Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Friday 19 May 2023

Morning (Time: 2 hours)

Paper reference **4MA1/1H**

Mathematics A

PAPER 1H

Higher Tier

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

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

Turn over ▶

P72790A

P 7 2 7 9 0 A 0 1 2 8

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

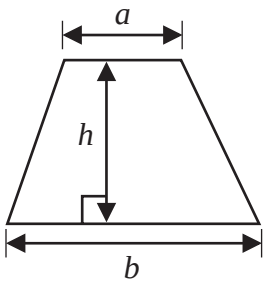
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

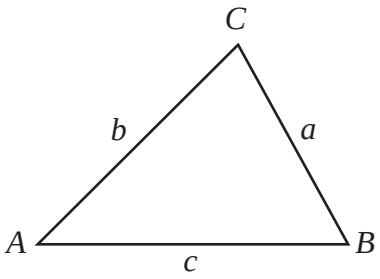
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

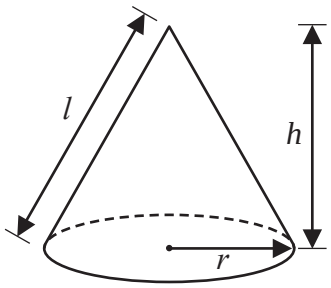
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

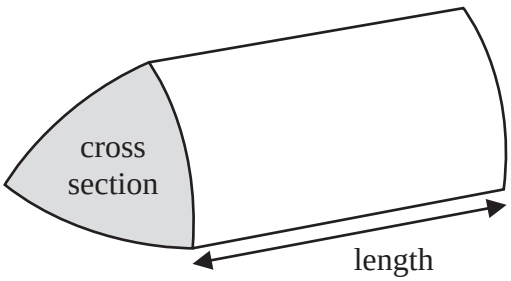
Area of triangle $= \frac{1}{2}ab\sin C$

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

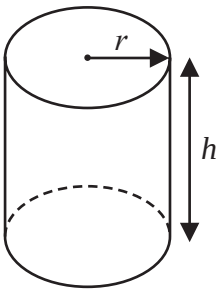
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

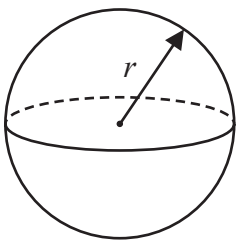


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

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



Answer ALL TWENTY THREE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Last season, the number of goals scored by Arjun, by Simon and by Kath for their football team were in the ratios 2 : 5 : 8

Simon scored 12 more goals than Arjun.

Work out the number of goals scored by Kath.

difference in ratio : 5 − 2 = 3

1 ratio equals to = $\frac{12}{3}$ = 4 goals (1)

Kath scores : 8 × 4 = 32 goals (1) (1)

32

(Total for Question 1 is 3 marks)

2 The table gives information about the number of minutes that Abby spent walking each day in September.

Number of minutes (M)	Frequency
$0 < M \leqslant 30$	5
$30 < M \leqslant 60$	6
$60 < M \leqslant 90$	8
$90 < M \leqslant 120$	9
$120 < M \leqslant 150$	2

Work out an estimate for the total number of minutes that Abby spent walking in September.

Estimated total : $(15 \times 5) + (45 \times 6) + (75 \times 8) + (105 \times 9) + (135 \times 2)$ (1)

$= 75 + 270 + 600 + 945 + 270$ (1)

$= 2160$ (1)

2160 ..... minutes

(Total for Question 2 is 3 marks)

3 Nanette buys 60 notebooks for a total cost of 780 dirhams.

Nanette sells 70% of the notebooks for 22 dirhams each.
She sells the remaining notebooks for 19 dirhams each.

Work out Nanette's percentage profit.
Give your answer correct to 3 significant figures.

$\frac{70}{100} \times 60 = 42$

Nanette sells: $42 \times 22 + (60 - 42) \times 19$

$= 924 + 342$ (1)

$= 1266$ (1)

Percentage profit: $\frac{1266 - 780}{780} \times 100\%$ (1)

$= \frac{486}{780} \times 100\%$

$= 62.3\%$ (1)

62.3 ..... %

(Total for Question 3 is 4 marks)

