WAEC BECE

Mathematics

Past Questions & Solutions

MATHEMATICS 1

Objective Test

1 Hour

1. If set **N** is a subset of set **M**, then

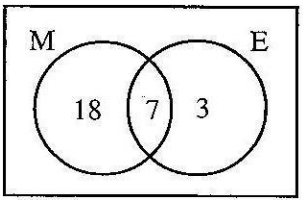
A. sets **M** and **N** have the same number of elements

B. some members of set **N** can be found in set **M**

C. no member of set **N** is in set **M**

D. all members of set **N** are in set **M**

The Venn diagram shows the number of pupils who offer Mathematics (M) and / or English in a class.



Use this information to answer Questions **2** and **3**.

2. How many pupils offer Mathematics?

A. 10

B. 18

C. 25

D. 28

3. How many pupils offer only one subject?

A. 3

B. 7

C. 18

D. 21

4. Simplify: $12 - 7 - (-5)$

A. 10

B. 2

C. 0

D. 10

5. Express 72 as a product of its prime factors

A. 2×3^3

B. $2^2 \times 3^3$

C. $2^3 \times 3$

D. $2^3 \times 3^2$

6. Find the **smallest** number which is divisible by 16 and 20?

A. 40
B. 80
C. 120
D. 160

7. Convert 243_{five} to a base ten numeral.

A. 40
B. 43
C. 45
D. 73

8. A pineapple which was bought for GH¢ 1.00 was sold at GH¢ 1.30. Calculate the profit percent.

A. 10%
B. 20%
C. 23%
D. 30%

9. Simplify $35x^5y^3 \div 7xy^2$

A. $5x^4y$
B. $5x^4y^5$
C. $5x^6y$
D. $5x^6y^5$

10. Two bells P and Q ring at intervals of 3 hours and 4 hours, respectively. After how many hours will the two bells **first** ring simultaneously (at the same time)?

A. 6 hours
B. 8 hours
C. 12 hours
D. 24 hours

11. A boy scores $\frac{17}{25}$ in a French test. Express his score as a percentage.

A. 17%
B. 34%
C. 68%
D. 85%

12. Arrange the following fractions in ascending order of magnitude $\frac{2}{5}, \frac{5}{12}$ *and* $\frac{3}{4}$,

A. $\frac{2}{5}, \frac{3}{4}, \frac{5}{12}$
B. $\frac{2}{5}, \frac{5}{12}, \frac{3}{4}$
C. $\frac{5}{12}, \frac{2}{5}, \frac{3}{4}$
D. $\frac{3}{4}, \frac{2}{5}, \frac{5}{12}$

13. Kofi paid rent of GH¢ 1,800.00 each year. If the rent is 0.3 of his annual income, find his annual income.

A. GH¢ 600.00
B. GH¢5,400.00
C. GH¢ 6,000.00
D. GH¢ 18,000.00

14. I gave a storekeeper a GH¢10.00 note for goods I bought. He asked me for another 15Gp for ease of change. If he then gave me 50 Gp, how much did I pay for the goods?

A. GH¢ 9.35
B. GH¢ 9.45
C. GH¢ 9.65
D. GH¢ 10.65

15. Kojo can buy 15 shirts at GH¢ 4.00 each. If the price is increased to GH¢ 5.00, how many shirts can he now buy?

A. 12
B. 15
C. 19
D. 20

16. A hall which is 8m long is represented on a diagram as 4 cm long. What is the scale of the diagram?

A. 1:200
B. 1:250
C. 1:400
D. 1:800

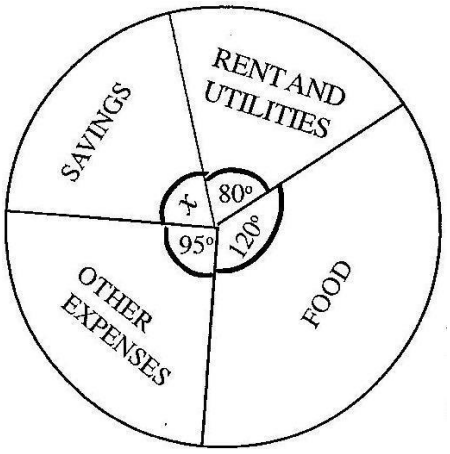
17. Jane arrived at work at 7:55 am and left at 4:15 pm. For how long was she at work?

