Please check the examination details below before entering your candidate information

Candidate surname	Other names
Solved by Mr. Pabitra	

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Monday 3 June 2024

Morning (Time: 2 hours)

Paper reference **4MA1/2HR**

Mathematics A

PAPER 2HR

Higher Tier

Solved by Mr. Pabitra



You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

Solved by Mr. Pabitra | Math Tonic

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over

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Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

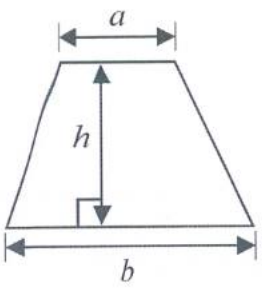
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

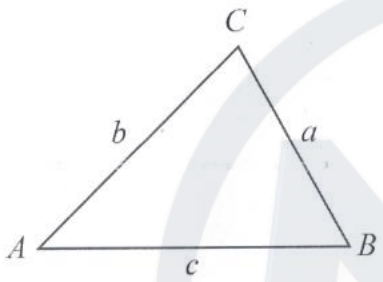
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Area of trapezium $= \frac{1}{2}(a+b)h$



Trigonometry



In any triangle ABC

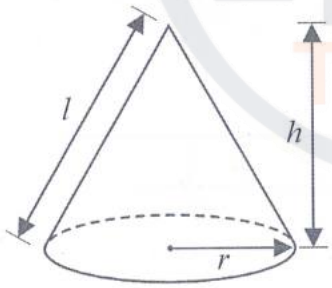
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

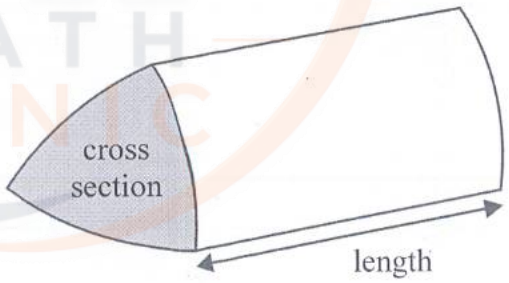
Area of triangle $= \frac{1}{2}ab\sin C$

Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

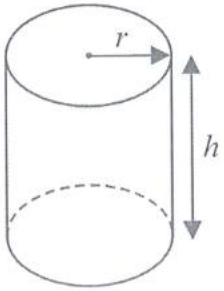


Volume of prism
= area of cross section × length



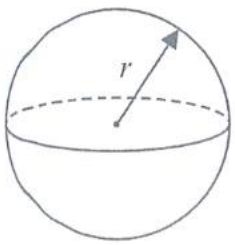
Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi r h$



Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



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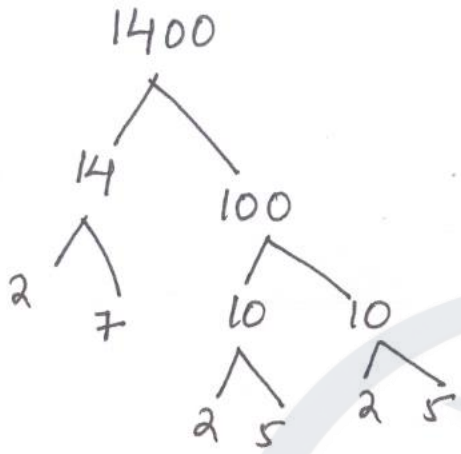
Solved by Mr. Pabitra

Answer ALL TWENTY SIX questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Write 1400 as a product of powers of its prime factors.
Show your working clearly.