4 The diagram shows a sketch of triangle **A** and triangle **B** on a coordinate grid.

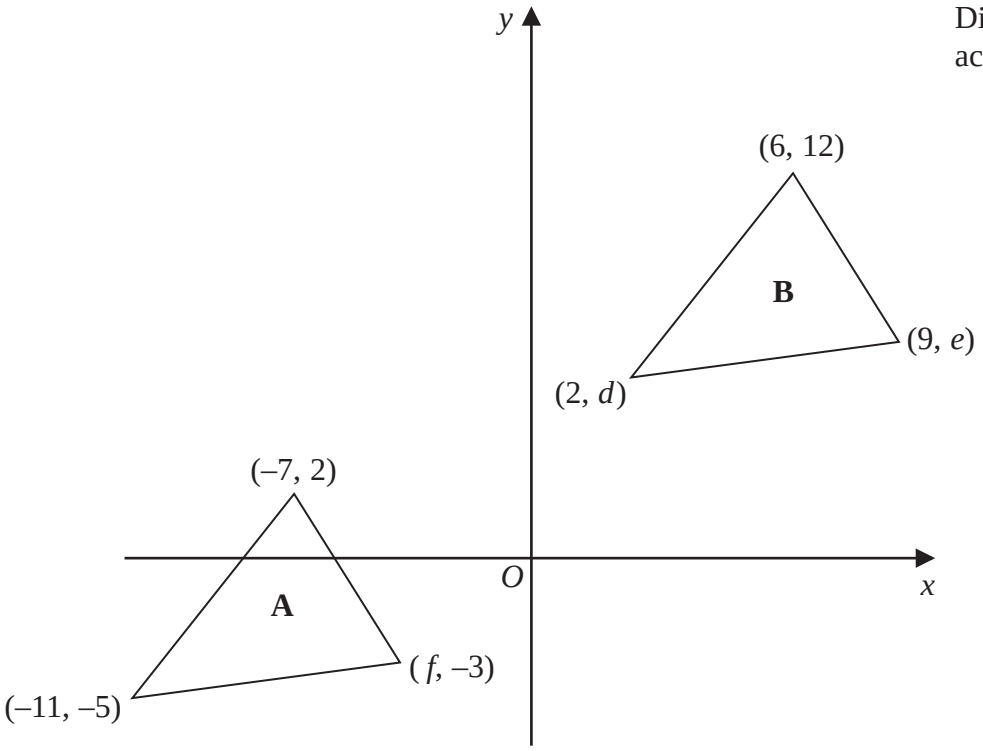


Diagram **NOT** accurately drawn

(a) Given that triangle **A** has been translated to give triangle **B**, work out the value of d, the value of e and the value of f

translation = $\begin{pmatrix} 6-(-7) \\ 12-2 \end{pmatrix}$

$= \begin{pmatrix} 13 \\ 10 \end{pmatrix}$ (1)

point $(-11, -5)$: $\begin{pmatrix} -11+13 \\ -5+10 \end{pmatrix}$

$= \begin{pmatrix} 2 \\ 5 \end{pmatrix}$ ∴ $d = 5$

(1)

point $(f, -3)$: $\begin{pmatrix} f+13 \\ -3+10 \end{pmatrix} = \begin{pmatrix} 9 \\ e \end{pmatrix}$

$f = 9-13 = -4$

$e = -3+10 = 7$

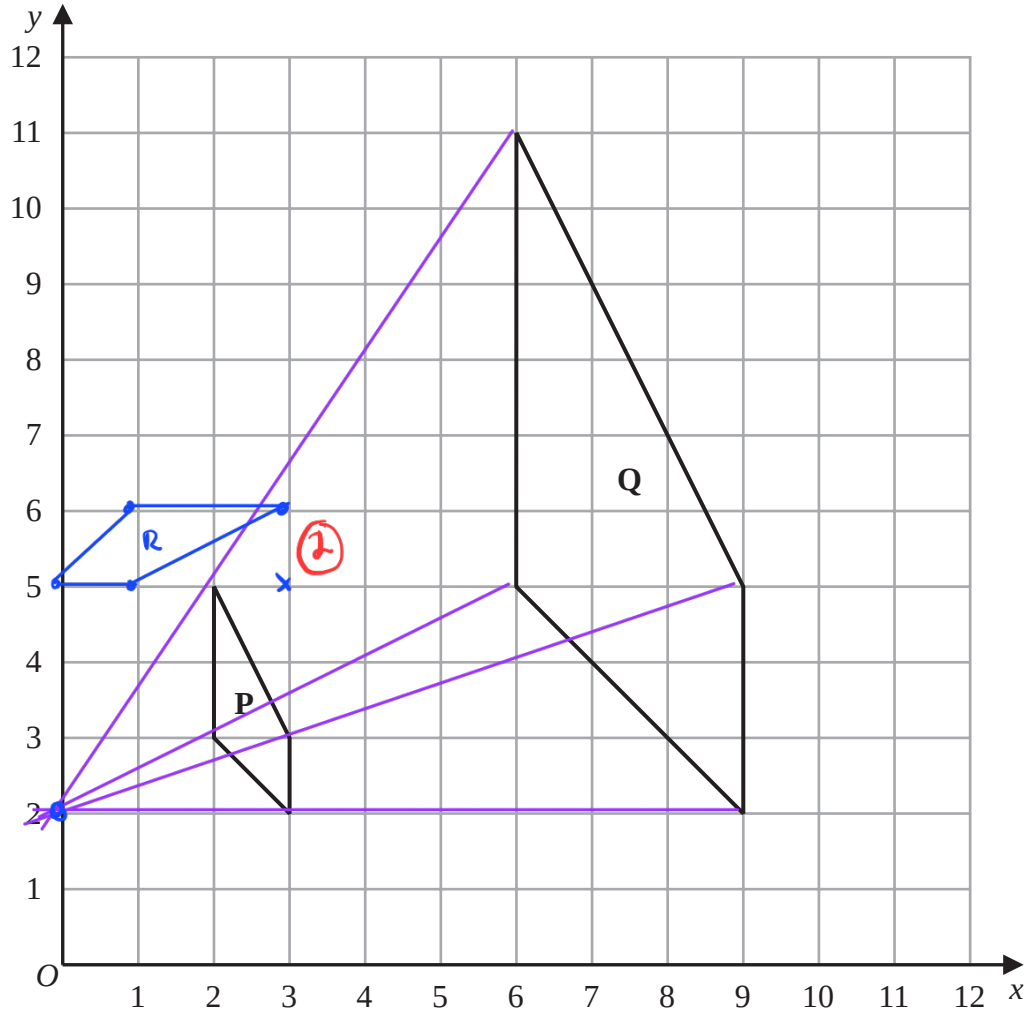
$d =$ 5 (1)

$e =$ 7

$f =$ −4

(3)

The diagram shows shape **P** and shape **Q** drawn on a grid.



