Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | Candidate Number

Tuesday 15 January 2019

Morning (Time: 2 hours) | Paper Reference **4MA1/2H**

Mathematics A

Level 1/2

Unit 2H

You must have:
Ruler graduated in centimetres and millimetres, protractor, 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 ▶

1/1/1/

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

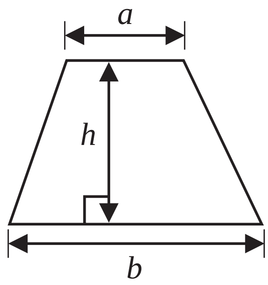
Sum to n terms, $S_n = \frac{n}{2}\,[2a + (n - 1)d]$

The quadratic equation

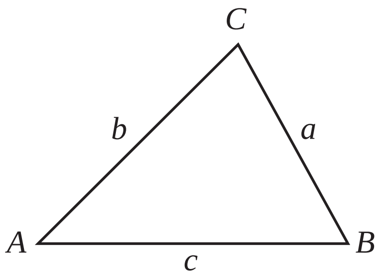
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle ***ABC***

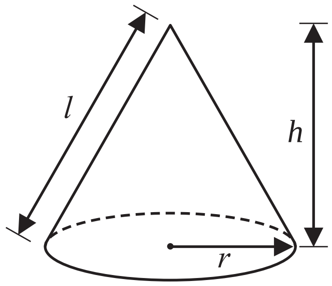
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

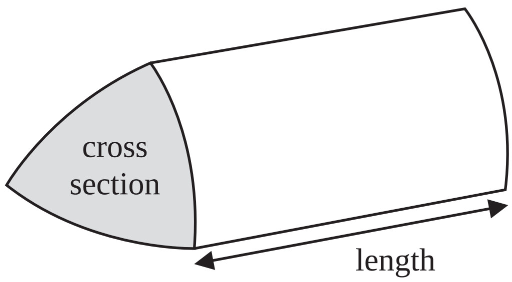
Area of triangle $= \frac{1}{2}ab\sin C$

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

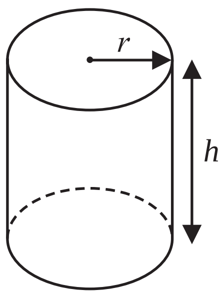
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

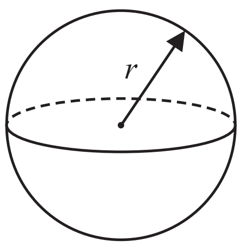


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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 A plane has a length of 73 metres.

A scale model is made of the plane.
The scale of the model is 1 : 200

Work out the length of the scale model.
Give your answer in centimetres.

$73 \div 200 = 0.365\text{m}$

$0.365 \times 100 = 36.5\text{cm}$ $1\text{m} = 100\text{cm}$

36.5 cm

(Total for Question 1 is 3 marks)

---

2 Here are the first five terms of an arithmetic sequence.

7 11 15 19 23

Write down an expression, in terms of *n*, for the *n*th term of this sequence.

$\underbrace{7 \quad 11}_{+4} \; \underbrace{\quad 15}_{+4} \; \underbrace{\quad 19}_{+4} \; \underbrace{\quad 23}_{+4} \rightarrow 4n$

when $n = 1$, $4(1) = 4$

$7 - 4 = 3$ this must be added to make the nth term the same as the sequence

$4n + 3$ is the nth term

(Total for Question 2 is 2 marks)

---

3 There are 90 counters in a bag.
Each counter in the bag is either red or blue so that

the number of red counters : the number of blue counters = 2 : 13

Li is going to put some more red counters in the bag so that

the probability of taking at random a red counter from the bag is $\frac{1}{3}$

Work out the number of red counters that Li is going to put in the bag.

in the ratio 2 : 13 there are 2 + 13 = 15 parts

90 - 15 = 6 counters per part

6 X 2 = 12 red counters

Li adds x red counters such that $\frac{12 + x}{90 + x} = \frac{1}{3}$

$3(12 + x) = 1(90 + x)$

cross-multiply

$36 + 3x = 90 + x$

$-x$ $\quad 36 + 2x = 90 \quad$ $-x$

-36 $\quad 2x = 54 \quad$ -36

$\div 2$ $\quad x = 27 \quad$ $\div 2$

Li will add 27 red counters to the bag.