$1400 = 2^3 \times 5^2 \times 7$

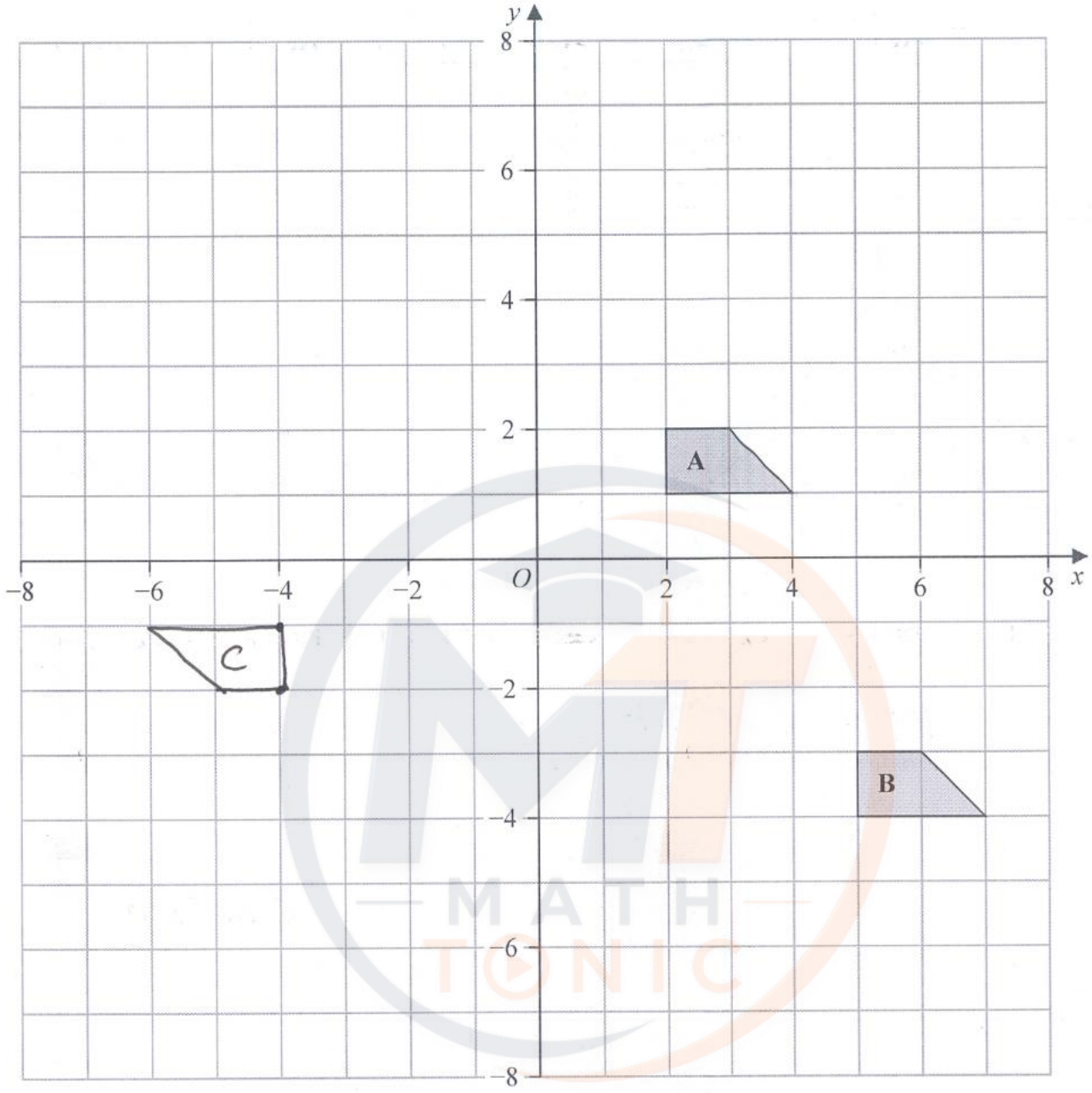
$2^3 \times 5^2 \times 7$

(Total for Question 1 is 3 marks)

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Solved by Mr. Pabitra

2



(a) Describe fully the single transformation that maps shape **A** onto shape **B**

Translation by vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$

(2)

(b) On the grid above, rotate shape **A** 180° about (−1, 0)
Label your shape **C**

(2)

(Total for Question 2 is 4 marks)

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Solved by Mr. Pabitra

3 Here is a list of four numbers written in ascending order of size

x x y 15

where x and y are integers.

The numbers have

a median of 12.5
a range of 4

Find the value of x and the value of y

Range = 4

$15 - x = 4$

$x = 15 - 4$

$x = 11$

Median $= \frac{11 + y}{2} = 12.5$

$11 + y = 2 \times 12.5$

$11 + y = 25$

$y = 25 - 11$

$y = 14$

$x =$ 11

$y =$ 14

(Total for Question 3 is 2 marks)

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MATH TONIC
Solved by Mr. Pabitra

4 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A = \{\text{factors of } 6\}$
$B = \{\text{prime numbers}\}$

(a) List the members of the set

(i) $A \cup B$

$\{1, 2, 3, 5, 6, 7\}$
(1)

(ii) A'

$\{4, 5, 7, 8, 9, 10\}$
(1)

Harpreet states that $A \cap B = \varnothing$

Harpreet is incorrect.

(b) Explain why.

Because 2 and 3 belong to both set

(1)

C is a set with 4 members such that

the set $A \cap C$ has 2 members
the set $B \cap C$ has 2 members

Set $A \cap C$ and set $B \cap C$ have no members in common.

(c) List the 4 members of set C

$A \cup B = \{1, 2, 3, 5, 6, 7\}$.

$\{1, 5, 6, 7\}$.
(2)

(Total for Question 4 is 5 marks)

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MATH TONIC

Solved by Mr. Pabitra

5 The diagram shows the design for a badge, which will be made using wire.
The design is a circle inside a square $ABCD$

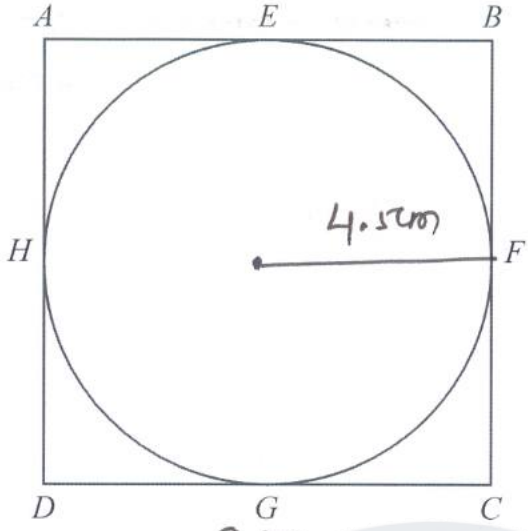


Diagram **NOT** accurately drawn

Area of Square = 81cm²
Length of square = $\sqrt{81}$ = 9cm

Radius of Circle = 9/2 = 4.5cm

The circle touches the square at the points E, F, G and H

The area of the square is 81 cm^2

Calculate the total length of wire that will be needed to make the square and the circle.
Give your answer correct to 3 significant figures.