A. 7 hr 20 min
B. 7 hr 45 min
C. 8 hr 20 min
D. 8 hr 40 min

18. Given that $(3.14 \times 18) \times 17.5 = 3.14 \times (3p \times 17.5)$, find the value of p

A. 3.0
B. 5.8
C. 6.0
D. 9.0

The pie chart shows how Kwaku spends his monthly salary.



Use this information to answer Questions **19** *to* **21**

19. Find the value of x

A. 65°
B. 75°
C. 85°
D. 100°

20. Kwaku earns GH¢ 630.00 a month. How much of this does he spend on food?

A. GH¢ 140.00
B. GH¢ 157.00
C. GH¢ 210.00
D. GH¢ 350.00

21. What percentage of his salary does he spend on rent and utilities?

A. 12.1%
B. 12.5%
C. 22.2%
D. 33.3%

22. In an enlargement with scale factor 2, which of the following statements is not true?

A. Each length is multiplied by 2
B. Each angle remains the same
C. The shape of the figure does not change.
D. The size of the figure does not change.

23. Kofi, Kojo and Ama shared GH¢ 480,000.00 in the ratio 3:5:4. How much did Ama receive?

A. GH¢ 160,000.00
B. GH¢ 200,000.00
C. GH¢ 218,181.81
D. GH¢ 342,859.14

24. If w = 12, x = 5, y = 6 and z = 4, find the value of wx – yz.

A. 18
B. 27
C. 36

D. 84

25. A man was 24 years old when his son was born. Now he is three times as old as his son. Find the age of the son.

A. 6 years
B. 12 years
C. 18 years
D. 36 years

26. There are 20 identical balls in a box. Twelve are blue and the rest are green. If one ball is taken at random from the box, find the probability that the ball is green.

A. $\frac{1}{20}$

B. $\frac{2}{5}$

C. $\frac{3}{5}$

D. $\frac{3}{4}$

27. Using the following mapping, find the missing numbers p and q.

x	1	2	3	4	5	6
↓	↓	↓	↓	↓	↓	↓
y	3	5	p	9	11	q

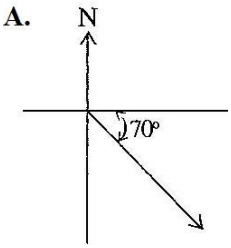
A. p = 6, q = 12
B. p = 6, q = 13
C. p = 7, q = 12
D. p = 7, q = 13

28. The perimeter of a rectangle is 24 cm. If the length is 7 cm, find its width.

A. 3 cm
B. 5 cm
C. 10 cm
D. 12 cm

29. A boy walks on a bearing 070°. Which of the following diagrams show his direction?

A.



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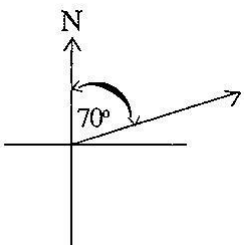

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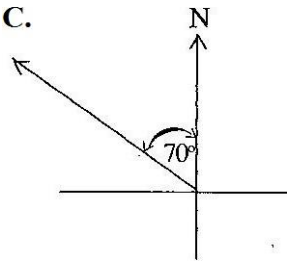
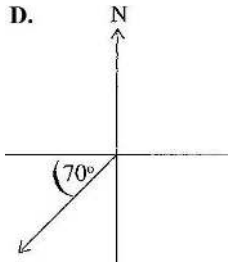


D.



30. How many faces has a cube?

A. 4
B. 6
C. 8
D. 12

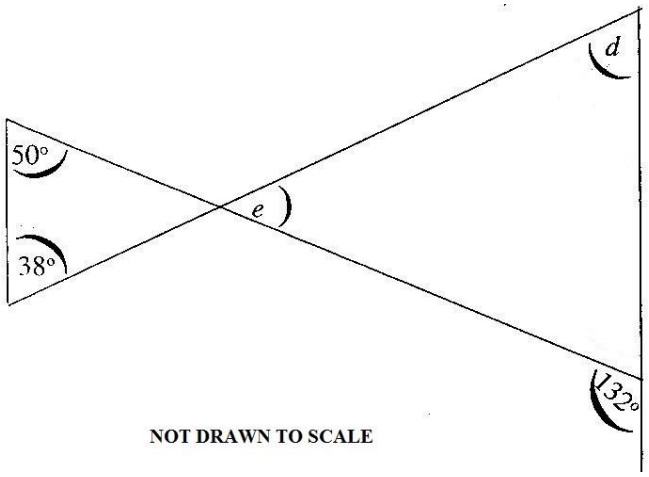
31. The diameter of a circular tray is 28 cm. Find the area of the tray. [Take $\pi = \frac{22}{7}$]

