,230; 81,700; 245,110**

To find the next term in the pattern, multiply by 3 and add 10.

Correct pattern: 1,000; 3,010; 9,040; **27,130; 81,400; 244,210**

c) 1.5; 1.25; 0.75; 0.5; 0.25; 0

Pattern is created by subtracting 0.25 from the previous term each time.

Correct pattern: 1.5; 1.25; **1.00; 0.75; 0.5; 0.25; 0**

- d) 125; 300; 475; 650; **850; 1,025**

Pattern is created by adding 175 to the previous term each time.

Correct pattern: 125; 300; 475; 650; **825; 1,000**

3. a)

Pattern	1	2	3	4	5	6	7	8
Elements	130	270	550	1,110	2,230	4,465	8,940	17,890

Terms 6, 7 and 8 should be:

6	7	8
4,470	8,950	17,910

- b) Start with 130. To find the next term, multiply each term by 2 and add 10.

3. a) Term 6 should be 2,357,895.

- b) Start with 1 and multiply every number by 20 and then subtract 5 to find the next term in the pattern.

Exercise 6 Determine elements in a pattern

WB page 78

1. a)

Bags	1	2	3	4
Number of marbles	3	6	9	15

The number of marbles in the fourth bag is not correct. The difference between the number of marbles in the first and second bags is 3, and the difference between the number of marbles in the second and third bags is also 3. So, Efua should have put 12 marbles in the fourth bag ($9 + 3 = 12$).

- b)

Pattern number	1	2	3	4	n
Elements (terms)	3	6	9	12	$3n$

2. a) $6 \times 2 = 12$; $12 \times 2 = 24$; but $24 \times 2 \neq 50$

- b)

Pattern number	1	2	3	4	20
Elements (terms)	6	12	24	48	3,145,728

$$T_n = 2^{(n-1)} \times 6$$

$$\text{So, } T_{20} = 2^{(20-1)} \times 6$$

$$= 2^{19} \times 6$$

$$= 3,145,728$$

Exercise 7 Use algebra to represent a given pattern
WB page 80

	1	2	3	4	5	6	Rule for n in words	Rule for n using algebra
A	7	14	21	24	27	30	7 times n	$7n$
B	8	13	18	23	28	33	(5 times n) + 3	$5n + 3$
C	15	20	25	30	35	40	(5 times n) + 10	$5n + 10$
D	3	7	11	15	19	23	(4 times n) - 1	$4n - 1$
E	4	7	10	13	16	19	(3 times n) + 1	$4n + 1$
F	7	17	27	37	47	57	(10 times n) - 3	$10n - 3$
G	9	13	17	21	25	29	(4 times n) + 5	$4n + 5$
H	13	19	25	31	37	43	(6 times n) + 7	$6n + 7$
I	1	3	5	7	9	11	(2 times n) - 1	$2n - 1$
J	0	7	14	21	28	35	(7 times n) - 7	$7n - 7$

Exercise 8 Use algebra to represent a given pattern
WB page 80

- For every child, one prepared meal costs GH¢30. So, as the children increase, the price of the prepared meals also increase by GH¢30 per child.
 - $\text{GH¢}600 \div 3 = 20$
 \therefore GH¢600 can buy 20 prepared meals.
- It costs GH¢90 to buy a stationery pack for one learner. So, as the learners increase, the cost of stationery packs also increase by GH¢90 per learner.
 - $\text{GH¢}1,080 \div 90 = 12$
 \therefore GH¢1,080 can buy 12 stationery packs.

B5.2.3.1**Solve problems involving single-variable, one-step equations with whole number coefficients****Exercise 1 Solving problems using algebra****WB page 85**





1. a) $7.50 + x = 17.00$
 $x = 17.00 - 7.50$
 $x = 9.50$
 The other cold drink costs GH¢9.50.
- b) $25 \times y = 350$
 $y = 350 \div 25 = 14$
 Fatima will be able to buy 14 gifts.

2. a)

Days	1	2	3	4	5	6	7	n
Height (cm)	3	5	7	9	11	13	15	$2n+1$

- b) $2n + 1$
- c) $2n + 1 = 2(15) + 1 = 31$
 The plant's height will be 31 cm after 15 days.
- d) $2n + 1 = 60$; $2n = 60 - 1$; $2n = 59$
 $n = 59 \div 2 = 29\frac{1}{2}$
 It will take $29\frac{1}{2}$ days for the plant to grow 60 cm.