Total length of wire = Square + Circle ($2\pi r$)

$= (4 \times 9) + 2\pi \times 4.5\text{cm}$

$= 36 + 9\pi$

$= 64.3$

64.3 cm

(Total for Question 5 is 4 marks)

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Solved by Mr. Pabitra

6 (a) Solve $\frac{2f}{3} = 4f - 17$

Show clear algebraic working.

$2f = 3(4f - 17)$

$2f = 12f - 51$

$51 = 12f - 2f$

$51 = 10f$

$f = \frac{51}{10}$

$f =$ 5.1

(3)

(b) Simplify $(e + 12)^0$ where $e > 0$

1

(1)

(c) Simplify fully $\frac{12a^4h^6}{4ah^2}$

$3a^3h^4$

$3a^3h^4$

(2)

(d) Factorise fully $20x^5y + 12x^3y^4$

$4x^3y(5x^2 + 3y^3)$

$4x^3y(5x^2+3y^3)$

(2)

(Total for Question 6 is 8 marks)

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MATH TONIC

Solved by Mr. Pabitra

7 $\frac{3^{-2} \times 3^5}{3^{10}} = 3^n$

Find the value of n

$$\frac{3^3}{3^{10}} = 3^n$$

$$3^{-7} = 3^n$$

$$n = -7$$

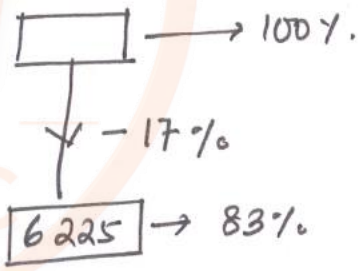
$n =$ -7

(Total for Question 7 is 2 marks)

8 In a sale, all normal prices are reduced by 17%

The sale price of a fridge is 6225 rupees.

Work out the normal price of the fridge.



83% ⟶ 6225

1% ⟶ $\frac{6225}{83}$

100% ⟶ $\frac{6225}{83} \times 100 = 7500$

7500 rupees

(Total for Question 8 is 3 marks)

Solved by Mr. Pabitra

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9 (a) Write 6.04×10^5 as an ordinary number.

604000

(1)

(b) Write 0.000 07 in standard form.

7×10^{-5}

(1)

(c) Work out $\dfrac{7.6 \times 10^{10}}{4 \times 10^5 - 2 \times 10^4}$

Give your answer in standard form.

$4 \times 10^5 - 2 \times 10^4 = 3.8 \times 10^5$

$\dfrac{7.6 \times 10^{10}}{3.8 \times 10^5} = 2 \times 10^5$

2×10^5

(2)

(Total for Question 9 is 4 marks)

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MATH TONIC

Solved by Mr. Pabitra

10 The diagram shows a hexagon *ABCDEF*

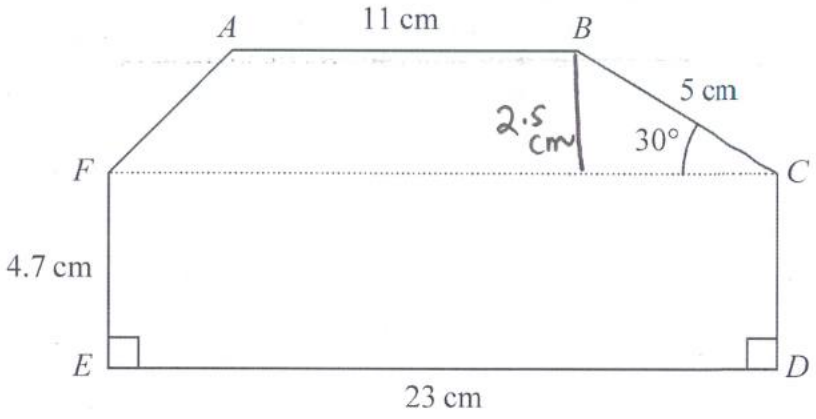


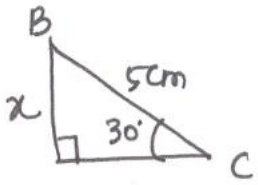
Diagram **NOT** accurately drawn

Angle $BCF = 30°$
AB, *FC* and *ED* are parallel.

Calculate the area of *ABCDEF*
Show your working clearly.

$x = 5 \sin 30$

$x = 2.5$ cm



Total Area: Area (Trapezium) + Area (Rectangle)

