Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number	Candidate Number

Thursday 6 June 2019

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

Mathematics A
Level 1/2
Paper 2H
Higher Tier

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 ▶

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

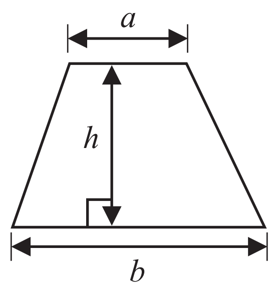
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

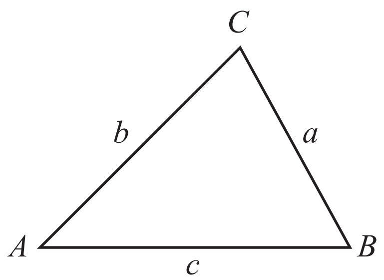
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

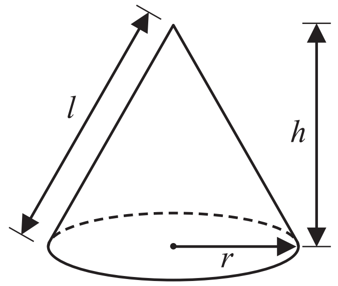
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

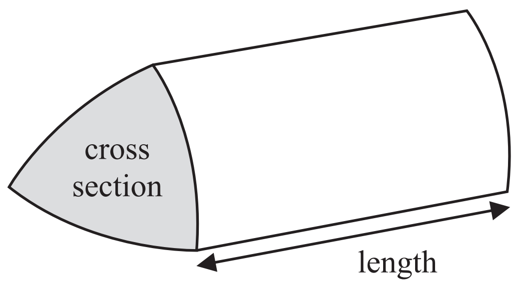
Area of triangle $= \frac{1}{2}ab\sin C$

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

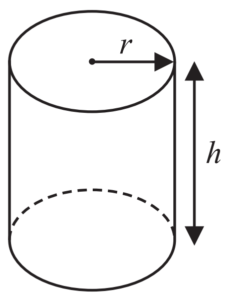
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

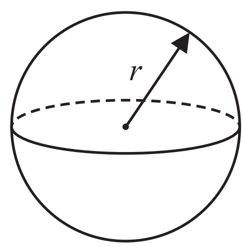


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

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



Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The table shows information about the heights, in cm, of 48 sunflowers in a garden centre.

Height of sunflower (h cm)	**Frequency**	midpoint x
$90 < h \leqslant 100$	8	95
$100 < h \leqslant 110$	12	105
$110 < h \leqslant 120$	15	115
$120 < h \leqslant 130$	10	125
$130 < h \leqslant 140$	3	135
	48	

Work out an estimate for the mean height of the sunflowers.

$$\text{Mean} = \frac{\Sigma f x}{\Sigma f}$$

$$= \frac{95 \times 8 + 105 \times 12 + 115 \times 15 + 125 \times 10 + 135 \times 3}{48}$$

$$= \frac{760 + 1260 + 1725 + 1250 + 405}{48}$$

$$= \frac{5400}{48}$$

112.5 .... cm

(Total for Question 1 is 4 marks)