Exercise 2 Solve equations**WB page 86**

1. a)  = $92 - 67 = 25$
- b)  = $47 + 24 = 71$
- c)  = $196 \div 14 = 14$
- d)  = $120 \times 5 = 600$
2. a) $m = 49 - 7 = 42$
- b) $-n = 54 - 49 = 5$
 $n = -5$
- c) $t = 42 \div 7 = 6$
- d) $y = 72 \times 8 = 576$
- e) $m \times 9$; $9m = 72$
 $m = 72 \div 9 = 8$

Exercise 3 Make up a story for a given equation

WB page 87

1. The sum of a number and 5 is 12. Find the other number.
2. Kessie is a babysitter. She charges GH¢4 per hour. Her transportation costs are GH¢4 per week. She earns GH¢20 per week. How many hours does she work in one week?

Exercise 4 Solve problem puzzles

WB page 88

1.

Solve for m :	Find n :	Solve for p :	Determine x :	Solve for y :
$48 + m = 63$	$63 - n = 35$	$35 \times p = 140$	$140 \div x = 2$	$2 + y = 51$
$m = 63 - 48$	$-n = 35 - 63$	$p = 140 \div 35$	$140 = 2x$	$y = 51 - 2$
	$-n = -28$		$x = 140 \div 2$	
$m = 15$	$n = 28$	$p = 4$	$x = 70$	$y = 49$
Answers checked in the space below:				
$48 + 15 = 63$	$63 - 28 = 35$	$35 \times 4 = 140$	$140 \div 70 = 2$	$2 + 49 = 51$

2. Solve the following puzzle.

$$\boxed{5} + \triangle 1 \times \boxed{5} = 10$$

$$\boxed{5} + \textcircled{4} \div \triangle 1 = 9$$

$$\textcircled{4} - \diamond 2 = 4$$

$$\boxed{5} - \diamond 2 \times \textcircled{4} \div \triangle 1 = -3$$

Strand 3: Geometry and measurement

B5.3.1.1 Identify and sort quadrilaterals, including rectangles, squares, trapeziums, parallelograms, and rhombuses, according to their attributes

Exercise 1 Compare the properties

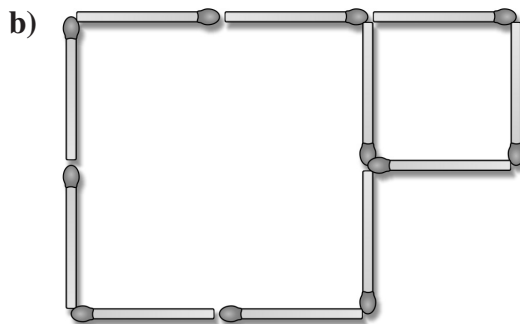
WB page 90

1. B and G are squares: four sides equal in length; opposite sides are parallel and equal; all angles are 90 degrees.
J is a rectangle: opposite sides are parallel and equal in length; all angles are 90 degrees.
2. Any four:
Opposite sides are parallel and equal in length.
Angles are 90 degrees.
Diagonals bisect each other.
Diagonals are equal in length.
They are both quadrilaterals.
3. 1) All four sides of a square are equal in length.
Only opposite sides of a rectangle are equal in length.
2) The diagonals of a square bisect the angles.
4. A square shares all the properties of a rectangle, but the opposite is not true. For example, the next two properties of a square are not true for rectangles:
All four sides are equal in length.
The diagonals bisect the angles.

Exercise 2 Fold squares and rectangles

WB page 92

1. a) True
b) False. Opposite sides are parallel.
c) False. The angles in Shape B are all 90 degrees.
d) True



3. a)

2	7	6
9	5	1
4	3	8

b)

8	1	6
3	5	7
4	9	2

4. a) A regular polygon has all sides of equal length and all interior angles of equal size.
- b) An irregular polygon does not have all sides equal and all angles of equal size. (It can have sides of any length and each interior angle can be any measure. They can be convex or concave, but all concave polygons are irregular since the interior angles cannot all be the same.)
5. a) A, B, H b) C, D, E, F, G, I, J

B5.3.2.1**Estimate and measure perimeter and surface area of 2D shapes using centimetre and metre****Exercise 1 Find the perimeter****WB page 98**