$$\frac{(11+23) \times 2.5}{2} + 23 \times 4.7$$

$42.5 + 108.1$

150.6 cm

150.6 cm²

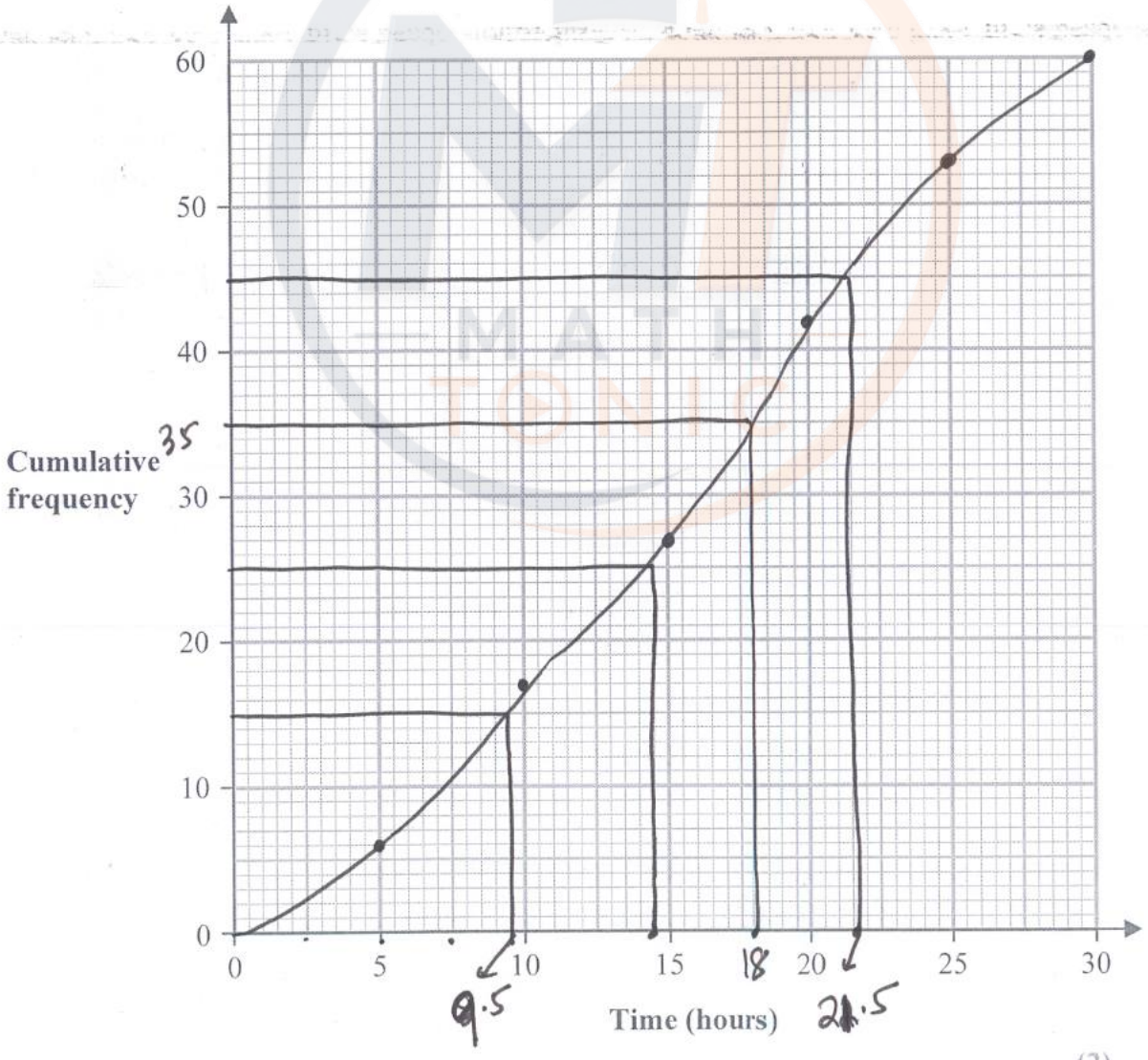
(Total for Question 10 is 5 marks)

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MATHTONIC
Solved by Mr. Pabitra

11 The cumulative frequency table gives information about the time, in hours, that each of 60 workers spent working from home in one week.

Time (t hours)	Cumulative frequency
$0 < t \leqslant 5$	6
$0 < t \leqslant 10$	17
$0 < t \leqslant 15$	27
$0 < t \leqslant 20$	42
$0 < t \leqslant 25$	53
$0 < t \leqslant 30$	60

(a) On the grid below, draw a cumulative frequency graph for the information in the table.

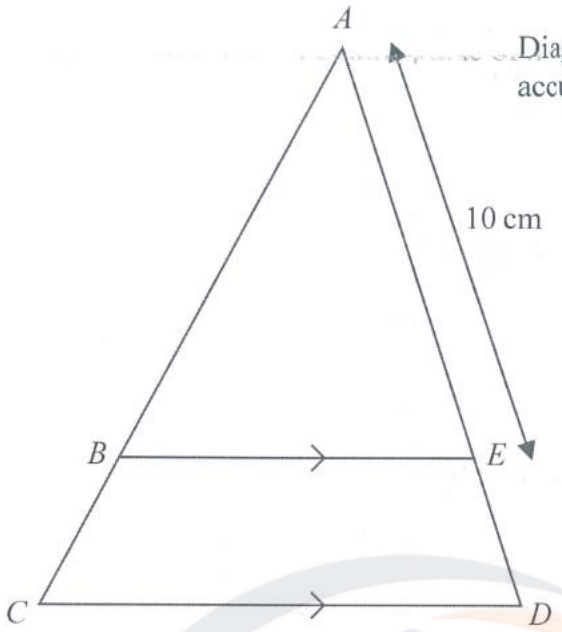


(2)

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Solved by Mr. Pabitra

12



In the diagram, ABC and AED are straight lines.
BE is parallel to CD

$AE = 10\,\text{cm}$ and $CD = 1.5 \times BE$

(a) Work out the length of ED

length scale factor 1·5

$AD = 1.5 \times AE$

$AD = 1.5 \times 10$

$AD = 15$

$ED = 15 - 10$

5 cm

(2)

$AB = (2x + 5)\,\text{cm}$ and $BC = (3x - 5)\,\text{cm}$

(b) Work out the value of x

$AE = AB + BC = 2x + 5 + 3x - 5$

$AE = 5x$

$AE = 1.5 \times AB$

$5x = 1.5 \times (2x + 5)$

$5x = 3x + 7.5$

$5x - 3x = 7.5$

$2x = 7.5$

$x = 3.75$

$x =$ 3·75

(2)

(Total for Question 12 is 4 marks)

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Solved by Mr. Pabitra

(b) Use your graph to find an estimate for the interquartile range of the times.