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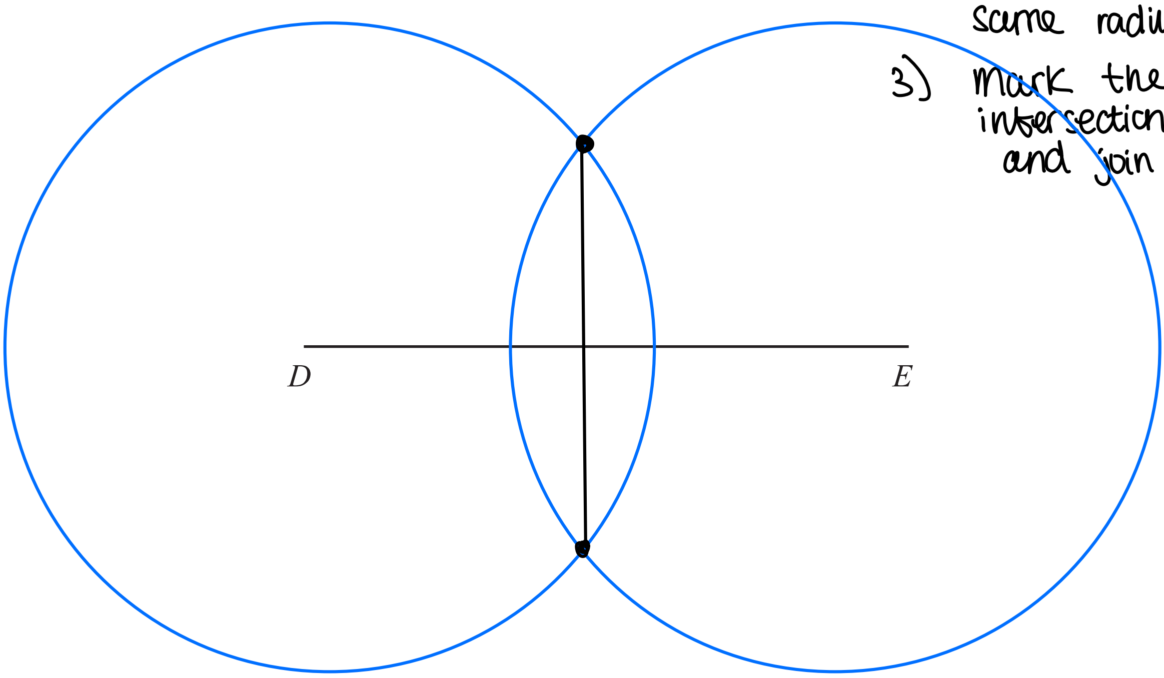
2 Use ruler and compasses to construct the perpendicular bisector of the line *DE*.
You must show all your construction lines.

1) Draw a circle centre D

2) Draw a circle centre E with the same radius

3) Mark the intersection points and join.



(Total for Question 2 is 2 marks)

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

Empty set

(a) Explain why $A \cap B = \varnothing$

There are no members that are in set A and Set B

(1)

$x \in \mathscr{E}$ and $x \notin A \cup B$ – x is not a subset of A or B

Not in list A or B

(b) Write down the **two** possible values of x.

x can't be: $\underbrace{2, 3, 5, 7}_{A}, \underbrace{4, 6, 8, 10}_{B}$

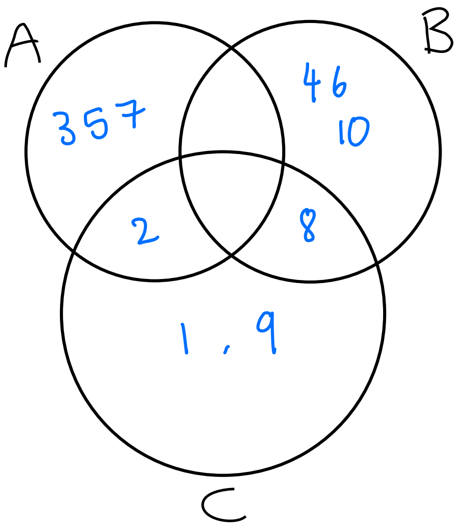
1 , 9

(1)

Set C is such that

$A \cup B \cup C = \mathscr{E}$ – 1 and 9 are in C
$A \cap C = \{2\}$ – 2 is in A and C
$B \cap C' = \{4, 6, 10\}$ not in C

(c) List all the members of set C.



1, 2, 8, 9

(2)

(Total for Question 3 is 4 marks)

4 A cylinder has diameter 14 cm and height 20 cm.

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

Volume = $\pi r^2 \times h$

Radius = $14 \div 2 = 7$ cm

Volume $= \pi \times 7^2 \times 20$

$= 980\pi$

$= 307\underline{8}.76$

round up

$= 3080$ (3sf)

3080 cm^3

(Total for Question 4 is 2 marks)

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5 Josh buys and sells books for a living.