1.
 - a) Estimated $P = 2(20 + 30) = 100$ cm
Calculated $P = 2(25 + 15) = 80$ cm
 - b) Estimated $P = 4 \times 10 = 40$ cm
Calculated $P = 4 \times 12 = 48$ cm
 - c) Estimated $P = 2(20 + 20) = 80$ m
Calculated $P = 2(24 + 24) = 96$ m
or $4 \times 24 = 96$ m
 - d) Estimated $P = 2(10 + 6) = 32$ m
Calculated $P = 2(12+6) = 36$ m

2.
 - a) $P = 11 + 2(18) + 2(8) = 11 + 36 + 16 = 63$ cm
 - b) $P = 2(35 + 20) = 2 \times 55 = 110$ m
 - c) $P = 17 + 13 + 16 + 15 = 61$ cm
 - d) $P = 2(12) + 15 + 2(3) + 10 + 6 + 7 = 68$ m
 - e) $P = 2(9 + 10) = 2 \times 19 = 38$ cm
 - f) $P = 3 + 1 + 3 + 7 + 3 + 2 + 5 = 24$ cm
 - g) $P = 2(10 + 7) + 2(3) = 2 \times 17 + 6 = 34 + 6 = 40$ cm
 - h) $P = 4(4) + 2(12) + 4(5) + 2(3) = 16 + 24 + 20 + 6 = 66$ m

3. $P = 2(130 + 80) = 2(210) = 410$ m
 2×410 m = 820 m
The learner covered a distance of 820 m.

4. $P = 2(134 + 75) = 2(209) = 418$ cm
The perimeter of the teacher's table is 418 cm.

5. $P = 2(23 + 15) = 2(38) = 76$ cm
The perimeter of the book is 76 cm.

Exercise 2 Find the area**WB page 101**

1.
 - a) $A = 5 \times 4 = 20$ cm²
 - b) $A = 9 \times 9 = 81$ cm²
 - c) $A = 8 \times 3 = 24$ m²
 - d) $A = 25 \times 25 = 625$ m²

2. a) $A = (10 \times 3) + (5 \times 3) + (3 \times 3)$
 $= 30 + 15 + 9$
 $= 54 \text{ cm}^2$
- b) $A = (9 \times 5) + (5 \times 4)$
 $= 45 + 20$
 $= 65 \text{ cm}^2$
- c) $A = (6 \times 6) + (2 \times 5)$
 $= 36 + 10$
 $= 46 \text{ cm}^2$
- d) $A = (7 \times 4) + (7 \times 3) + (4 \times 4)$
 $= 28 + 21 + 16$
 $= 65 \text{ cm}^2$

3. Let $x = 5$.

$$\begin{aligned} \text{Area of plot A: } & (5 + 2) \times (5 + 2) + 5 \times ((2)(5) + 2) \\ & = (7 \times 7) + (5 \times 12) \\ & = 49 + 60 \\ & = 109 \text{ units}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of plot B: } & (3)(5 + 1) \times (2)(5) + 7 - (5 + 1)(5 - 4) \\ & = (18 \times 17) - (6 \times 1) \\ & = 306 - 6 \\ & = 300 \text{ units}^2 \end{aligned}$$

So, plot B has the bigger area.

4. $A = (10 \times 5) + (3 \times 3)$
 $= 50 + 9$
 $= 59 \text{ m}^2$

The area of the lounge is 59 m^2 .

B5.3.2.2 Demonstrate an understanding of volume of common 3D shapes

Exercise 1 Calculate volume

WB page 105

1. a) $V = 3 \times 4 \times 3 = 36 \text{ units}^3$
 $36 \times 8 = 288$
 $\therefore V = 288 \text{ cm}^3$
- b) $V = 2 \times 2 \times 4 = 16 \text{ units}^3$
 $16 \times 8 = 128$
 $\therefore V = 128 \text{ cm}^3$

- c) $V = 2 \times 4 \times 4 = 32 \text{ units}^3$
 $32 \times 8 = 256$
 $\therefore V = 256 \text{ cm}^3$
2. a) $V = 13 \text{ cm}^3$ b) $V = 9 \text{ cm}^3$
c) $V = 10 \text{ cm}^3$ d) $V = 13 \text{ cm}^3$
3. a) $V = 8 \times 5 \times 12 = 480 \text{ cm}^3$
b) $V = 15 \times 9 \times 7 = 945 \text{ cm}^3$
c) $V = 30 \times 10 \times 20 = 6,000 \text{ cm}^3$
d) $V = 9 \times 9 \times 9 = 729 \text{ cm}^3$
4. $V = 6 \times 12 \times 9 = 648 \text{ cm}^3$
The volume of the package was 648 cm^3 .
5. $V = 10 \times 6 \times 5 = 300 \text{ cm}^3$
So, 300 cubes will fill into the box.