A. 44 cm2
B. 88 cm2
C. 154 cm2
D. 616 cm2

32. Calculate the volume of a cylinder with radius 7 cm and height 10 cm. [Take $\pi = \frac{22}{7}$]

A. 220 cm3
B. 440 cm3
C. 1,540 cm3
D. 3,080 cm3

Use the diagram below to answer questions **33** *and* **34**



33. Find the value of e.

A. 38°
B. 40°
C. 88°
D. 92°

34. Find the angle marked d

A. 38°
B. 40°
C. 48°
D. 88°

35. A 3.6 m long string is to be cut into pieces, each of length 40 cm. How many pieces can be cut from the string?

A. 4
B. 6
C. 8
D. 9

36. Solve the inequality $2x + 10 \geq \frac{7x}{2} - 5$

A. $x \leq 10$
B. $x \geq 10$
C. $x \leq 40$
D. $x \geq 40$

37. The point P (5, 4) is reflected in the y-axis. Find its image.

A. (– 5, 4)
B. (5, –4)
C. (–4, 5)
D. (4, –5)

38. If $\left(\frac{4}{11}\right) = \left(\frac{x-3}{11}\right)$, find the value of x.

A. 1
B. 1
C. 7
D. 12

39. Find the gradient of the line which passes through the points M(–1, 2) and N(6, –3)

A. $\frac{-5}{7}$
B. $\frac{-7}{5}$
C. $\frac{5}{7}$
D. $\frac{7}{5}$

40. Find the next two terms in the sequence 11, 7, 3, –1,____,_____.

A. 5, 9
B. 3, 7
C. –4, –9
D. –5, –9

MATHEMATICS 1

Objective Test

SOLUTIONS

1. D. all members of set N are in set M

2. C. 25

3. D. 21

4. D. 10

5. D. $2^3 \times 3^2$

6. B. 80

7. D. 73

8. D. 30%

9. A. $5x^4y$

10. C. 12 hours

11. C. 68%

12. B. $\frac{2}{5}$, $\frac{5}{12}$, $\frac{3}{4}$

13. C. GHC 6,000

14. C. GHC 9.65

15. A. 12

16. A. 1:200

17. C. 8hr 20 min

18. C. 6.0

19. A. 65°

20. C. 210°

21. C. 22.2%

22. D. The size of the figure does not change

23. A. GHC 160,000.00

24. C. 36

25. B. 12 years

26. B. $\frac{2}{5}$

27. D. p = 7, q = 13

28. B. 5 cm

29. B.

30. B. 6

31. D. 616 cm^2

32. C. 1540 cm3

33. D. 92°

34. B. 40°

35. D. 9

36. A. $x \leq 10$

37. A. (-5, 4)

38. C. 7

39. A. $\frac{-5}{7}$

40. D. –5, –9

MATHEMATICS 2

Essay

1 hour

1. (a) P = {factors of 30}
Q = {Multiples of 5 less than 40}
Find $P \cap Q$

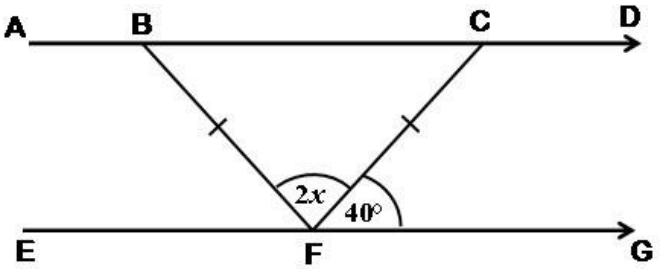
(b) A trader saved GH¢ 200.00 for 3 years at 12% simple interest per annum.
What will be the total amount in the trader's account at the end of the 3 years?