He buys 120 books for £4 each.

He sells $\frac{1}{2}$ of the books for £5 each.

He sells 40% of the books for £7 each.
He sells the rest of the books for £8 each.

(a) Calculate Josh's percentage profit.

Josh's Cost: 120 × 4 = £48

Sells ½ × 120 for £5 : 60 × 5 = £300

Sells 40% of 120 for £7 : 48 × 7 = £336

sells 120 − 60 − 48 for £8 : 12 × 8 = £96

Josh's Revenue : 300 + 336 + 96 = £736

$$\text{Profit}: \frac{\overset{\text{difference}}{732-480}}{\underset{\text{original}}{480}} \times 100 = \overset{\text{percentage}}{52.5}$$

52.5 %

(5)

One book that Josh owns had a value of £15 on the 1st May 2019
The value of this book had increased by 20% in the last year.

(b) Find the value of the book on the 1st May 2018

Increase : 100% + 20% = 120%

120% = £15 ÷12

10% = £1.25 ×10

100% = £12.50

£ 12.50

(3)

(Total for Question 5 is 8 marks)

6 *ABC* and *DEF* are similar triangles.

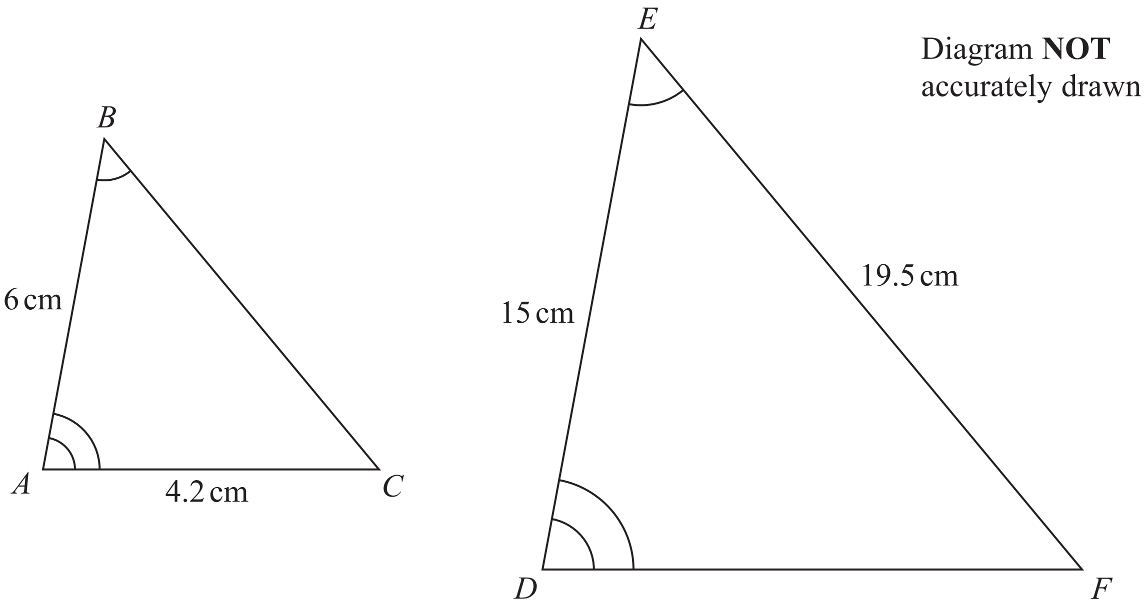

Diagram **NOT** accurately drawn

(a) Work out the length of *DF*.

scale factor : $15 \div 6 = 2.5$

$DF : AC \times 2.5$

$= 10.5$

10.5 cm

(2)

(b) Work out the length of *BC*.