Exercise 2 How many cubes can fit in a box?

WB page 107

1. a) $V = 5 \times 2 = 10 \text{ units}^3$
 $10 - 7 = 3$
So, 3 cubes can still fit in the box.
b) $V = 3 \times 2 \times 3 = 18 \text{ units}^3$
 $18 - 9 = 9$
So, 9 cubes can still fit in the box.
c) $V = 4 \times 4 \times 4 = 64 \text{ units}^3$
 $64 - 25 = 39$
So, 39 cubes can still fit in the box.
2. a–c) Learners construct an open cubical box.
d) $V = 10 \times 10 \times 10 = 1,000 \text{ cm}^3$
e) Learners' own work
f) Learners' own work

Exercise 3 Determine different sizes of boxes that have the same volume

WB page 108

1. a) True
b) Box A: $V = 8 \times 6 \times 5 = 240 \text{ cm}^3$
Box B: $V = 12 \times 4 \times 5 = 240 \text{ cm}^3$

2. a) True
 b) Box C: $V = 7 \times 3 \times 6 = 126 \text{ cm}^3$
 Box D: $V = 9 \times 2 \times 7 = 126 \text{ cm}^3$

Exercise 4 Work with volume and capacity
WB page 109

1. a) $250 \text{ cm}^3 = 0.25 \text{ l}$
 b) $3,250 \text{ cm}^3 = 3.25 \text{ l}$
 c) $1,750 \text{ cm}^3 = 1.75 \text{ l}$
2. a) $348 \text{ l} = 348,000 \text{ cm}^3$
 b) $798 \text{ l} = 798,000 \text{ cm}^3$
 c) $8,546 \text{ l} = 8,546,000 \text{ cm}^3$
3. a) 48 cm^3
 b) $1,728 \text{ cm}^3$
 c) $(35 \times 10) + (35 \times 6) = 350 + 210 = 560$
 $(560 \times 10) + (560 \times 4) = 5,600 + 2,240$
 $= 7,840 \text{ cm}^3$
4. a) A: $V = 3 \times 3 \times 3 = 27 \text{ cm}^3$
 B: $V = 5 \times 5 \times 5 = 125 \text{ cm}^3$
 C: $V = 4 \times 2 \times 2 = 16 \text{ cm}^3$
 D: $V = 6 \times 3 \times 4 = 72 \text{ cm}^3$
 b) A: $27 \text{ cm}^3 = 0.027 \text{ l}$
 B: $125 \text{ cm}^3 = 0.125 \text{ l}$
 C: $16 \text{ cm}^3 = 0.016 \text{ l}$
 D: $72 \text{ cm}^3 = 0.072 \text{ l}$
5. a) $\frac{1}{4}$ of $60 = 15 \text{ l}$
 b) $15 + 39 = 54 \text{ l}$
 c) $60 - 54 = 6 \text{ l}$
 d) $40 \times 60 = \text{GH}\text{¢}2,400$
 e) $60 \text{ l} = 60,000 \text{ cm}^3$
6. $l = b = x$
 $630 = x \times x \times 17.5$
 $630 = x^2 \times 17.5$
 $36 = x^2$
 $\therefore x = 6 \text{ cm}$
 So, the length and breadth of the object is 6 cm.