(c) Evaluate $\frac{4.56 \times 3.6}{0.12}$ and leave your answer in standard form.

2. (a) (i) Ama scored 82, 74 and 90 in three tests. What mark should she score in the fourth test so that her average mark for the four tests would be 85?

(ii) What was her median score in the four tests?

(b)



In the diagram $\overline{AD}$ is parallel to $\overline{EG}$, angle CFG = 40° and triangle BCF is isosceles.
Find the value of :
(i) angle CBF
(ii) angle DCF;
(iii) x

3. (a) Solve for x, if

$$\frac{1}{3}x + 1\frac{2}{3} < -\frac{3}{4}x - \frac{1}{2}$$

(b) The following shows the distribution of marks of students in an examination.

6	43	26	18	27
42	8	22	31	39
55	44	37	47	59
10	12	36	53	48

(i) Make a stem-and-leaf plot of the marks above

(ii) Find the probability of selecting a student who scored between 40 and 50.

(iii) Find the number of students who passed the examination, if the pass mark was 30.

4. (a) A box has length 8.0 cm, width 5.0 cm and height 10.0 cm.
Find the:

(i) total surface area of the box

(ii) the volume of the box.

(b) (i) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes Ox and Oy on a graph sheet.

(ii) On the same graph sheet mark the x-axis from –5 to 5 and the y-axis from – 6 to 6

(iii) Plot and join the points
A(0, 3), B(2, 3), C(4, 5) to form triangle ABC.

(iv) Draw the image $A_1B_1C_1$ of triangle ABC under a translation by the vector $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$

(v) Draw the image $A_2B_2C_2$ of triangle ABC under a reflection in the x - axis

5. (a) Using a ruler and a pair of compass only;

(i) construct triangle PQR such that $|\overline{PR}| = 8$cm, $|\overline{PQ}| = 6$ cm and $|\overline{QR}| = 5$cm;

(ii) construct the perpendicular bisector of $\overline{PR}$ and label it l_1;

(iii) construct the perpendicular bisector of $\overline{QR}$ and label it l_2;

(iv) Label the point of intersection of l_1 and l_2 as N;

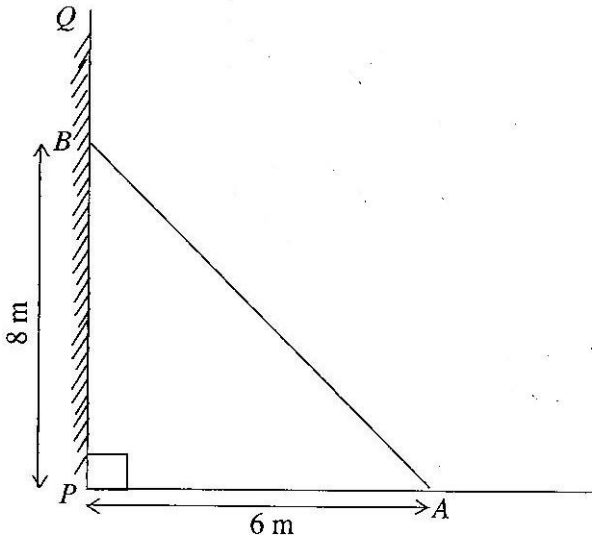
(v) With N as centre and radius equal to |PN|, draw a circle.

(b) (i) Measure the radius of the circle.

(ii) Calculate the circumference of the circle, correct to 3 significant figures.
[Take $\pi = 3.14$]

6. (a) Factorize completely $6xy - 3y + 4x - 2$

(b)



NOT DRAWN TO SCALE

The diagram shows a ladder AB which leans against a vertical wall PQ at B.
If |PB| is 8 m, and the other end of the ladder is 6 m away from the foot of the wall (at P), find the length of the ladder (|AB|)

(c) Kojo had 1800 bags of rice in stock for sale. In January, he sold ⅔ of it.
In February, he sold ¾ of what was left.

(i) What fraction of the stock of rice did he sell
(α) in February?
(β) in January and February?

(ii) How many bags of rice were left unsold, by the end of February?