(Total for Question 3 is 4 marks)

4 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

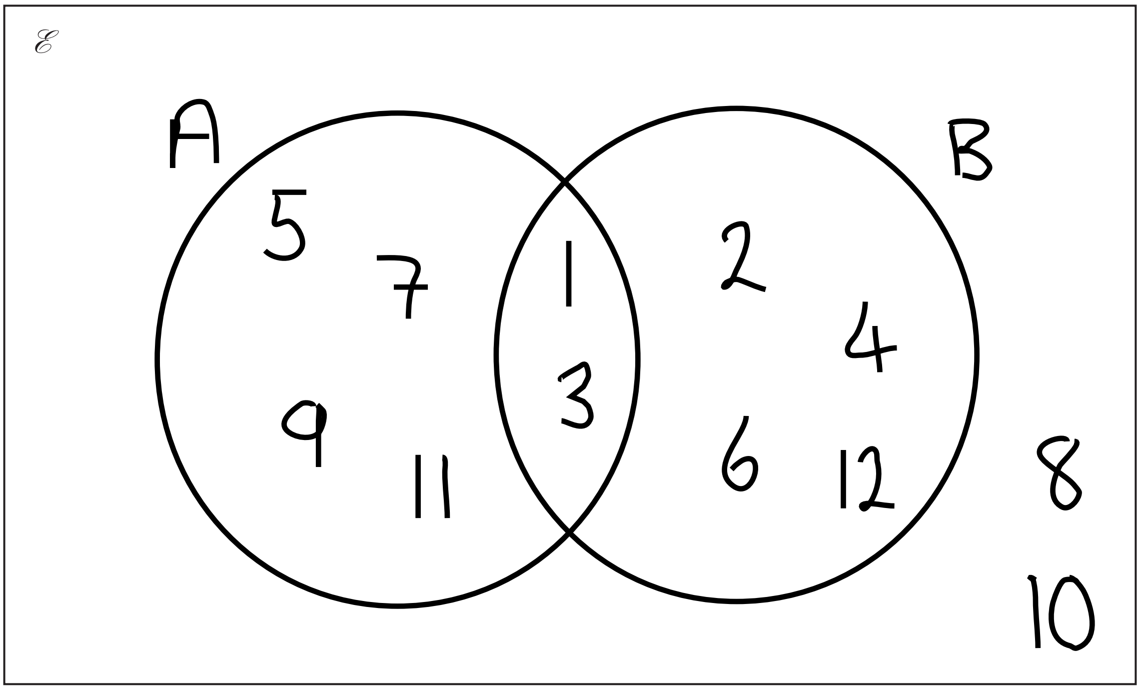
$A = \{\text{odd numbers}\}$

$A \cap B = \{1, 3\}$ ← union (A AND B) = the bit in the middle

$A \cup B = \{1, 2, 3, 4, 5, 6, 7, 9, 11, 12\}$ ← these must go in A if they are odd and B if they are not

Draw a Venn diagram to show this information.

the remaining numbers go outside the circles



(Total for Question 4 is 4 marks)

5 Calvin has 12 identical rectangular tiles.
He arranges the tiles to fit exactly round the edge of a shaded rectangle, as shown in the diagram below.

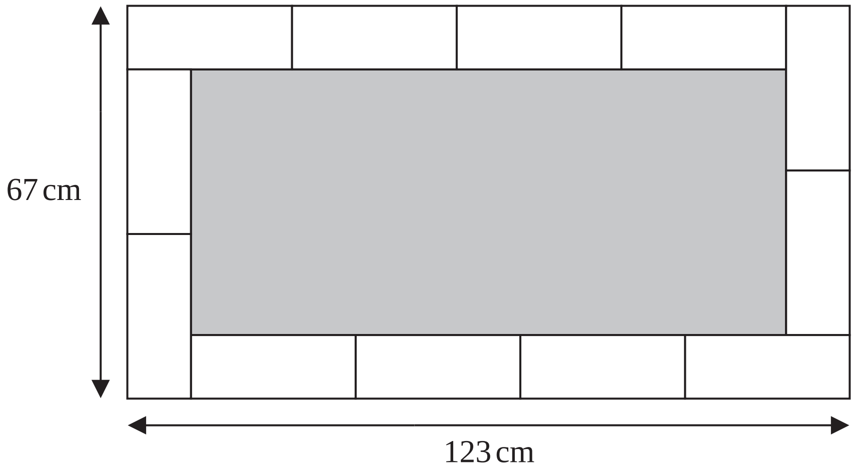


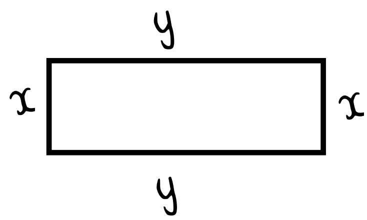
Diagram **NOT** accurately drawn

Work out the area of the shaded rectangle.

let:

short side = x

long side = y



vertical:

1 $2y + x = 67$

horizontal:

2 $4y + x = 123$

solve simultaneous equations by subtraction

2 − 1 ⇒

$$\begin{aligned} 4y + x &= 123 \\ 2y + x &= 67 \\ \hline 2y \quad &= 56 \\ y &= 56 \div 2 \\ y &= 28\text{cm} \end{aligned}$$

$$\begin{aligned} 2y + x &= 67 \\ 2(28) + x &= 67 \\ x &= 11\text{cm} \end{aligned}$$

$$\begin{aligned} \text{length} &= 3y + (y - x) \\ &= 4y - x \\ &= 4(28) - 11 \\ &= 101\text{cm} \end{aligned}$$

$$\begin{aligned} \text{height} &= y + (y - x) \\ &= 2y - x \\ &= 2(28) - 11 \\ &= 45\text{cm} \end{aligned}$$

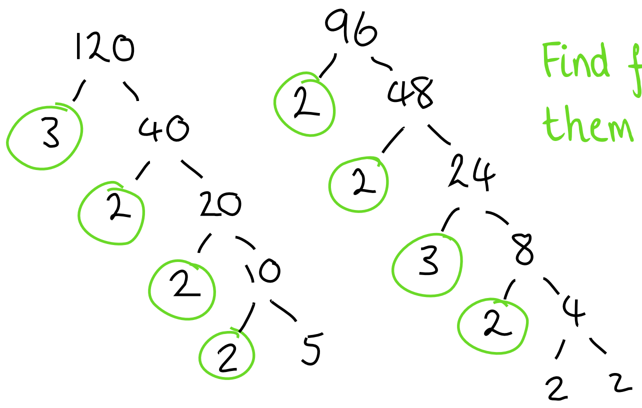
$$\begin{aligned} \text{area} &= \text{length} \times \text{height} \\ &= 101 \times 45 \\ &= 4545\text{cm} \end{aligned}$$

4545 cm^2

(Total for Question 5 is 5 marks)

P 5 9 0 1 9 A 0 6 2 4

6 (a) Find the highest common factor (HCF) of 96 and 120



Find factors in both lists and multiply them together.

$2 \times 2 \times 2 \times 3 = 24$

HCF = 24

(2)

$A = 2^3 \times 5 \times 7^2 \times 11$
$B = 2^4 \times 7 \times 11$
$C = 3 \times 5^2$

(b) Find the lowest common multiple (LCM) of A, B and C.

To find LCM, raise each factor to the highest power it appears to in the list.

$\text{LCM} = 2^4 \times 3^1 \times 5^2 \times 7^2 \times 11^1$

$= 646800$

(2)

(Total for Question 6 is 4 marks)

7 Jenny invests \$8500 for 3 years in a savings account.
She gets 2.3% per year compound interest.

(a) How much money will Jenny have in her savings account at the end of 3 years?
Give your answer correct to the nearest dollar.

final amount = starting amount X (1 + interest rate)

final amount = $8500 \times (1 + 0.023)^3$
= 9100.092...
= \$9100

\$ 9100

(3)

Rami bought a house on 1st January 2015

In 2015, the house increased in value by 15%
In 2016, the house decreased in value by 8%

On 1st January 2017, the value of the house was \$687 700

(b) What was the value of the house on 1st January 2015?

let V = value on 1st Jan 2015

$0.92 \times 1.15V = 687\,700$ 15% increase = X 1.15
1.058V = 687 700 8% decrease = X 1 - 0.08 = 0.92
V = 650 000

\$ 650 000

(3)

(Total for Question 7 is 6 marks)

8 A block of wood has a mass of 3.5 kg.
The wood has density 0.65 kg/m^3

(a) Work out the volume of the block of wood.
Give your answer correct to 3 significant figures.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$0.65 = \frac{3.5}{V}$$

$\times V, \div 0.65$ $\times V, \div 0.65$

$$V = \frac{3.5}{0.65}$$

$$V = 5.38\text{m}^3$$

5.38 m^3
(3)

(b) Change a speed of 630 kilometres per hour to a speed in metres per second.

1 hour = 60 mins
1 min = 60 seconds

630 km/h ÷ 60 = 10.5 km/min
10.5 km/min ÷ 60 = 0.175 km/s

0.175 X 1000 = 175 m/s 1 km = 1000 m

175 m/s
(3)

(Total for Question 8 is 6 marks)

9 Solve the simultaneous equations

$$4x + 5y = 4$$
$$2x - y = 9$$

Show clear algebraic working.