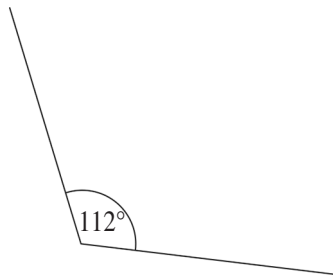
B5.3.3.1**Demonstrate an understanding of angles****Exercise 1 Identify different angles****WB page 113**

1. a) Acute angle and obtuse angle
b) Acute angle
c) Right angle
d) Straight angle
e) Reflex angle
f) Reflex angle

Exercise 2 Define different angles**WB page 114**

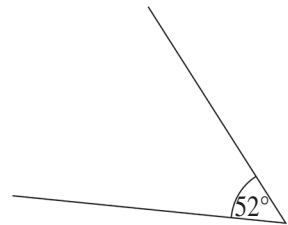
1. Learners' own work
2. Learners' own work

3. a)



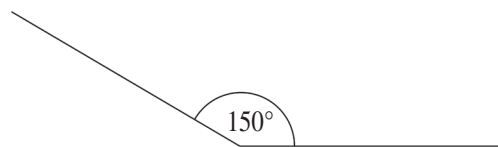
Obtuse angle

b)



Acute angle

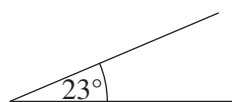
c)



Obtuse angle

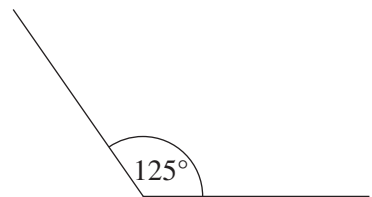
4. Draw and name the angles for the given sizes.

a)

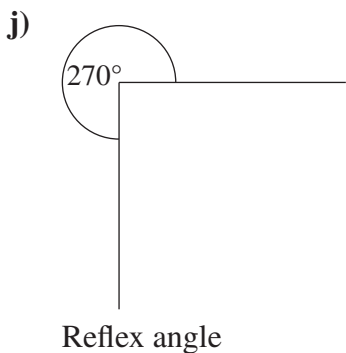
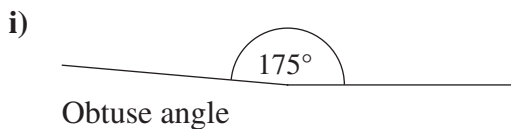
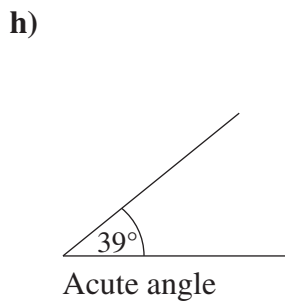
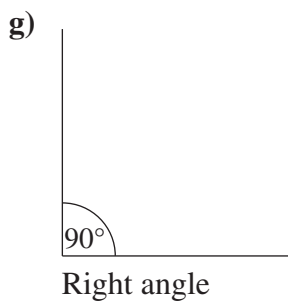
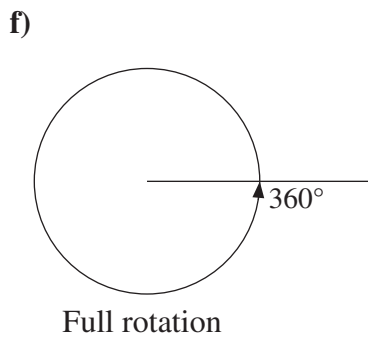
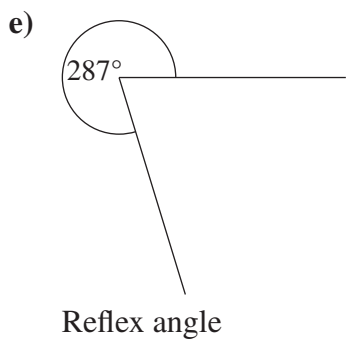
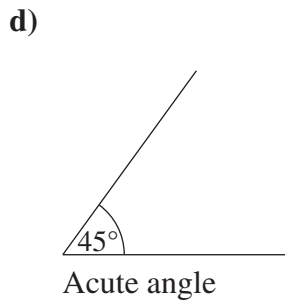
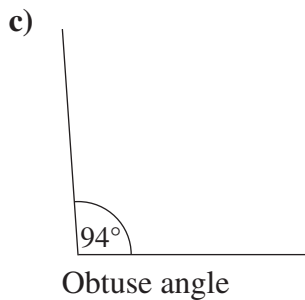


Acute angle

b)



Obtuse angle



5.