(b) Describe fully the single transformation that maps shape **P** onto shape **Q**

Enlargement of scale factor 3 at centre (0, 2)

(1) (1) (1)

(3)

(c) On the grid above, rotate shape **P** 90° clockwise about (3, 5)
Label your shape **R**

(2)

(Total for Question 4 is 8 marks)

5 The diagram shows a shaded shape *AEBCD* made by removing triangle *AEB* from rectangle *ABCD*

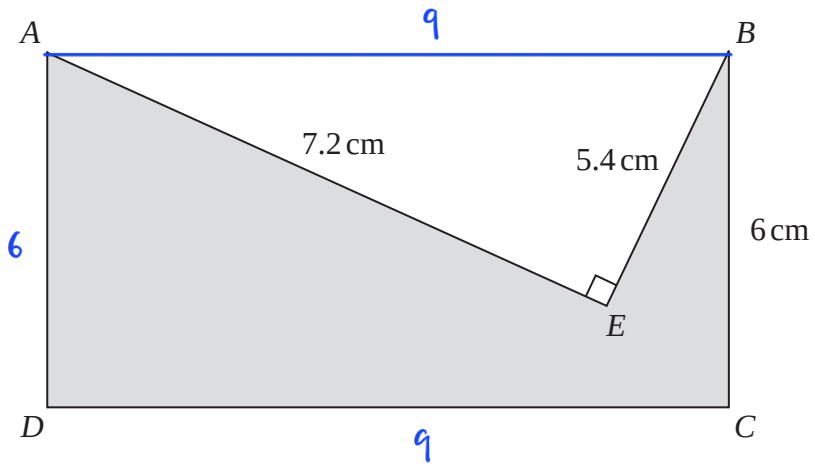


Diagram **NOT** accurately drawn

AE = 7.2 cm *BE* = 5.4 cm *BC* = 6 cm angle *AEB* = 90°

Work out the perimeter of the shaded shape.

$AB^2 = 7.2^2 + 5.4^2$

$= 81$ (1)

$AB = \sqrt{81} = 9$ (1)

Perimeter $= 6 + 7.2 + 5.4 + 6 + 9$ (1)

$= 33.6$ (1)

33.6 ..... cm

(Total for Question 5 is 4 marks)

6 (a) Simplify $(2c^4d^7)^3$

$2^3 \times c^{4\times3} \times d^{7\times3}$

$= 8c^{12}d^{21}$

$8c^{12}d^{21}$ (2)

(2)

(b) Find the value of $5y^0$ where $y > 0$

$y^0 = 1$

$5(1) = 5$ (1)

5

(1)

(c) Factorise fully $16a^2b^3 + 20a^3b$

$4(4a^2b^3 + 5a^3b)$

$4a^2(4b^3 + 5ab)$

$4a^2b(4b^2 + 5a)$ (2)

$4a^2b(4b^2+5a)$

(2)

(d) (i) Factorise $x^2 + 9x - 22$

$(x \pm 11)(x \pm 2)$ (1)

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

$(x+11)(x-2)$

(2)

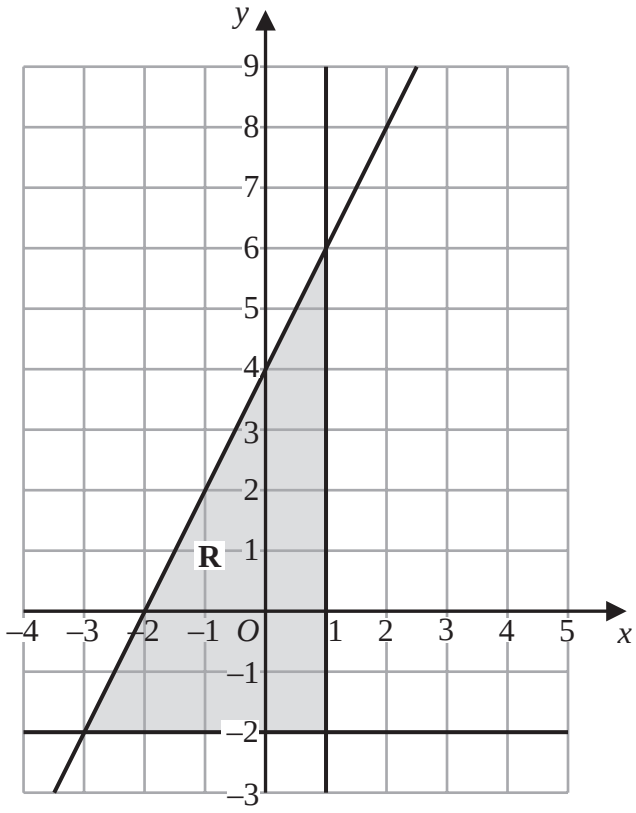
(ii) Hence solve $x^2 + 9x - 22 = 0$

$-11, 2$ (1)