$IQR = Q_3 - Q_1$

$= \left(\frac{3}{4} \times 60\right)^{th} - \left(\frac{1}{4} \times 60\right)^{th}$

$= 45^{th} - 15^{th}$

$21.5 - 9.5 = 12$

12 hours

(2)

25 workers spent more than W hours working from home.

(c) Use your graph to find an estimate for the value of W

$60 - 25 = 35$ less than W

$W =$ 18

(2)

One of the 60 workers is chosen at random.
This worker spent H hours working from home.

(d) Find the probability that $5 < H \leqslant 10$

$0 < t \leq 10 \Rightarrow 17$

$-$

$0 < t \leq 5 \Rightarrow 6$

11 workers

$\frac{11}{60}$

(1)

(Total for Question 11 is 7 marks)

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Solved by Mr. Pabitra

13 OAB is a sector of a circle with centre O and radius r cm.

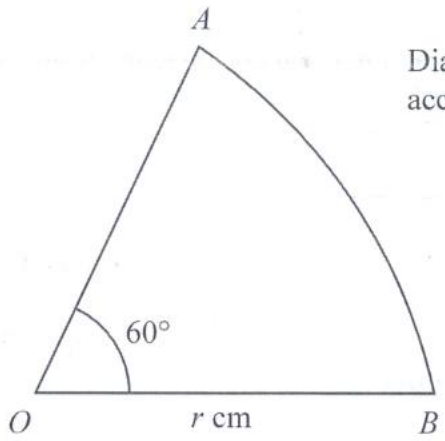


Diagram **NOT** accurately drawn

Angle $AOB = 60°$
The perimeter of the sector is P cm.

Find a formula for P in terms of r
Give your answer in the form $P = r(c\pi + k)$ where c and k are values to be found.

Perimeter = Arc length AB + OA + OB

$\frac{60}{360} \times 2\pi r + r + r$

$\frac{1}{3}\pi r + 2r$

$r\left(\frac{1}{3}\pi + 2\right)$

$r\left(\frac{1}{3}\pi + 2\right)$

(Total for Question 13 is 3 marks)

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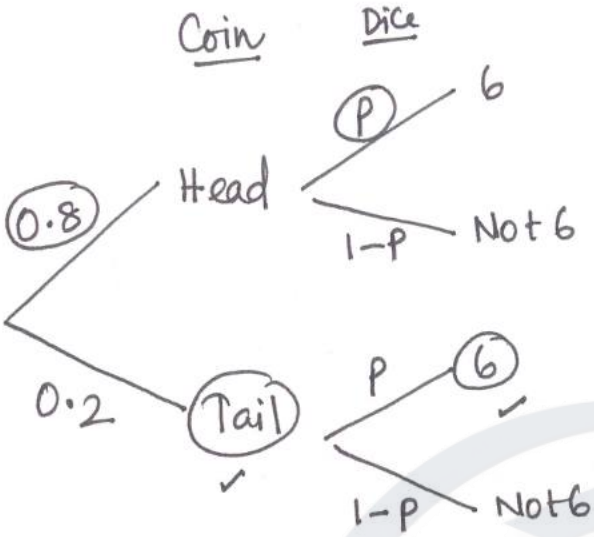
Solved by Mr. Pabitra

14 Adriana is going to roll a biased dice and spin a biased coin.

The probability that the coin will land on Heads is 0.8

The probability that the dice will land on 6 and the coin will land on Heads is 0.24

Work out the probability that the dice will land on 6 and the coin will land on Tails.



$0.8 \times P = 0.24$

$P = \frac{0.24}{0.8} = 0.3$

Probability that the dice will land on 6 and the Coin will land on tails

$0.2 \times P = 0.2 \times 0.3 = 0.06$

0.06

(Total for Question 14 is 3 marks)

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Solved by Mr. Pabitra

15

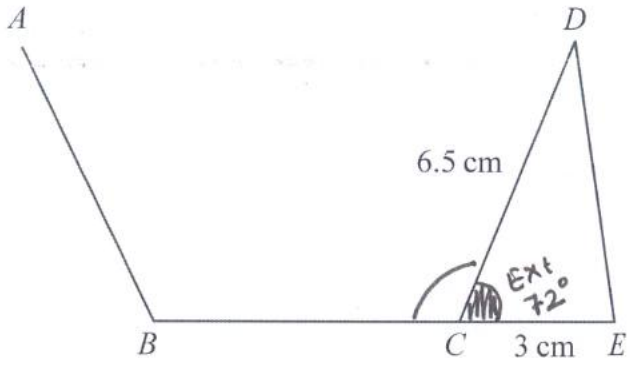


Diagram **NOT** accurately drawn

AB, *BC* and *CD* are three sides of a regular pentagon and *CDE* is a triangle.
BCE is a straight line.

$CD = 6.5\,\text{cm}$ $CE = 3\,\text{cm}$

Work out the area of triangle *CDE*
Give your answer correct to 3 significant figures.