$\angle DAB = 60^\circ$	$\angle DAC = 30^\circ$
	$\angle BAC = 30^\circ$
$\angle DCB = 60^\circ$	$\angle DCA = 30^\circ$
	$\angle BCA = 30^\circ$
$\angle ADC = 120^\circ$	$\angle ADB = 60^\circ$
	$\angle CDB = 60^\circ$
$\angle ABC = 120^\circ$	$\angle ABD = 60^\circ$
	$\angle CBD = 60^\circ$

- b) Opposite angles are equal in size.
The diagonals bisect the angles.
- c) equal in size
- d) bisect
- e) $\angle AEB = \angle BEC = \angle CED = \angle DEA = 90^\circ$
- f) 90°
- g) $4 \times 90^\circ = 360^\circ$

B5.3.4.1 Describe the position of objects in space using the cardinal points

Exercise 1 Position in space

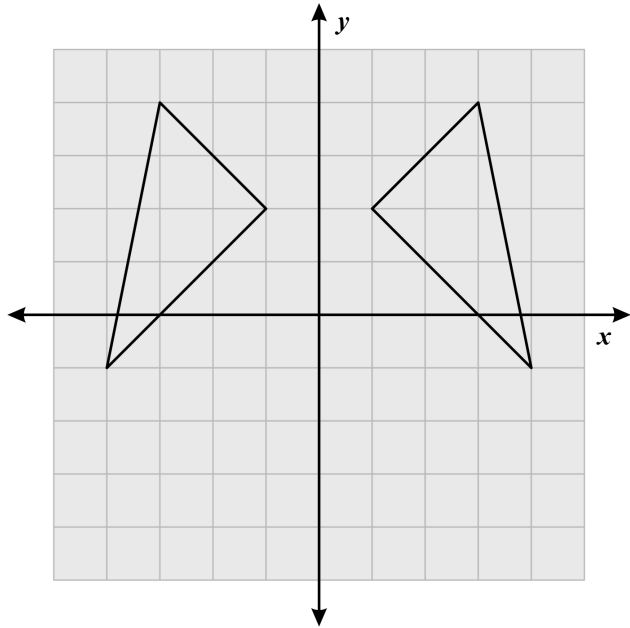
WB page 120

- Point A is to the west of point B.
 - Point B is to the south of point C.
 - Point C is to the east of point D.
 - Point D is to the north of point A.
- Drive in a southern direction and then slightly to the west (or a southwestern direction).
 - Drive in a northwestern direction.
 - Drive in a southern direction and then slightly to the west.
 - Drive in a northern direction and then slightly to the east.
 - He drove in an eastern direction, then in a northern direction and finally in a northeastern direction.

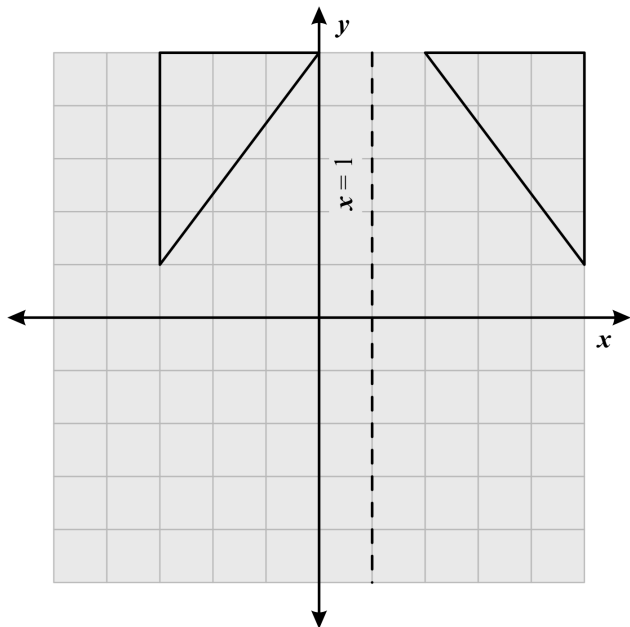
B5.3.4.2**Perform a single transformation (i.e. reflection) on a 2D shape****Exercise 1 Transformations**