(1)

(Total for Question 6 is 8 marks)

7



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Find the inequalities that define **R**

Take point (1, 6) : $6 = m(1) + 4$

$m = 2$ (1)

$y = 2x + 4$

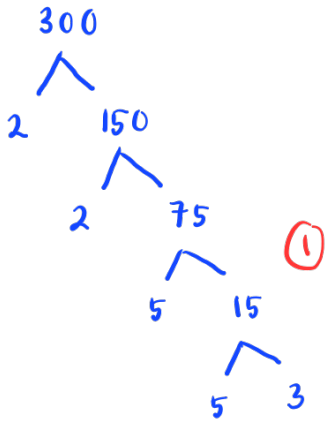
$x \leqslant 1$ (1)

$y \geqslant -2$ (1)

$y \leqslant 2x + 4$ (1)

(Total for Question 7 is 4 marks)

8 (a) Write 300 as a product of its prime factors.
Show your working clearly.



$2 \times 2 \times 3 \times 5 \times 5 = 300$ (1)

(1)

$2 \times 2 \times 3 \times 5 \times 5$

(2)

$A = 2 \times 2 \times 2 \times 3 \times 3 \times 5$

$B = 2 \times 2 \times 3 \times 3 \times 3 \times 5$

(b) Find the lowest common multiple (LCM) of $5A$ and $7B$
Show your working clearly.

$5A : 2^3 \times 3^2 \times 5^2 = 1800$ (1)

$7B : 2^2 \times 3^3 \times 5 \times 7 = 3780$

LCM of 5A and 7B $= 2^3 \times 3^3 \times 5^2 \times 7$

$= 8 \times 27 \times 25 \times 7$

$= 37\,800$ (1)

37800

(2)

(Total for Question 8 is 4 marks)

9 Solve the simultaneous equations

$$2x + 9y = 14.5 \quad (1)$$
$$7x + 3y = 8$$

Show clear algebraic working.

$\times 3$ ↓ $21x + 9y = 24$ ↓ $\times 3$ (2)

(2) − (1) :

$21x - 2x + 9y - 9y = 24 - 14.5$ (1)

$19x = 9.5$

$x = \frac{9.5}{19} = \frac{1}{2}$

$2\left(\frac{1}{2}\right) + 9y = 14.5$ (1)

$1 + 9y = 14.5$

$9y = 13.5$

$y = \frac{13.5}{9} = 1.5$

$x =$ 0.5 (1)

$y =$ 1.5

(Total for Question 9 is 3 marks)

10 Here are the test marks of 15 students.

7 10 14 (15) 16 17 18 (19) 20 20 23 (25) 30 39 40

LQ median UQ

Find the interquartile range of these marks.

IQR : 25 − 15 (1)

: 10 (1)

10

(Total for Question 10 is 2 marks)

11 The curve **C** has equation $y = 4x^3 + x^2 - 20x$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} = 12x^2 + 2x - 20$ (2)

$\frac{dy}{dx} =$ $12x^2 + 2x - 20$

(2)

(b) Find the x coordinates of the points on **C** where the gradient is 4
Show clear algebraic working.

$\frac{dy}{dx} = 4 = 12x^2 + 2x - 20$ (1)

$12x^2 + 2x - 24 = 0$

$6x^2 + x - 12 = 0$ (1)

$(3x - 4)(2x + 3) = 0$ (1)