Exterior angle $= \frac{360^\circ}{n} = \frac{360}{5} = 72^\circ$

Area of triangle $= \frac{1}{2}ab\sin C = \frac{1}{2} \times 6.5 \times 3 \times \sin 72^\circ$

$= 9.27$

9.27 cm^2

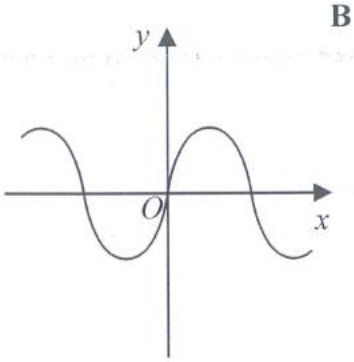
(Total for Question 15 is 3 marks)

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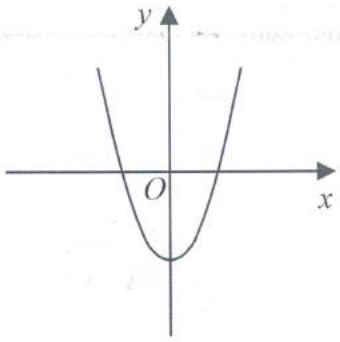
Solved by Mr. Pabitra

16 Here are six graphs.

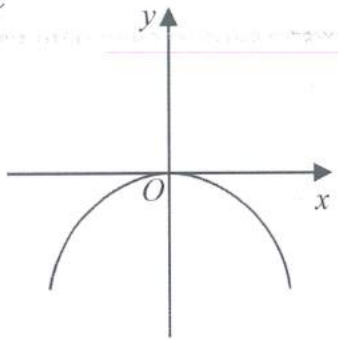
A



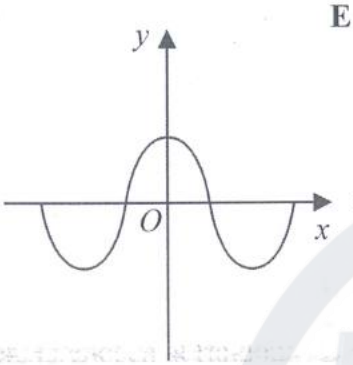
B



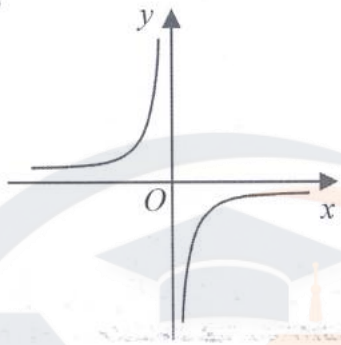
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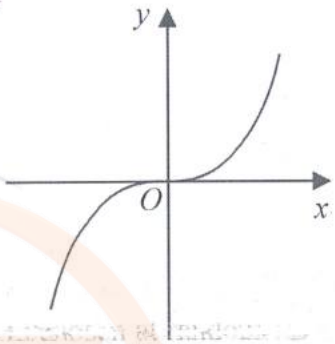
D



E



F



Write down the letter of the graph that could have the equation

(i) $y = -\frac{1}{x}$

E

(1)

(ii) $y = \sin x°$

A

(1)

(Total for Question 16 is 2 marks)

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MATH TONIC

Solved by Mr. Pabitra

17 $f(x) = \dfrac{x}{2x-4}$ $\quad g(x) = 3x+1$

Given that $fg(k) = 2$

work out the value of k

$$f(x) = \frac{x}{2x-4}$$

$$fg(x) = \frac{3x+1}{2(3x+1)-4} = \frac{3x+1}{6x+2-4}$$

$$fg(x) = \frac{3x+1}{6x-2}$$

$$fg(k) = \frac{3k+1}{6k-2}$$

$$fg(k) = 2$$

$$\frac{3k+1}{6k-2} = 2$$

$$3k+1 = 2(6k-2)$$

$$3k+1 = 12k-4$$

$$1+4 = 12k-3k$$

$$5 = 9k$$

$$k = 5/9$$

$k =$ 5/9

(Total for Question 17 is 3 marks)

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DO NOT WRITE IN THIS AREA

Solved by Mr. Pabitra

18 Use algebra to show that $0.\dot{3}0\dot{6} = \frac{34}{111}$

$x = 0.306306306\ldots$

$\times 1000$ ( ) $\times 1000$

$1000x = 306.306306306\ldots$

$1000x = 306.306306306\ldots$

$-\quad x = 0.306306306\ldots$

$999x = 306$

$x = \frac{306}{999} = \frac{34}{111}$

(Total for Question 18 is 2 marks)

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MATH TONIC

Solved by Mr. Pabitra

19 Aviv goes on a cycle journey.

For the cycle journey

average speed = 19 km/h correct to the nearest whole number

time = 1.5 hours correct to one decimal place

Work out the upper bound for the distance Aviv travels.
Give your answer correct to 3 significant figures.