① $4x + 5y = 4$

② $2x - y = 9$

② $\times 2 \Rightarrow 4x - 2y = 18$ ③

③ − ① $\Rightarrow$

$$\begin{aligned} 4x - 2y &= 18 \\ 4x + 5y &= 4 \\ \hline -7y &= 14 \\ -y &= 2 \\ y &= -2 \end{aligned}$$

÷7 ÷7 ×−1 ×−1

$$\begin{aligned} 2x - y &= 9 \\ 2x - (-2) &= 9 \\ 2x &= 7 \\ x &= 3.5 \end{aligned}$$

−2 −2 ÷2 ÷2

$x =$ 3.5

$y =$ -2

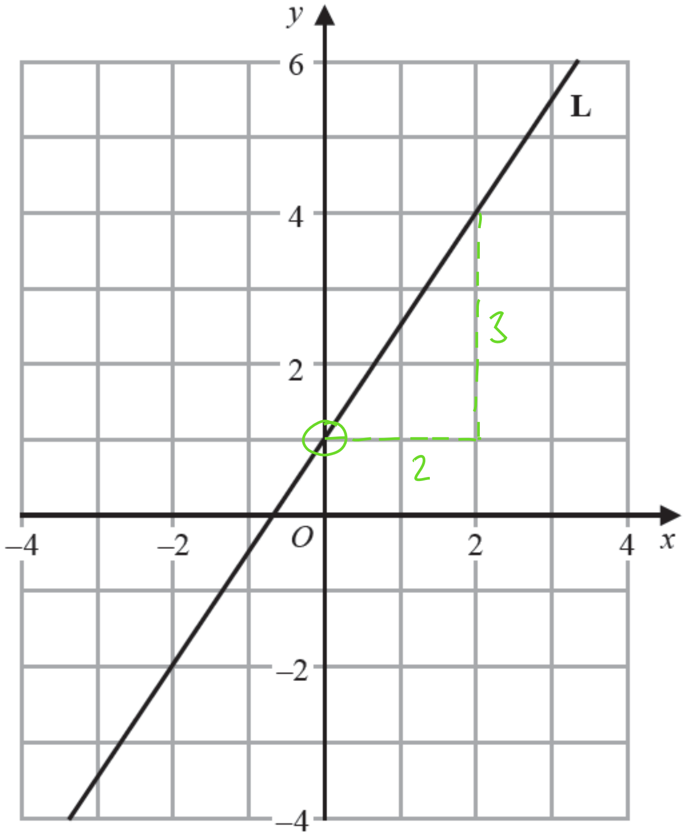
(Total for Question 9 is 3 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

P 5 9 0 1 9 A 0 1 0 2 4

DO NOT WRITE IN THIS AREA

10 The line **L** is drawn on the grid.



Find an equation for **L**.

y-intersect at $y = 1$

gradient $m = 3 \div 2 = 1.5$

gradient

$y = mx + c$ y-intersect

$y = 1.5x + 1$

(Total for Question 10 is 3 marks)

11 Twenty students took a Science test and a Maths test.

Both tests were marked out of 50

The table gives information about their results.

	Median	**Interquartile range**
Science	27	18
Maths	24.5	11

Use this information to compare the Science test results with the Maths test results.
Write down **two** comparisons.

1 Overall students have a higher mark in science.

2 Results are more consistent for maths.

(Total for Question 11 is 2 marks)

DO NOT WRITE IN THIS AREA

12 (a) Simplify n^0

anything to the power of 0 is 1

$n^0 = 1$

(1)

(b) Simplify $(3x^2y^5)^3$

$(a^n)^m = a^{n \times m}$

$(3x^2y^5)^3 = 3^3 \times x^{2\times 3} \times y^{5\times 3}$
$= 27x^6y^{15}$

(2)

(c) Factorise fully $2e^2 - 18$

two is a common factor

$2e^2 - 18 = 2\underbrace{(e^2 - 9)}_{}= 2(e+3)(e-3)$

this is the difference of two squares

(2)

(d) Make r the subject of $m = \sqrt{\dfrac{6a + r}{5r}}$

$m = \sqrt{\dfrac{6a+r}{5r}}$

2 $\quad$ 2

$m^2 = \dfrac{6a+r}{5r}$

$\times 5r$ $\quad$ $\times 5r$

$5rm^2 = 6a + r$

$-r$ $\quad$ $-r$

$5rm^2 - r = 6a$

take out r as a factor

$r(5m^2 - 1) = 6a$

$\div 5m^2 - 1$ $\quad$ $\div 5m^2 - 1$

$r = \dfrac{6a}{5m^2 - 1}$

(4)

(Total for Question 12 is 9 marks)

13 The frequency table gives information about the numbers of mice in some nests.

Number of mice	Frequency
5	4
6	13
7	16
8	x
9	6

$$\text{mean} = \frac{\text{sum of data points}}{\text{number of data points}}$$

The mean number of mice in a nest is 7

Work out the value of x.