MATHEMATICS 2

Essay

SOLUTIONS

1. **(a)** P = {1, 2, 3, 5, 6, 10, 15, 30}
Q = {5, 10, 15, 20, 25, 30, 35}
P∩Q = {5, 10, 15, 30}

1. (b) Total amount = Simple Interest + Principal

Simple interest = Principal × Rate × Time

$$\text{Simple interest} = 200 \times 12\% \times 3$$

$$= 200 \times \frac{12}{100} \times 3$$

$$= 2 \times 12 \times 3$$

Simple interest = GHC 72.00

Total amount = Interest + Principal
= GHC 72.00 + GHC 200.00
= GHC 272.00

1. (c)

$$\frac{4.56 \times 3.6}{0.12}$$

1st Method

$$= \frac{(4.56 \times 3.6)}{0.12} \times \frac{1000}{1000}$$

$$= \frac{456 \times 36}{120}$$

$$= \frac{456 \times 3}{10} = \frac{1368}{10}$$

$$= 136.8$$

$$= 1.368 \times 10^2$$

STEPS (1st Method)

1. Multiply both numerator and denominator by 1000
(or shift the decimal point 3 places to the right in both numerator and denominator – to convert to whole numbers)
2. Divide ('cancel') both 36 and 120 by 12 to get 3 and 10 resp.
3. Multiply 456 by 3 to get 1368
4. Shift the decimal point 1 place to the left (because of division by 10)
5. Convert to standard form by shifting decimal point 2 places to the left and multiplying by 10 to the power 2 (because decimal point was shifted 2 times)

1 (c) **2nd Method**

$$\frac{4.56 \times 3.6}{0.12}$$

$$= (4.56 \times 3.6) \div 0.12$$

$$= \frac{456}{100} \times \frac{36}{10} \div \frac{12}{100}$$

$$= \frac{456}{100} \times \frac{36}{10} \times \frac{100}{12}$$

$$= \frac{456}{1} \times \frac{3}{10} \times \frac{1}{1}$$

$$= \frac{456 \times 3}{10} = \frac{1368}{10}$$

$$= 136.8$$

$$= \underline{1.368} \times 10^2$$

STEPS (2nd Method)

1. Express using the ÷ sign
2. Change all decimals to fractions
3. Change the ÷ sign to × and turn the divisor ($\frac{12}{100}$) upside down to ($\frac{100}{12}$)
4. Divide ('cancel') 36 and 12 by 12 to get 3 and 1 resp.& Divide ('cancel') 100 (numerator) by 100 (denominator) to get 1 and 1 respectively
5. Multiply 456 by 3 to get 1368
6. Shift the decimal point 1 place to the left (because of division by 10)
7. Convert to standard form by shifting decimal point 2 places to the left and multiplying by 10 to the power 2 (because decimal point was shifted 2 times to the left)

1 (c) **3rd Method**

$$= \frac{4.56 \times 3.6}{0.12}$$

$$= \frac{456 \times 10^{-2} \times 36 \times 10^{-1}}{12 \times 10^{-2}}$$

$$= \frac{456 \times 36 \times 10^{-1} \times 10^{-2}}{12 \times 10^{-2}}$$

$$= \frac{456 \times 3 \times 10^{-1} \times 10^{-2}}{10^{-2}}$$

$$= 1368 \times 10^{-1}$$

$$= 1.368 \times 10^3 \times 10^{-1}$$

$$= 1.368 \times 10^{3+(-1)}$$

$$= \underline{1.368} \times 10^2$$

STEPS (3rd Method)

1. Change decimals to whole numbers by shifting decimal point to the right and multiplying by 10 raised to negated same no.of times the point was shifted.
2. Rearrange to group similar number forms
3. Divide 36 (numerator) by 12 (denominator) to get 3
4. Divide 10^{-2} (numerator) by 10^{-2} (denominator) to get 1
5. Multiply 456 by 3 to get 1368
6. Express 1368 in standarm form to get 1.368×10^3
7. Simplify $10^3 \times 10^{-1}$ by adding the powers [3 + (-1) = 3-1 = 2]

2. **(a)** **(i)** Let x = Ama's score in the fourth test

Method 1

$$\text{Mean} = \frac{82+74+90+x}{4} = 85$$

$$\Rightarrow \frac{246+x}{4} = 85$$

$$\Rightarrow 246 + x = 4 \times 85$$

$$\Rightarrow x = 340 - 246$$

$$\Rightarrow \underline{\underline{x = 94}}$$

1. Write an expression for her mean score, using the given scores,
2. Multiplying both sides by 4 (to clear fraction) Or 'Cross-multiply'
3. Subtract 246 from both sides (send 246 across the '=' sign and negate it)
4. Simplify to get answer.