WB page 123

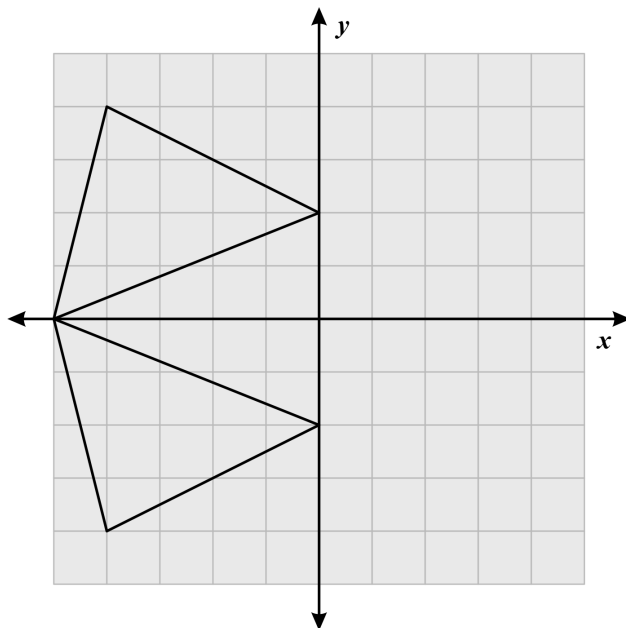
1. a)



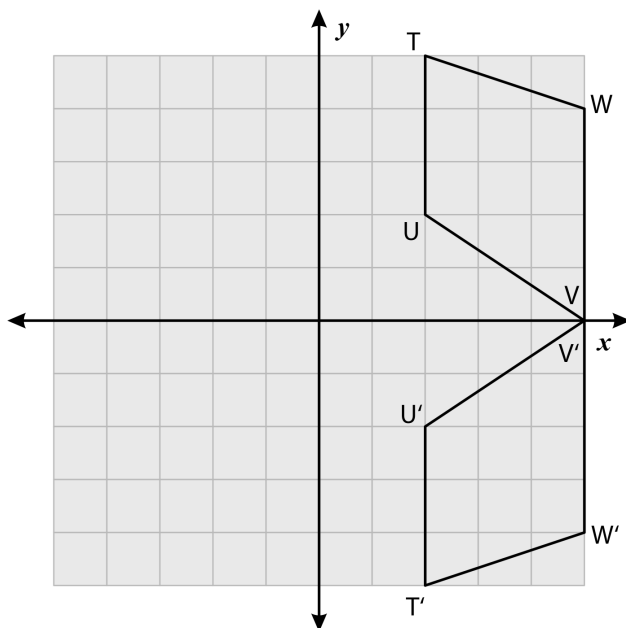
b)



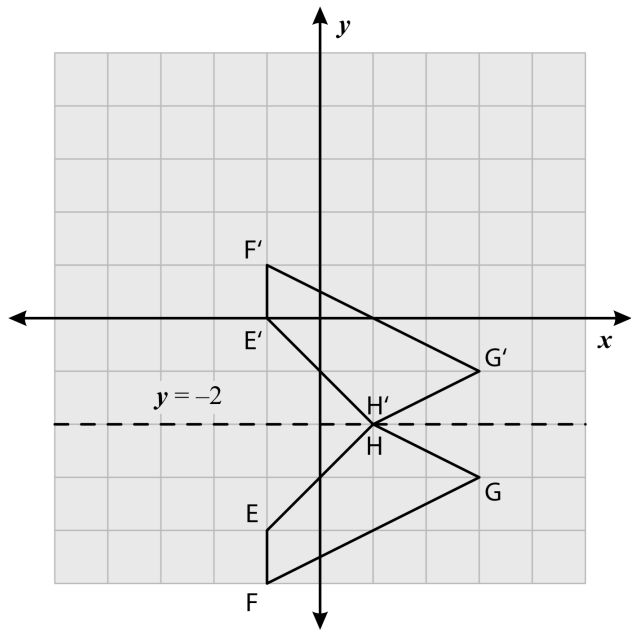
c)



2. a)



b)



Strand 4: Data

B5.4.1.1 Differentiate between first-hand and second-hand data

Exercise 1 First-hand and second-hand data

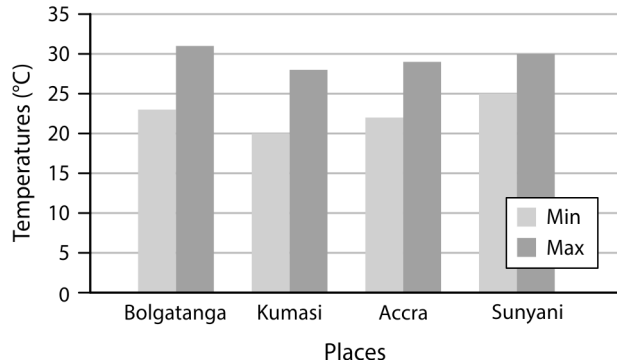
WB page 126

- True
 - False
First-hand data is data that you collect yourself.
 - False
Second-hand data is data that was collected and organised by somebody else.
- Second-hand data
 - First-hand data
 - First-hand data
 - Second-hand data