$$\frac{(5 \times 4) + (6 \times 13) + (7 \times 16) + 8x + (9 \times 6)}{4 + 13 + 16 + x + 6} = 7$$

$$\frac{264 + 8x}{39 + x} = 7 \quad \times(39 + x)$$

$$264 + 8x = 7(39 + x) \quad \text{expand}$$

$$264 + 8x = 273 + 7x \quad -7x$$

$$264 + x = 273 \quad -264$$

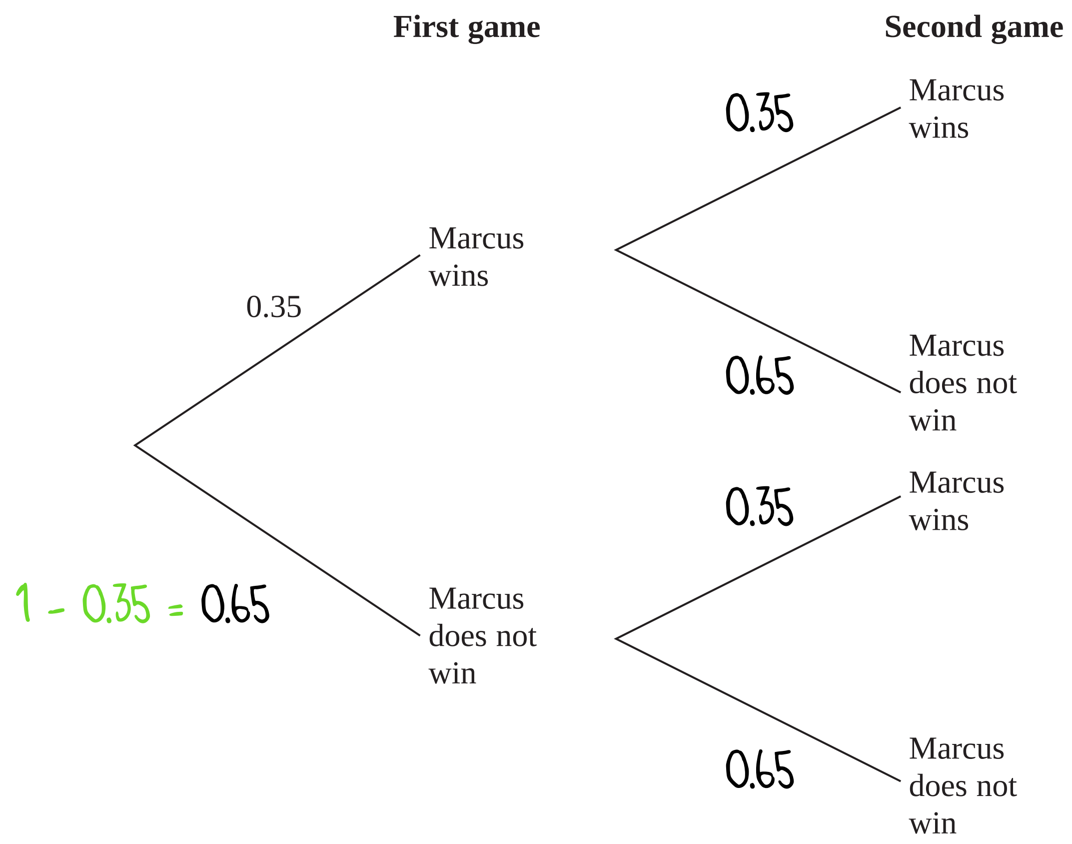
$$x = 9$$

$x =$ 9

(Total for Question 13 is 4 marks)

14 Marcus plays two games of tennis.
For each game, the probability that Marcus wins is 0.35

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Marcus wins at least one of the two games of tennis.

'wins at least one' could be:

wins and wins $0.35 \times 0.35 = 0.1225$

wins and loses $0.35 \times 0.65 = 0.2275$

loses and wins $0.65 \times 0.35 = 0.2275$

OR is +
AND is X

$0.1225 + 0.2275 + 0.2275 = 0.5775$

(3)

(Total for Question 14 is 5 marks)

15 The diagram shows a trapezium.

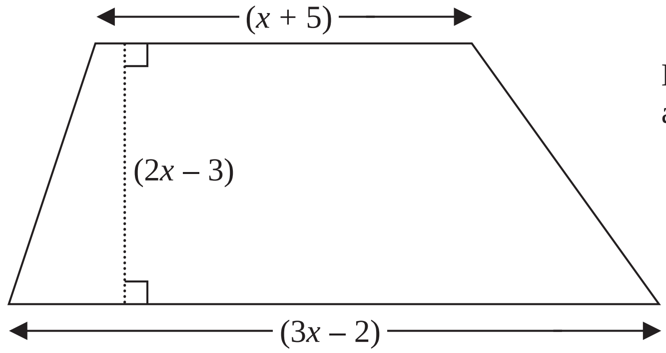


Diagram **NOT** accurately drawn

All measurements shown on the diagram are in centimetres.