2. **(a)** **(i)** **Method 2**

Total marks = No. of marks × mean mark
= 4 × 85
= 340

Sum of first 3 marks = 82 + 74 + 90
= 246

Ama's fourth mark = Total mark – sum of first three
= 340 – 246
= <u>94</u>

(a) **(ii)** **Median score**

Scores arranged in order gives 74, 82, 90, 94

$$\text{Median} = \frac{82+90}{2} = \frac{172}{2}$$

$$= \underline{\underline{86}}$$

(b) **(i)** Since angles BCF and CFG are alternate angles,

⇒ Angle BCF = 40°

Now, since base angles of isosceles triangle BFC are equal,

⇒ <u>Angle CBF</u> = 40°

(ii) angle DCF + angle BCF = 180° (angles at a point on a straight line = 180°)

⇒ angle DCF + 40° = 180°

⇒ angle DCF = 180° – 40°
= <u>140°</u>

(iii) 2x + 40° + 40° = 180° (Sum of interior angles of a triangle = 180°)

2x + 80° = 180°
2x = 180° – 80°
2x = 100°

$$\frac{2x}{2} = \frac{100}{2}$$

$$\underline{\underline{x = 50}}$$

3. **(a)** **Solve for x,**

$$\frac{1}{3}x + 1\frac{2}{3} < -\frac{3}{4}x - \frac{1}{2}$$

Method 1

$$\frac{1}{3}x + \frac{5}{3} < -\frac{3}{4}x - \frac{1}{2}$$

$$12\left(\frac{1}{3}x\right) + 12\left(\frac{5}{3}\right) < -12\left(\frac{3}{4}x\right) - 12\left(\frac{1}{2}\right)$$

$$4(x) + 4(5) < -3(3x) - 6(1)$$

$$4x + 20 < -9x - 6$$

$$4x + 9x < -20 - 6$$

$$13x < -26$$

$$\frac{13x}{13} < \frac{-26}{13}$$

$$\underline{\underline{x < -2}}$$

STEPS (Method 1)

1. Change mixed fraction ($1\ ^2/_3$) to improper fraction ($^5/_3$)
2. Multiply both sides by 12 (LCM of denominators)
3. Simplify each term
4. Group like terms on same side
5. Simplify
6. Divide both sides by 13

3. **(a)** **Method 2**

$$\frac{1}{3}x + \frac{5}{3} < -\frac{3}{4}x - \frac{1}{2}$$

$$\frac{1(x) + 1(5)}{3} < \frac{-1(3x) - 2(1)}{4}$$

$$\frac{x+5}{3} < \frac{-3x-2}{4}$$

$$12\left(\frac{x+5}{3}\right) < 12\left(\frac{-3x-2}{4}\right)$$

$$4(x+5) < 3(-3x-2)$$

$$4x + 20 < -9x - 6$$

$$4x + 9x < -20 - 6$$

$$13x < -26$$

$$\frac{13x}{13} < \frac{-26}{13}$$

$$\underline{\underline{x < -2}}$$

STEPS (Method 2)

1. Simplify (add / subtract) fractions on both sides
2. Multiply both sides by 12 (LCM of denominators)
3. Simplify ('cancel')
4. Expand and simplify
5. Group like terms on same side
6. Simplify
7. Divide both sides by 13

3.(b)(i) Stem-and-leaf plot

Stem	Leaf
0	6, 8
1	0, 2, 8
2	2, 6, 7
3	1, 6, 7, 9
4	2, 3, 4, 7, 8
5	3, 5, 9

(ii) Probability of selecting a student who scored between 40 and 50

$$= \frac{\text{No. of students who scored between 40 and 50}}{\text{Total no. of students}}$$

$$= \frac{5 \text{ students}}{20 \text{ students}} = \frac{5}{20}$$

$$= \underline{\underline{\frac{1}{4}}}$$

(iii) Number of students who passed, if the pass mark was 30

= n (31, 36, 37, 39, 42, 43, 44, 47, 48, 53, 55, 59)