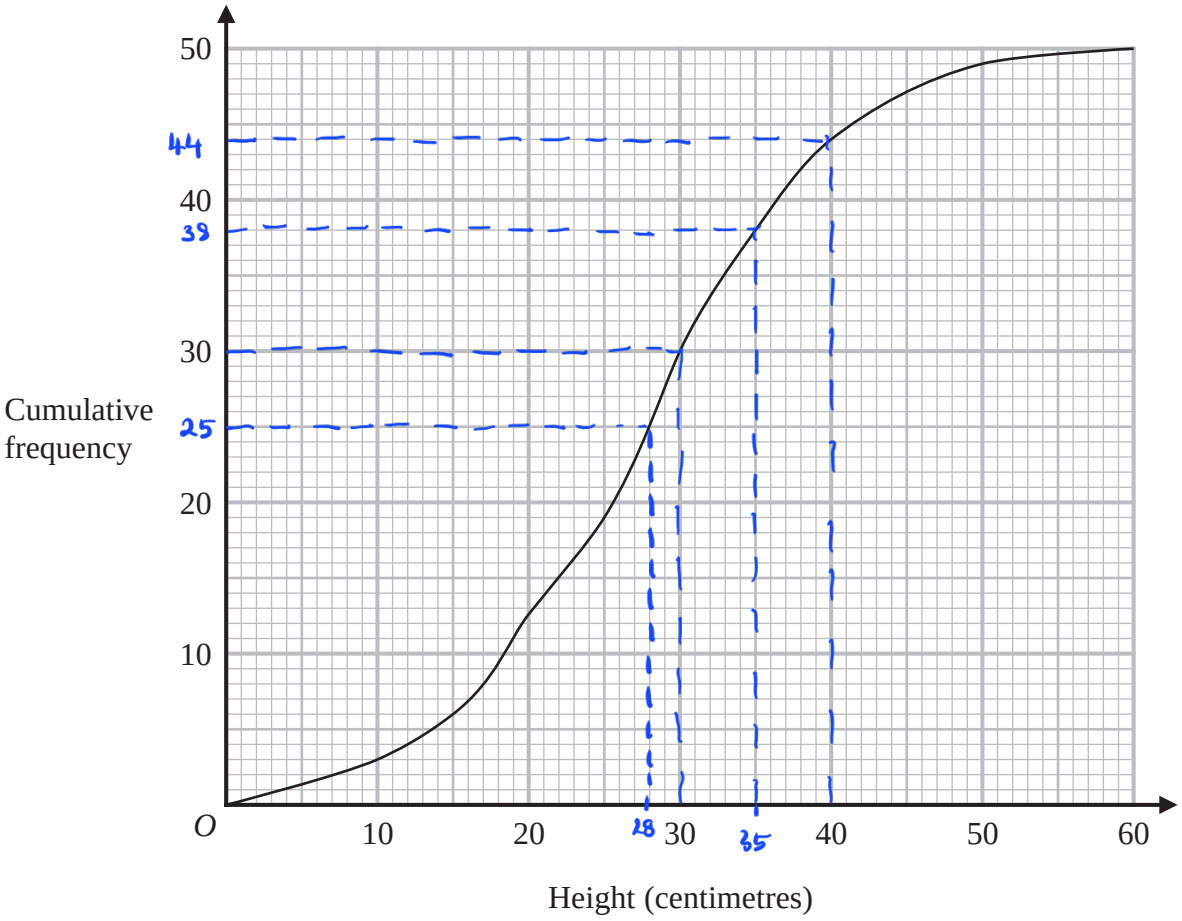
$x = \frac{4}{3}$ and $x = -\frac{3}{2}$ (1)

$\frac{4}{3}$, $-\frac{3}{2}$

(4)

(Total for Question 11 is 6 marks)

12 The cumulative frequency graph shows information about the heights, in centimetres, of 50 plants in a flowerbed.



(a) Use the graph to find an estimate for the median height of these plants.

28 (1)

..... centimetres

(1)

(b) Use the graph to find the frequency for the class interval $30 < \text{Height} \leqslant 40$

44 - 30 = 14

14 (1)

.....

(1)

(c) Use the graph to find an estimate for the number of plants with a height greater than 35 centimetres.

50 - 38 = 12

12 (1)

.....

(2)

(Total for Question 12 is 4 marks)

13 *A* is the point with coordinates (–5, 12)

B is the point with coordinates (19, –48)

Find an equation of the straight line that passes through the points *A* and *B*

gradient $= \frac{12-(-48)}{-5-19} = \frac{60}{-24} = -2.5$ (1)

equation : $12 = -2.5(-5) + c$

$12 = 12.5 + c$

$c = -0.5$ (1)

$y = -2.5x - 0.5$ (1)

$y = -2.5x - 0.5$

(Total for Question 13 is 3 marks)

14 Factorise fully $50g^2 - 18$

$2(25g^2 - 9)$

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

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

(Total for Question 14 is 3 marks)

15 (a) $\sqrt{2} \div \dfrac{8^3}{16^{\frac{3}{2}}} = 2^n$

Work out the value of n
Show your working clearly.

$\sqrt{2} = 2^{\frac{1}{2}}$

$8^3 = (2^3)^3 = 2^9$

$16^{\frac{3}{2}} = (2^4)^{\frac{3}{2}} = 2^6$ (1)

$2^{\frac{1}{2}} \div \dfrac{2^9}{2^6} = 2^n$

$2^{\frac{1}{2}-(9-6)} = 2^n$ (1)

$\frac{1}{2} - 3 = n$ $\quad n = -2.5$ (1)

$n =$ -2.5

(3)

(b) Find 4% of 4.5×10^{157}
Give your answer in standard form.

$0.04 \times 4.5 \times 10^{157}$ (1)

$= 4 \times 10^{-2} \times 4.5 \times 10^{157}$

$= 4 \times 4.5 \times 10^{-2+157}$

$= 18 \times 10^{155}$ (1)

$= 1.8 \times 10^{156}$ (1)