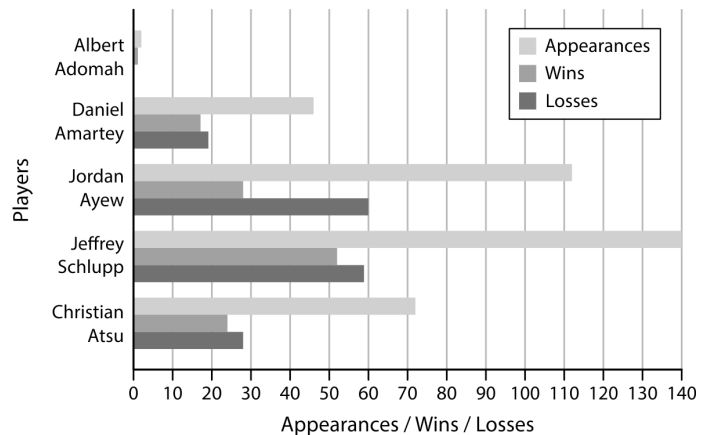
Exercise 2 Example of second-hand data

WB page 128

- Nutterz Putterz
 - $28 - 21 = 7$ points
 - 12 matches
 - Kama Minigolf Club
 - $1,060 - 1,018 = 42$
 - Kama Minigolf Club and Power Minigolf club

B5.4.1.2**Construct and interpret double bar graphs to draw conclusions****Exercise 1 Draw and label double and triple bar graphs****WB page 129****1. a)****Minimum and maximum temperatures for places in Ghana for September****b)** Kumasi**c)** Bolgatanga**d)** Minimum temperature is 5 degrees higher and maximum temperature is 2 degrees higher in Sunyani.**e)** The range of temperatures is between 20 °C and 31 °C.

All the places experienced mild to warm weather.

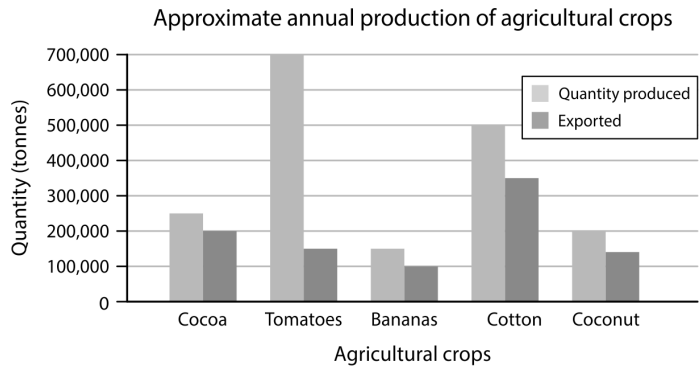
2. a)**Ghanaian football players who play in the Barclays Premier League in the UK**

- b) Jeffrey Schlupp had the most appearances.
- c) Albert Adomah had the least appearances.
- d) Daniel Amartey played in 17 games which his team won.
- e) $112 - 2 = 110$

Exercise 2 More work with graphs

WB page 132

1. a)



- b) Bananas
 - c) Tomatoes
 - d) $500,000 - 200,000 = 300,000$ tonnes
 - e) $700,000 - 150,000 = 550,000$ tonnes
2. a) 23 new cars were sold in January.
- b) 57 second-hand cars were sold in January.
 - c) The most new cars were sold during June.
 - d) The least number of second-hand cars was sold during October.
 - e) Total number of cars sold in May = $70 + 35 = 105$
 Percentage of new cars sold = $\frac{35}{105} \times \frac{100}{1} = 33.3\%$

B5.4.2.1 Describe the likelihood of a single outcome occurring using words such as impossible, possible and certain

Exercise 1 Outcomes with coins and dice

WB page 135

1. Learners' own work
2. Learners' own work