Scale factor : 2.5

$BC = EF \div 2.5$

$= 19.5 \div 2.5$

$= 7.8$

7.8 cm

(2)

(Total for Question 6 is 4 marks)

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7 30 students in a class sat a Mathematics test.
The mean mark in the test for the 30 students was 26.8

13 of the 30 students in the class are boys.
The mean mark in the test for the boys was 25

Find the mean mark in the test for the girls.
Give your answer correct to 3 significant figures.

$$\text{Mean} = \frac{\text{Total}}{\text{Freq}}$$

For all students: $26.8 = \frac{\text{Total}}{30}$ Total $= 30 \times 26.8 = 804$

For boys: $25 = \frac{\text{Total}}{13}$ Total: $13 \times 25 = 325$

For girls: Total: $804 - 325 = 479$

$$\text{Mean} = \frac{479}{17} = 28.17$$

round up

.......28.2.......

(Total for Question 7 is 3 marks)

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8 Change a speed of x kilometres per hour into a speed in metres per second.
Simplify your answer.

1 hour = 60 minutes

60×60

$$\frac{x\text{ km}}{1\text{ hour}} \times \frac{1000\text{m}}{1\text{km}} \times \frac{1\text{h}}{3600\text{sec}}$$

$$= \frac{1000x}{3600} \text{ m/s} = \frac{5x}{18} \text{ m/s}$$

.......$\frac{5x}{18}$....... m/s

(Total for Question 8 is 3 marks)

P 5 8 3 7 1 A 0 9 2 8

9 Solve the simultaneous equations

$$x + 2y = -0.5 \quad ①$$
$$3x - \ y = \ 16 \quad ②$$

Show clear algebraic working.

① $x + \cancel{2y} = -0.5$

②×2 $6x - \cancel{2y} = 32$ + add to cancel y term

$7x = 31.5$

$x = 4.5$

Sub into ② $3(4.5) - y = 16$ +y, -16

$y = 13.5 - 16$

$y = -2.5$

$x =$ 4.5

$y =$ −2.5

(Total for Question 9 is 3 marks)

10 The straight line **L** has gradient 5 and passes through the point with coordinates (0, −3)

(a) Write down an equation for **L**.

m=5

y intercept
(c value)

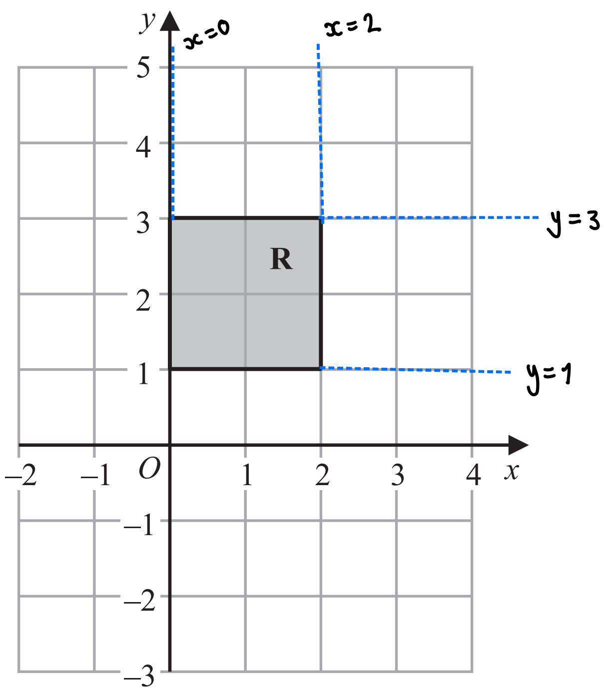
$y = mx + c$

$y = 5x - 3$

$y = 5x - 3$

(2)

(b)



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

Write down the inequalities that define **R**.