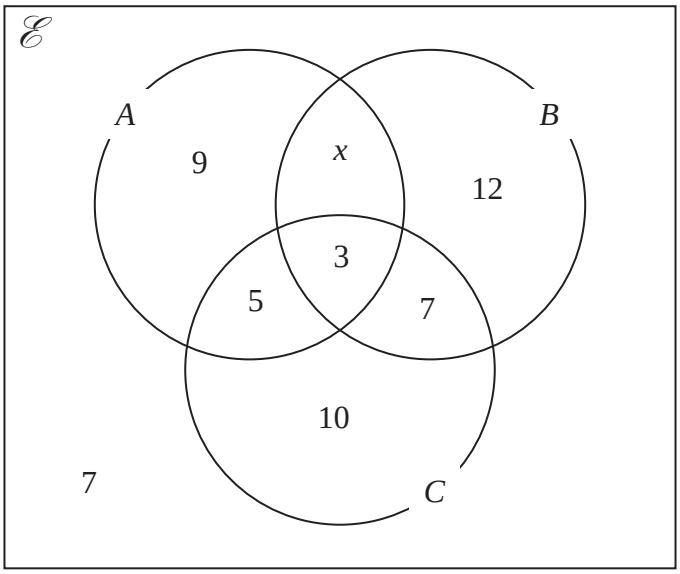
1.8×10^{156}

(3)

(Total for Question 15 is 6 marks)

16 The Venn diagram shows a universal set $\mathscr{E}$ and sets A, B and C

The numbers and the letter x represent **numbers** of elements.



Given that $n(A \cup B) = 42$

(a) find the value of x

$x = 42 - 9 - 5 - 3 - 7 - 12$

$= 6$

$x =$ 6 (1)

(1)

(b) Find $n(A')$

$7 + 10 + 7 + 12 = 36$

36 (1)

(1)

(c) Find $n(B' \cap C)$

$5 + 10 = 15$

15 (1)

(1)

(Total for Question 16 is 3 marks)

17 The functions g and h are such that

$$g(x) = \frac{11}{2x - 5}$$

$$h(x) = x^2 + 4 \qquad x \geqslant 0$$

(a) What value of x must be excluded from any domain of g?

$2x - 5 = 0$

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

$\frac{5}{2}$ (1)

.....

(1)

(b) Solve $gh(x) = 1$

$gh(x) = \frac{11}{2(x^2+4) - 5}$ (1)

$1 = \frac{11}{2(x^2+4) - 5}$

$2x^2 + 8 - 5 = 11$

$2x^2 = 8$

$x^2 = 4$ (1)

$x = 2$ since $x \geqslant 0$ (1)

2

.....

(3)

(Total for Question 17 is 4 marks)

18 The incomplete table and incomplete histogram give information about the times, in minutes, that 140 people waited at a station for a train.

Time (t minutes)	Frequency
$0 < t \leqslant 5$	23
$5 < t \leqslant 15$	25
$15 < t \leqslant 30$	60
$30 < t \leqslant 40$	18
$40 < t \leqslant 60$	14

(1)

$140 - 23 - 18 - 14 = 85$ (1)

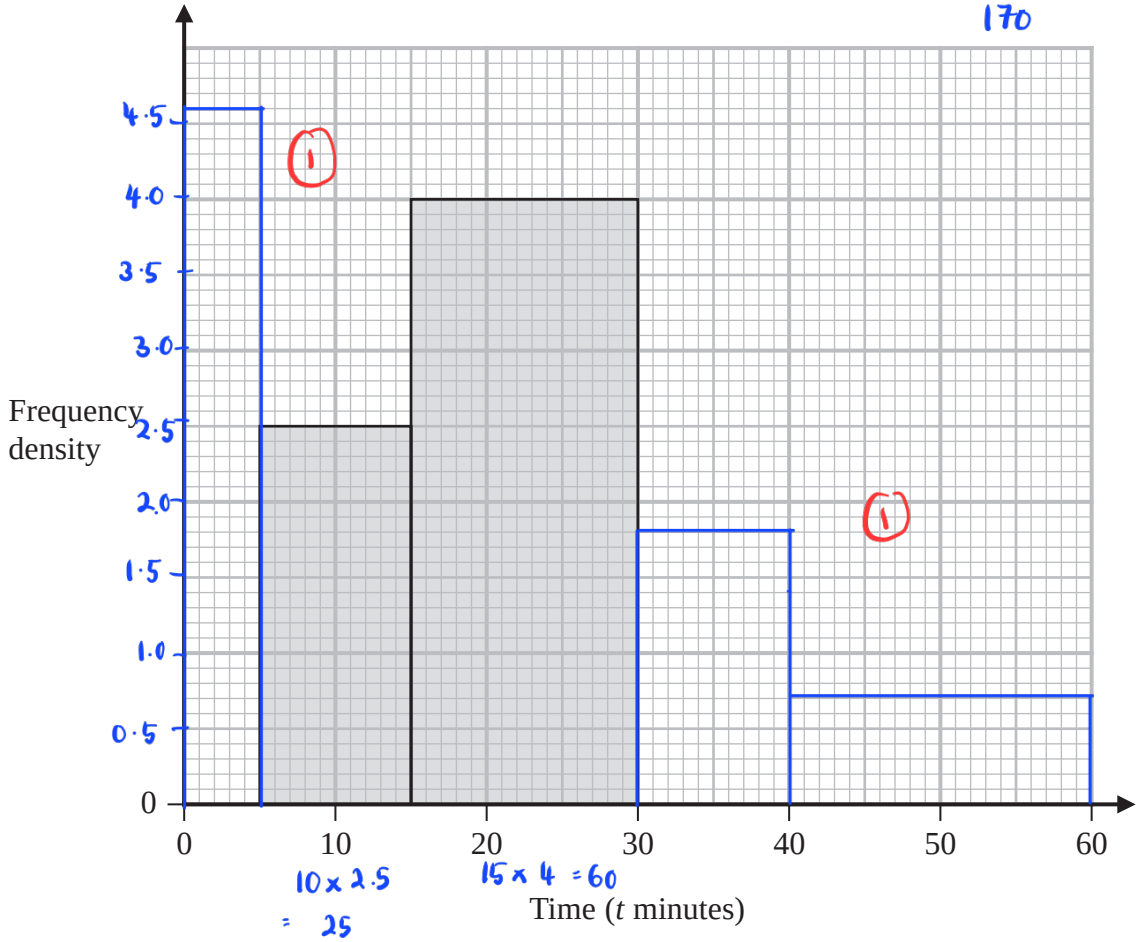
From graph : (let 5 small square = x)