LB		UB
18.5	Speed = 19 km/h	19.5
1.45	Time = 1.5 hr	1.55

$\text{Distance}_{UB} = \text{Speed}_{UB} \times \text{Time}_{UB}$

$= 19.5 \times 1.55$

$\text{Distance}_{UB} = 30.225$

30.225 km

(Total for Question 19 is 3 marks)

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Solved by Mr. Pabitra

20 Solve $6x^2 - 7x - 20 > 0$
Show clear algebraic working.

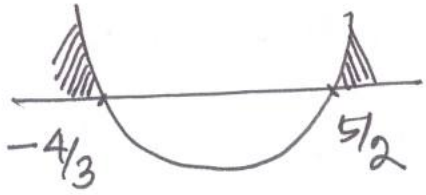
$6x^2 - 7x - 20 > 0$

$6x^2 - 7x - 20 = 0$

$(3x+4)(2x-5) = 0$

$3x+4=0$ $\quad 2x-5=0$

$x = -4/3$ $\quad x = 5/2$



$x > 5/2$ or $x < -4/3$

$x > 5/2$ or $x < -4/3$

(Total for Question 20 is 4 marks)

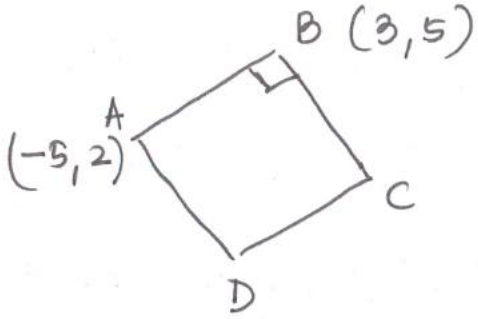
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Solved by Mr. Pabitra

21 *ABCD* is a square.

The point A has coordinates $(-5, 2)$
The point B has coordinates $(3, 5)$

Find an equation of the line that passes through B and C
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.



Gradient of AB

$$\frac{5-2}{3-(-5)} = \frac{3}{8}$$

Gradient of BC (AB and BC are perpendicular)

$$m_1 \times m_2 = -1$$

$$3/8 \times m_2 = -1$$

$$m_2 = -8/3$$

Equation of line BC

$$y = mx + c$$

$$y = -\frac{8}{3}x + c$$

at (3,5)

$$5 = -\frac{8}{3} \times 3 + c$$

$$5 = -8 + c$$

$$c = 5 + 8$$

$$c = 13$$

$$y = -8/3\,x + 13$$

$$3y = -8x + 39$$

$$\boxed{8x + 3y - 39 = 0}$$

(Total for Question 21 is 4 marks)

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Solved by Mr. Pabitra

22 Solve the simultaneous equations

$$x^2 + y^2 = y + 11$$
$$y = 3x - 1$$

Show clear algebraic working.

$x^2 + y^2 = y + 11$

$x^2 + (3x-1)^2 = 3x - 1 + 11$

$x^2 + 9x^2 - 6x + 1 = 3x + 10$

$10x^2 - 6x + 1 - 3x - 10 = 0$

$10x^2 - 9x - 9 = 0$

$(5x+3)(2x-3) = 0$

$5x + 3 = 0$

$\boxed{x = -3/5}$

$y = 3x - 1$

$y = 3(-3/5) - 1$

$y = -9/5 - 1$

$\boxed{y = \frac{-14}{5}}$

$2x - 3 = 0$

$\boxed{x = 3/2}$

$y = 3x - 1$

$y = 3 \times 3/2 - 1$

$y = 9/2 - 1$

$\boxed{y = 7/2}$

$x = -3/5, y = -14/5$ and $x = 3/2, y = 7/2$

(Total for Question 22 is 5 marks)

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Solved by Mr. Pabitra

23 A curve has equation $y = f(x)$
The coordinates of the minimum point on this curve are $(6, -3)$

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x) + 10$

$(6, -3+10)$
$(6, 7)$

(6 , 7)

(1)

(ii) $y = f(3x)$

$(6/3, -3)$
$(2, -3)$

(2 , −3)

(1)

(Total for Question 23 is 2 marks)

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MATH TONIC

Solved by Mr. Pabitra

24 The diagram shows a solid, **S**, made from a cone and a hemisphere.

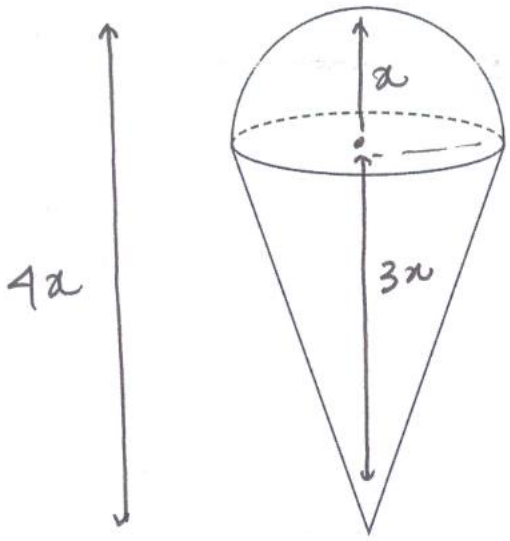


Diagram **NOT** accurately drawn

The centre of the circular face of the cone coincides with the centre of the flat surface of the hemisphere.

The radius of the circular face of the cone, x cm, is equal to the radius of the hemisphere.

The total height of **S** is 4 × the radius of the hemisphere.