= <u>1</u>2 students

4. **(a)** **(i)** Let length = l, width = w, height = h

Total surface area = 2lw + 2lh + 2wh,

= (2× 8cm × 5cm) + (2 × 8cm × 10cm) + (2 × 5cm × 10cm)

= $80cm^2$ + $160cm^2$ + $100cm^2$

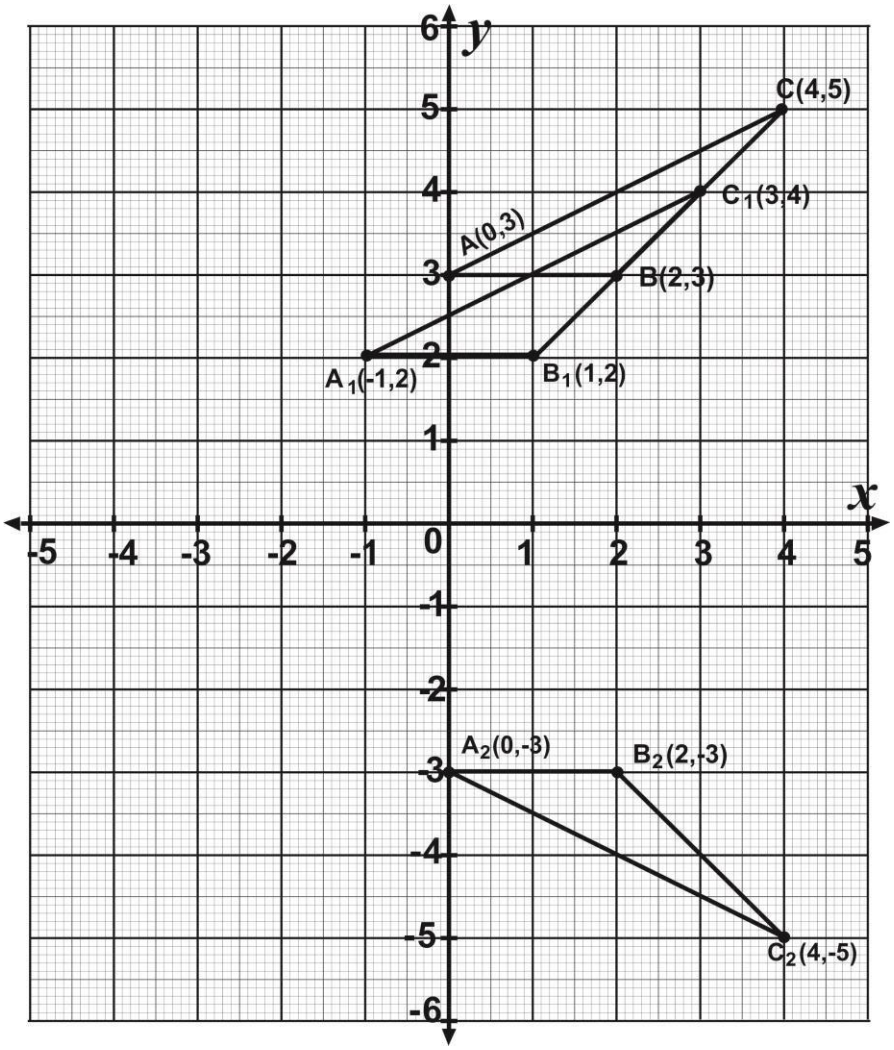
= <u>340 cm^2</u>

(ii) Volume = l × w × h

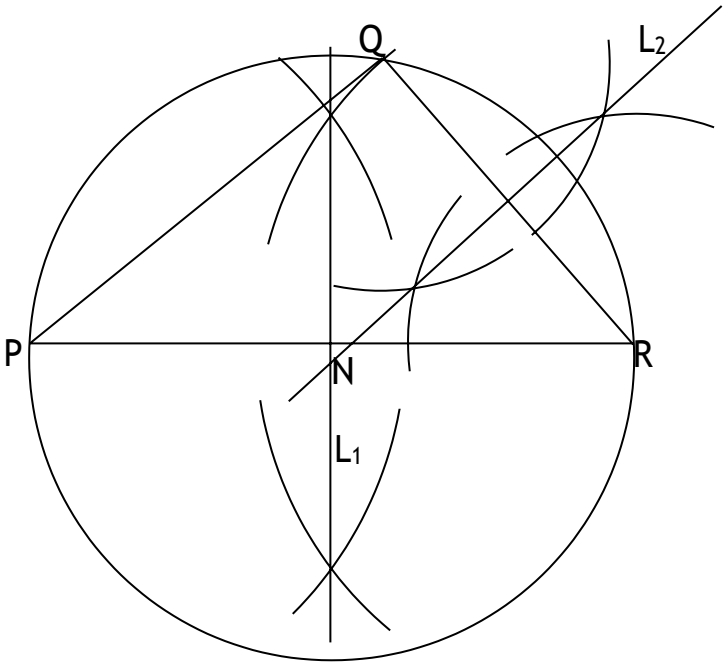
= 8cm × 5cm × 10cm

= <u>400 cm^3</u>

4 (b)



5. **(a)**



(b) **(i)** Radius = 4.0cm (or 4.1cm)

(ii) If r = 4.0 cm

C = $2\pi r$

$= \quad 2 \times 3.14 \times 4$ cm

$= \quad \underline{25.12}$ cm

Or if $r = 4.1$cm

$C = 2 \times 3.14 \times 4.1$ cm

$= \quad \underline{25.748}$ cm

6. **(a)** $6xy - 3y + 4x - 2$

$3y(2x - 1) + 2(2x - 1)$

$\underline{(2x - 1)}\ \underline{(3y + 2)}$

(b) The length of the ladder AB forms the hypotenuse of the right-angled triangle ABP

From the Pythagorean theorem,

$$|AB|^2 = |AP|^2 + |BP|^2$$
$$= (6)^2 + (8)^2$$
$$= 36 + 64$$
$$|AB|^2 = 100$$
$$\Rightarrow \quad |AB| = \sqrt{100}$$
$$= \underline{10}\,\text{m}$$

The length of the ladder AB is 10 m

6. **(c)** **<u>Method 1</u>**

No. of bags sold in January $= \frac{2}{3} \times 1800$

$= 2 \times 600$

$= \underline{1200}$

No. of bags left $= 1800 - 1200$

$= \underline{600}$

No. of bags sold in February $= \frac{3}{4} \times 600$

$= 3 \times 150$

$= \underline{450}$