The area of the trapezium is 133 cm^2

(a) Show that $8x^2 - 6x - 275 = 0$

area of a trapezium $= \frac{1}{2}(a \times b)\,h$

$133 = \frac{1}{2}((x+5)+(3x-2)) \times (2x-3)$

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

$= \frac{1}{2}(8x^2 - 6x - 9)$ $\times 2$

$266 = 8x^2 - 6x - 9$ $\times 2$

$0 = 8x^2 - 6x - 275$ -266 266

(3)

(b) Find the value of x.
Show your working clearly.

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

$\overset{a}{8x^2} - \overset{b}{6x} - \overset{c}{9} = 0$

$$\frac{--6 \pm \sqrt{6^2 - (4 \times 8 \times -9)}}{2 \times 8}$$

$$= \frac{6 \pm \sqrt{8836}}{16}$$

$= 6.25$ or -5.5

$x =$ 6.25

(3)

length cannot be negative so $x = 6.25$

(Total for Question 15 is 6 marks)

16 The diagram shows two mathematically similar vases, **A** and **B**.

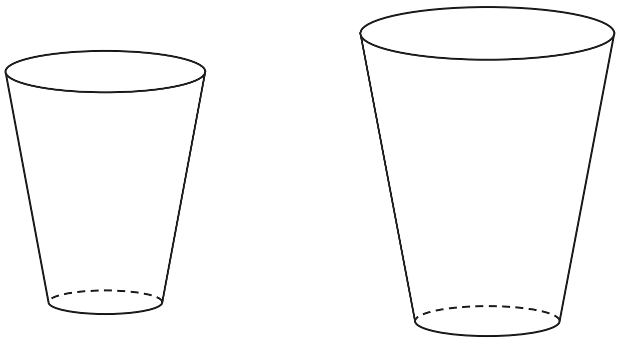


Diagram **NOT** accurately drawn

A has a volume of 405 cm^3
B has a volume of 960 cm^3

B has a surface area of 928 cm^2

Work out the surface area of **A**.

$\sqrt[3]{\frac{405}{960}} = \frac{3}{4}$

B is $\times\frac{3}{4}$ bigger than A

$\left(\frac{3}{4}\right)^{2} \times 928 = 522\text{ cm}^2$

2 for surface area

3 for volume

522 cm^2

(Total for Question 16 is 3 marks)

17 f is the function such that $f(x) = 4 - 3x$

(a) Work out f(5)

$f(5) = 4 - 3(5)$ replace x with 5

$= 4 - 15$

$= -11$

(1)

g is the function such that $g(x) = \dfrac{1}{1 - 2x}$

(b) Find the value of x that cannot be included in any domain of g

Cannot divide by 0, so set denominator to 0:

$1 - 2x = 0$

domain is the INPUT values of x

$1 = 2x \quad x = \frac{1}{2}$

(1)

(c) Work out fg(−1.5)

replace any x in $f(x)$ with $g(x)$

$fg(x) = 4 - 3\left(\frac{1}{1-2x}\right)$

$= 4 - \dfrac{3}{1-2(-1.5)}$

$= 4 - \dfrac{3}{4}$

$= \dfrac{13}{4}$ or 3.25

(2)

(Total for Question 17 is 4 marks)

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18 $P = \dfrac{a}{m - x}$

$x = 8$ correct to 1 significant figure
$a = 4.6$ correct to 2 significant figures
$m = 20$ correct to the nearest 10

Calculate the lower bound of P.
Show your working clearly.