A separate sphere has radius kx cm.
The volume of this sphere is 12.5 × the volume of **S**

(a) Work out the value of k

volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(kx)^3 = \frac{4}{3}\pi k^3 x^3$

volume of Solid = volume of Hemisphere + volume of Cone

$\frac{1}{2} \times \frac{4}{3}\pi x^3 + \frac{1}{3} \times \pi \times x^2 (3x)$

$\frac{2}{3}\pi x^3 + \pi x^3$

$\frac{5}{3}\pi x^3$

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Solved by Mr. Pabitra

volume of sphere = 12.5 × volume of solid

$\frac{4}{3}\pi k^3 x^3 = 12.5 \times \frac{5}{3}\pi x^3$

$\frac{4}{3}k^3 = \frac{125}{6}$

$k^3 = \frac{125}{6} \times \frac{3}{4} = \frac{125}{8}$

$k = \sqrt[3]{\frac{125}{8}} = \frac{5}{2}$

$k = \frac{5}{2}$

(4)

A solid, **T**, is similar to solid **S**

The volume of **T** is 512 × the volume of **S**

The total surface area of **T** is d × the total surface area of **S**

(b) Find the value of d

volume scale factor = 512

Length scale factor = $\sqrt[3]{512} = 8$

Area scale factor = $8^2 = 64$

$d = 64$

(1)

(Total for Question 24 is 5 marks)

Turn over for Question 25

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Solved by Mr. Pabitra

25 $OPQR$ is a parallelogram.

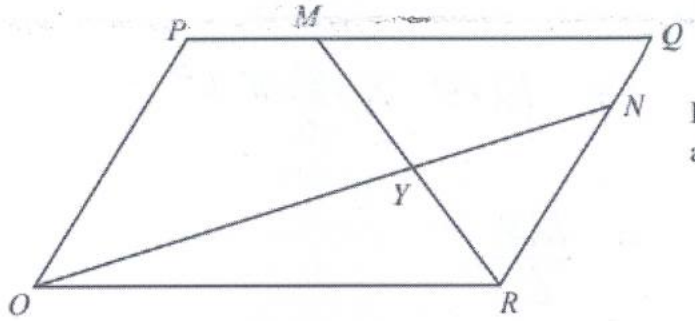


Diagram **NOT** accurately drawn

$\overrightarrow{OP} = 2\mathbf{a}$ and $\overrightarrow{OR} = 3\mathbf{b}$

The point M lies on PQ such that $PM = \frac{1}{4}PQ$

The point N lies on RQ such that $RN = \frac{4}{5}RQ$

(a) Find, in terms of **a** and **b**, giving your answers in simplest form

(i) $\overrightarrow{ON}$

$\overrightarrow{ON} = \overrightarrow{OR} + \overrightarrow{RN}$

$= 3b + \frac{4}{5} \times \overrightarrow{RQ} = 3b + \left(\frac{4}{5} \times 2a\right) = \frac{8}{5}a + 3b.$

(1)

(ii) $\overrightarrow{MR}$

$\overrightarrow{MR} = \overrightarrow{MP} + \overrightarrow{PO} + \overrightarrow{OR}$

$= \frac{1}{4} \times \overrightarrow{QP} + \overrightarrow{PO} + \overrightarrow{OR}$

$= -\frac{1}{4} \times 3b + (-2a) + 3b$

$-2a + \frac{9}{4}b$

(1)

MR and ON intersect at the point Y

Given that

$$OY = k \times ON$$

(b) use a vector method to find the value of k

$\overrightarrow{OY} = K \times \overrightarrow{ON}$ → from a(i)

$\overrightarrow{OY} = K\left[\frac{8}{5}a + 3b\right]$

$\overrightarrow{OY} = \frac{8}{5}Ka + 3Kb$ — (i)

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Solved by Mr. Pabitra

$\vec{OY} = \vec{OR} + \vec{RY}$

$\vec{OY} = 3b + m \times \vec{RM}$

$\vec{OY} = 3b + m\left(-2a - \frac{9}{4}b\right)$

$\vec{OY} = 3b + 2ma - \frac{9}{4}mb$

$\vec{OY} = 2ma + \left(3 - \frac{9}{4}m\right)b$ ——— (ii)

$\vec{MR} = -2a + \frac{9}{4}b$

$\vec{RM} = 2a - \frac{9}{4}b$

Equation (i) and (ii) are equal

$\frac{8}{5}ka + 3kb = 2ma + \left(3 - \frac{9}{4}m\right)b$

$\frac{8}{5}k = 2m$

$k = 2 \times \frac{5}{8}m$

$k = \frac{10}{8}m$

$3k = 3 - \frac{9}{4}m$

$3 \times \frac{10}{8}m = 3 - \frac{9}{4}m$

$\frac{15}{4}m = 3 - \frac{9}{4}m$

$k = \frac{5}{8}$ (4)

(Total for Question 25 is 6 marks)

$k = \frac{10}{8} \times \frac{1}{2}$

$\boxed{k = \frac{5}{8}}$

$15m = 12 - 9m$

$15m + 9m = 12$

$24m = 12$

$m = \frac{12}{24}$

$\boxed{m = 1/2}$

Turn over for Question 26

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MATHTONIC
Solved by Mr. Pabitra

26 Write $4-\left[(3x-5)\div\frac{3x^2+x-10}{4x-1}\right]$ as a single fraction in its simplest form.

$$4-\left[(3x-5)\times\frac{4x-1}{3x^2+x-10}\right]$$

$$4-\left[(3x-5)\times\frac{4x-1}{(3x-5)(x+2)}\right]$$

$$\frac{4}{1}-\left[\frac{4x-1}{x+2}\right]$$

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

$$\frac{4x+8-4x+1}{x+2}$$

$$\frac{9}{x+2}$$

$3x^2+x-10$

$(3x+6)(3x-5)$

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

$6\times -5=-30$

$6-5=1$

$\frac{9}{x+2}$

(Total for Question 26 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

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