(i) **(α)** Fraction of bags sold in February $= \frac{\text{No. of bags sold in February}}{\text{Total no. of bags}}$

$= \frac{450}{1800}$

$= \underline{\underline{\frac{1}{4}}}$

(i) **(β)** Fraction of bags sold in Jan and Feb $= \frac{1200 + 450}{1800}$

$$= \frac{1650}{1800}$$

$$= \underline{\underline{\frac{11}{12}}}$$

(ii) No. of bags left unsold by the end of February = 1800 – 1650

$$= \underline{\underline{150}}$$

6. (c) **<u>Method 2</u>**

Fraction sold in January = $\underline{\underline{\frac{2}{3}}}$

Fraction left $= 1 - \frac{2}{3}$

$$= \frac{1}{1} - \frac{2}{3}$$

$$= \frac{3-2}{3}$$

$$= \frac{1}{3}$$

(i) (α) Fraction sold in February = $\frac{3}{4}$ of fraction left

$$= \frac{3}{4} \times \frac{1}{3}$$

$$= \frac{1}{4} \times \frac{1}{1}$$

Fraction sold in Feb. $= \underline{\underline{\frac{1}{4}}}$

(i) (β) Fraction sold In January and February

$$= \frac{2}{3} + \frac{1}{4}$$

$$= \frac{4(2) + 3(1)}{12}$$

$$= \frac{8+3}{12} = \frac{11}{\underline{12}}$$

(ii) No. of bags left unsold by end of February

= Fraction left unsold × Total no. of bags

But fraction left unsold = $1-\frac{11}{12}$

$= \frac{12}{12}-\frac{11}{12}$

$= \frac{1}{12}$

Therefore No. of bags left unsold by end of February

$= \frac{1}{12}\times 1800 \text{ bags}$

$= 1 \times 150$ bags

$=$ <u>150 bags</u>