lowest = $\dfrac{\text{lowest}}{\text{highest}}$ highest = highest - lowest

$7.5 < x \leq 8.5$
$4.55 < a \leq 4.65$
$15 < m \leq 25$

lowest

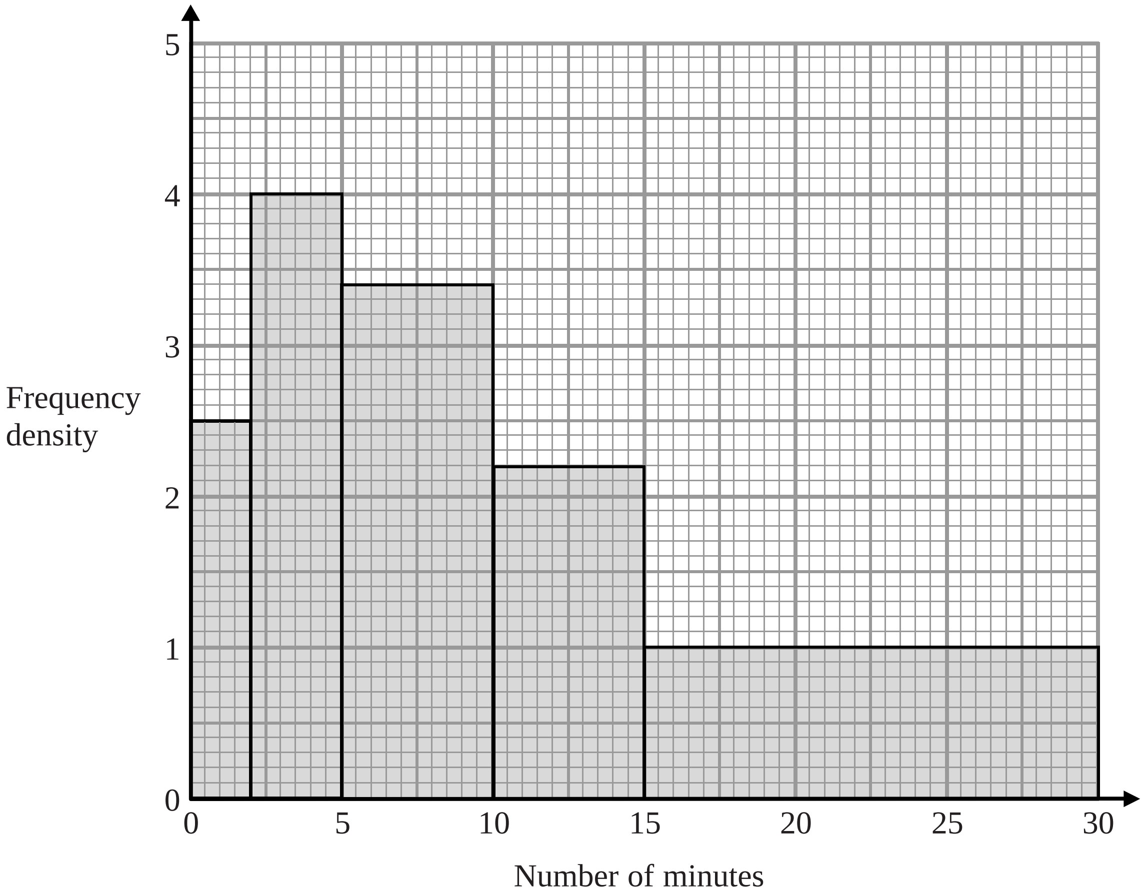
lowest P = $\dfrac{4.55}{25 - 7.5} = 0.26$

makes lowest

$0.26 < P$

(Total for Question 18 is 4 marks)

19 The histogram shows information about the numbers of minutes some people waited to be served at a Post Office.



Work out an estimate for the proportion of these people who waited longer than 20 minutes to be served.

frequency = frequency density X class width
= 1 X (30 - 15)
= 15 people

20-30 is $\frac{2}{3}$ of the bloch

$15 \times \frac{2}{3} = 10$ people who waited longer than 20 minutes

total people = $(2.5 \times 2) + (4 \times 3) + (3.4 \times 5) + (2.2 \times 5) + (1 \times 15)$
= 60

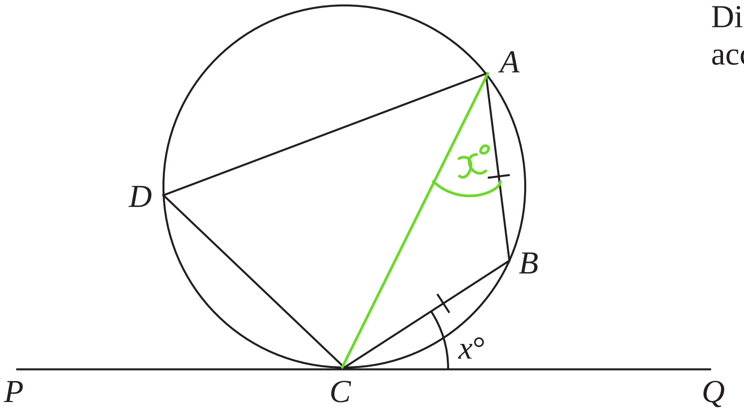
10 out of 60 = $\frac{10}{60} = \frac{1}{6}$ people

(Total for Question 19 is 3 marks)

P 5 9 0 1 9 A 0 2 0 2 4

20

Diagram **NOT** accurately drawn



A, *B*, *C* and *D* are points on a circle.
PCQ is a tangent to the circle.
AB = *CB*.