$(10 \times 5x) + (15 \times 8x) = 85$

$50x + 120x = 85$

$170x = 85$

$x = \frac{85}{170} = 0.5$



Complete the table and the histogram.

1st class : $\frac{23}{5} = 4.6$

4th class : $\frac{18}{10} = 1.8$

5th class : $\frac{14}{20} = 0.7$

(Total for Question 18 is 4 marks)

19

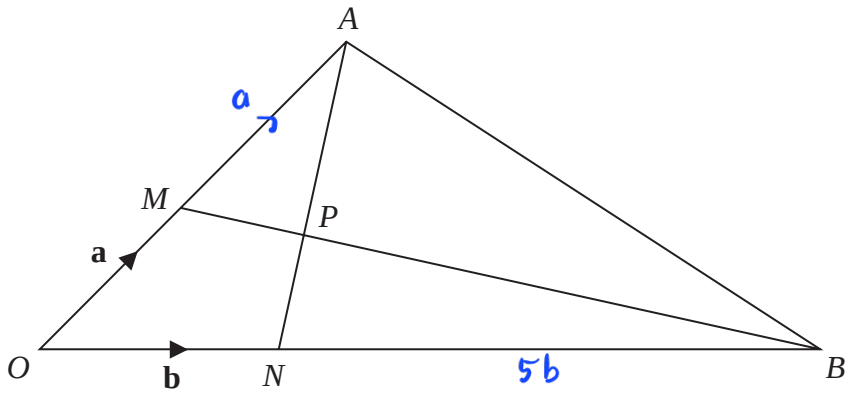


Diagram **NOT** accurately drawn

OMA, *ONB*, *MPB* and *NPA* are straight lines.

M is the midpoint of *OA*

ON : *NB* = 1 : 5

$\overrightarrow{OM} = \mathbf{a}$ $\overrightarrow{ON} = \mathbf{b}$

(a) Find in terms of **a** and **b** the vector $\overrightarrow{AN}$

$\overrightarrow{AN} = \overrightarrow{AO} + \overrightarrow{ON}$

$= -2\underline{a} + \underline{b}$

$-2\underline{a} + \underline{b}$ (1)

(1)

(b) Use a vector method to find the ratio *AP* : *PN*

$\overrightarrow{OP} = \overrightarrow{OM} + \overrightarrow{MP}$

$= \underline{a} + \lambda(\overrightarrow{MB})$ (1)

$= \underline{a} + \lambda(-\underline{a} + 6\underline{b})$

$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$

$= 2\underline{a} + \mu(\overrightarrow{AN})$ (1)

$= 2\underline{a} + \mu(-2\underline{a} + \underline{b})$

$\underline{a}: 1 - \lambda = 2 - 2\mu$ — (1)

$\underline{b}: 6\lambda = \mu$ — (2) (1)

substitute (2) into (1):

$1 - \lambda = 2 - 2(6\lambda)$

$1 - \lambda = 2 - 12\lambda$

$11\lambda = 1$

$\lambda = \frac{1}{11}$ $\mu = \frac{6}{11}$

$\overrightarrow{AP} = \frac{6}{11}\overrightarrow{AN}$

$\overrightarrow{AP} : \overrightarrow{PN} = 6 : 5$ (1)

$AP : PN =$ 6 : 5

(4)

(Total for Question 19 is 5 marks)

Turn over for Question 20

20 The sum of the first 80 terms of an arithmetic series, S, is 470

The 75th term of S is 14.5

The sum of the first X terms of S is 171

Work out the value of X
Show your working clearly.

$S_{80} = \frac{80}{2}[2a + 79d] = 470$

$\therefore 40(2a + 79d) = 470$ (1)

$2a + 79d = 11.75$ — (1)

$T_{75} = a + 74d = 14.5$ (1)

$2a + 148d = 29$ — (2)

(2) − (1) :

$148d - 79d = 29 - 11.75$

$69d = 17.25$ (1)

$d = 0.25$

$a = 14.5 - 0.25(74)$

$= -4$ (1)

$171 = \frac{x}{2}[2(-4) + (x-1)0.25]$

$342 = x(-8 + 0.25x - 0.25)$ (1)

$342 = -8x + 0.25x^2 - 0.25x$

$0.25x^2 - 8.25x - 342 = 0$

$x^2 - 33x - 1368 = 0$

$(x - 57)(x + 24) = 0$

X = 57 (1)