Angle *BCQ* = $x°$

Prove that angle *CDA* = $2x°$
Give reasons for each stage in your working.

$C\hat{A}B = x°$ alternate segment theorem (with theoretical line CA)

$C\hat{B}A = 180° - 2x°$ opposite angles in an isosceles triangle are equal
angles in a triangle sum to 180°

$C\hat{D}A = 180° - (180° - 2x°) = 2x°$ opposite angles of a cyclic quadrilateral sum to 180°

(Total for Question 20 is 5 marks)

21 Line **L** has equation $4y - 6x = 33$
Line **M** goes through the point A (5, 6) and the point B (−4, k)

L is perpendicular to **M**.

Work out the value of k.

L

$4y - 6x = 33$
$4y = 6x + 33$
$y = \frac{3}{2}x + \frac{33}{4}$

$m_2 \times \frac{3}{2} = -1$
$m_2 = -\frac{2}{3}$

or use gradient knowledge:

$\frac{k-6}{-4-5} = -\frac{2}{3}$

$3(k-6) = -2(-9)$
$3k - 18 = 18$
$3k = 36$
$k = 12$

M

$y - y_1 = m_2(x - x_1)$
$y - 6 = -\frac{2}{3}(x - 5)$
$y = -\frac{2}{3}x + \frac{8}{3}$

when $x = -4$:
$y = -\frac{2}{3}(-4) + \frac{8}{3}$
$= 12$
$K = 12$

(Total for Question 21 is 4 marks)

22 The diagram shows a cone.

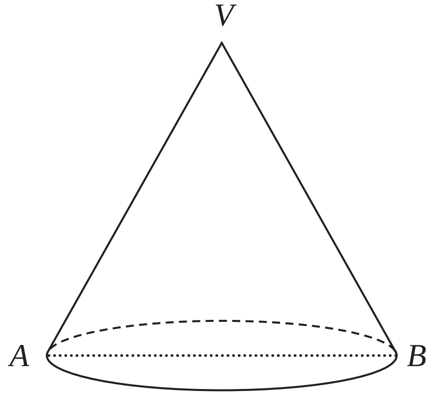


Diagram **NOT** accurately drawn

AB is a diameter of the cone.
V is the vertex of the cone.

Given that

the area of the base of the cone : the total surface area of the cone = 3 : 8

work out the size of angle *AVB*.
Give your answer correct to 1 decimal place.

base area $= \pi r^2$ total surface area $= \pi r^2 + \pi r l$

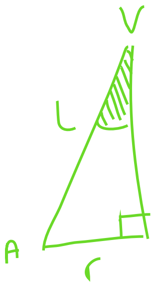
cancel because $\pi r^2 = 3$

$\pi r^2 : \cancel{\pi r^2} + \pi r l = 3 : 8$

$\pi r^2 : \pi r l = 3 : 5$ 8-3

$\pi r^2 = 3 \rightarrow r^2 = \frac{3}{\pi} \rightarrow r = \sqrt{\frac{3}{\pi}} = 0.9772...$

$\pi r l = 5 \rightarrow l = \frac{5}{r\pi} \rightarrow l = \frac{5}{\pi\sqrt{\frac{3}{\pi}}} = 1.62...$



$\sin = \frac{O}{H} = \frac{r}{l}$

$\sin\left(\frac{AVB}{2}\right) = \frac{r}{l}$

$= \frac{0.9772...}{1.62...}$

$= \frac{3}{5}$

keep values accurate by storing in your calculator or leaving in exact form

$\sin^{-1}(3/5) = 36.869...$

$2 \times 36.869... = 73.7$

73.7 °

(Total for Question 22 is 6 marks)

23 *ABCD* is a trapezium.

$\overrightarrow{DC} = 3\overrightarrow{AB}$

$\overrightarrow{DA} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\qquad \overrightarrow{DB} = \begin{pmatrix} -1 \\ 7 \end{pmatrix}$

Find the exact magnitude of $\overrightarrow{BC}$

$$\overrightarrow{AB} = \overrightarrow{AD} + \overrightarrow{DB} = \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -1 \\ 7 \end{pmatrix} = \begin{pmatrix} 2-1 \\ -3+7 \end{pmatrix} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

$$\overrightarrow{DC} = 3(\overrightarrow{AB}) = 3\begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} 3 \\ 12 \end{pmatrix}$$

$$\overrightarrow{BC} = \begin{pmatrix} 1 \\ -7 \end{pmatrix} + \begin{pmatrix} 3 \\ 12 \end{pmatrix} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$$

$$|\overrightarrow{BC}| = \sqrt{4^2 + 5^2}$$

$$= \sqrt{16+25}$$

$$= \sqrt{41}$$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

DO NOT WRITE IN THIS AREA
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