$X =$ 57

(Total for Question 20 is 6 marks)

21 A curve has equation $y = f(x)$

There is only one turning point on the curve.
The coordinates of this turning point are (6, 5)

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

(a) $y = f(x - 4)$

(10 , 5) (1)

(1)

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

(2 , 5) (1)

(1)

(Total for Question 21 is 2 marks)

22 The diagram shows two circles with centre O and a regular pentagon $ABCDE$

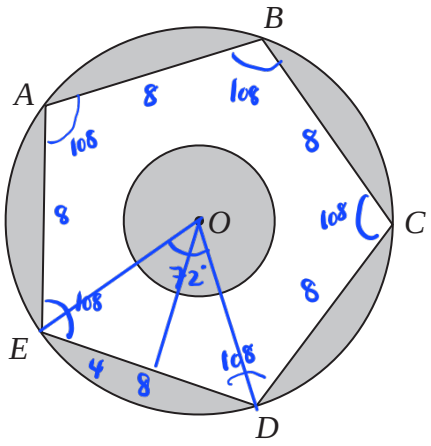


Diagram **NOT** accurately drawn

A, B, C, D and E are points on the larger circle.
The pentagon has sides of length 8 cm.

The diagram is shaded such that

shaded area = unshaded area

Work out the radius of the smaller circle.
Give your answer correct to 3 significant figures.

pentagon angle $= \frac{180 \times 3}{5} = 108°$

angle EOD $= 180 - 54 - 54$
$= 72°$

height of triangle : $\tan 54 = \frac{\text{height}}{4}$
$= 4 \tan 54 = 5.505\ldots$ (1)

$\frac{\text{length OE}}{\sin 54°} = \frac{8}{\sin 72}$

$OE = \frac{8 \sin 54}{\sin 72} = 6.805\ldots$ = radius of large circle

Area of whole diagram $= \pi \times 6.805^2 = 145.489\ldots$ (1)

Area of pentagon $= 5 \times \frac{1}{2} \times 8 \times 5.505\ldots = 110.11$ (1)

Shaded area = unshaded area

$145.489 - 110.11 + \pi r^2 = 110.11 - \pi r^2$ (1)

$2\pi r^2 = 74.731\ldots$ (1)

$r^2 = 11.89\ldots$

$r = 3.45$ (3 s.f.) (1)

3.45 ..... cm

(Total for Question 22 is 6 marks)

Turn over for Question 23

23 A frustum is made by removing a small square-based pyramid from a similar large squared-based pyramid as shown in the diagram.

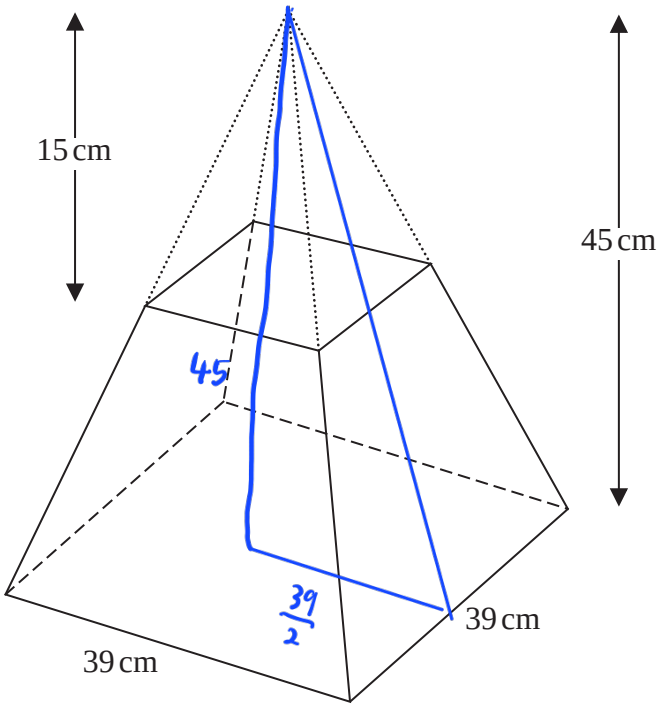


Diagram **NOT** accurately drawn

The height of the small pyramid is 15 cm.
The height of the large pyramid is 45 cm.
The square base of the large pyramid has side length 39 cm.

Work out the **total** surface area of the frustum.
Give your answer correct to the nearest whole number.

Area of small square $= \left(\frac{15}{45} \times 39\right)^2 = 13^2 = 169$

Area of large square $= 39^2 = 1521$ (1)

Slant height of large pyramid $= \sqrt{45^2 + \left(\frac{39}{2}\right)^2}$

$= 49.043\ldots$ (1)

Slant height of small pyramid $= 49.043 \times \frac{15}{45} = 16.347\ldots$

Area of large slanted triangles $: 4 \times \frac{1}{2} \times 49.043 \times 39 = 3825.381$ (1)

Area of small slanted triangles $: 4 \times \frac{1}{2} \times 16.347.. \times 13 = 425.042$

Area of slanted surfaces (frustum) $: 3825.381 - 425.042 = 3400.339\ldots$

Total surface area = 169 + 1521 + 3400.339 (1)

= 5090.339...

= 5090 (1)

5090 ..... cm^2

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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