Line are full - ≤ and ≥

All y values are between 1 and 3

All x values are between 0 and 2

$1 \leqslant y \leqslant 3$ and $0 \leqslant x \leqslant 2$

(2)

(Total for Question 10 is 4 marks)

11 The table gives the average crowd attendance per match for each of five football clubs for one season.

Football club	Average crowd attendance
Monaco	9.5×10^3
Chelsea	4.2×10^4
Juventus	3.9×10^4
Oxford United	8.3×10^3
Barcelona	7.7×10^4

(a) Find the difference between the average crowd attendance for Barcelona and the average crowd attendance for Monaco.
Give your answer in standard form.

$(7.7 \times 10^4) - (9.5 \times 10^3)$

$= 77000 - 9500 = 67500$

1 2 3 4

6.75×10^4

(2)

Antonio says,

"The average crowd attendance for Chelsea is approximately 50 times that for Oxford United."

(b) Is Antonio correct?
You must give a reason for your answer.

Oxford : 8.3×10^3

Antonio's statement : $8.3 \times 10^3 \times 50 = 415{,}000$

Chelsea $= 4.2 \times 10^4 = 42000$

No, Antonio is incorrect, 50times of Oxford is 415,000 where as Chelsea is 42000. Antonio is off by a factor of 10.

(2)

During last season the cost of a ticket to watch Seapron United increased by 15% and then decreased by 8%

(c) Work out the overall percentage change in the cost of a ticket to watch Seapron United during last season.

Let x = the cost of the ticket

Increase by 15% : $100\% + 15\% = 115\% = \times 1.15$
$= 1.15x$

Decrease by 8% : $100\% - 8\% = 92\% = \times 0.92$
$= 1.15x \times 0.92 = 1.058x$

Change :
$1.058x - x =$
$(x)\ 0.058$ percentage $\times 100$
$= 5.8\%$

5.8 %

(2)

(Total for Question 11 is 6 marks)

12 *ABCD* is a trapezium.

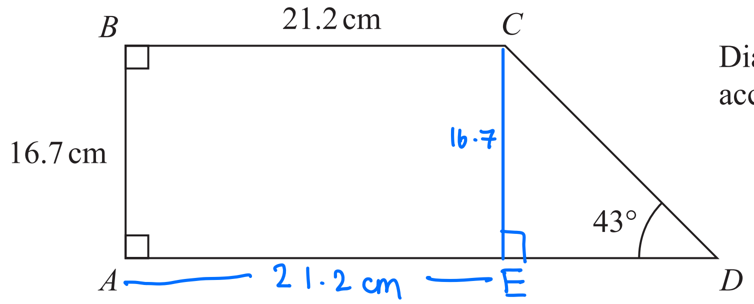


Diagram **NOT** accurately drawn

Calculate the perimeter of the trapezium.
Give your answer correct to 3 significant figures.

$\tan\theta = \frac{opp}{adj}$ $\sin\theta = \frac{opp}{hyp}$

ED : $\tan 43 = \frac{16.7}{ED}$

$ED = \frac{16.7}{\tan 43} = 17.90\ldots$ cm

CD : $\sin 43 = \frac{16.7}{CD}$

$CD = \frac{16.7}{\sin 43} = 24.486\ldots$ cm

Perimeter: $21.2 + 16.7 + 21.2 + 24.486.. + 17.90$

$= 101.486..$

round down

$= 101$ (3sf)

3sf ....101.......... cm

(Total for Question 12 is 4 marks)

13 The table gives information about the times taken, in minutes, for 80 taxi journeys.

Time taken (*t* minutes)	**Frequency**
$0 < t \leqslant 5$	7
$5 < t \leqslant 10$	10
$10 < t \leqslant 15$	12
$15 < t \leqslant 20$	19
$20 < t \leqslant 25$	18
$25 < t \leqslant 30$	14

(a) Complete the cumulative frequency table.

Time taken (*t* minutes)	**Cumulative frequency**	
$0 < t \leqslant 5$	7	
$0 < t \leqslant 10$	17	+10
$0 < t \leqslant 15$	29	+12
$0 < t \leqslant 20$	48	+19
$0 < t \leqslant 25$	66	+18
$0 < t \leqslant 30$	80	+14

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

Curve, plotted at upper bound

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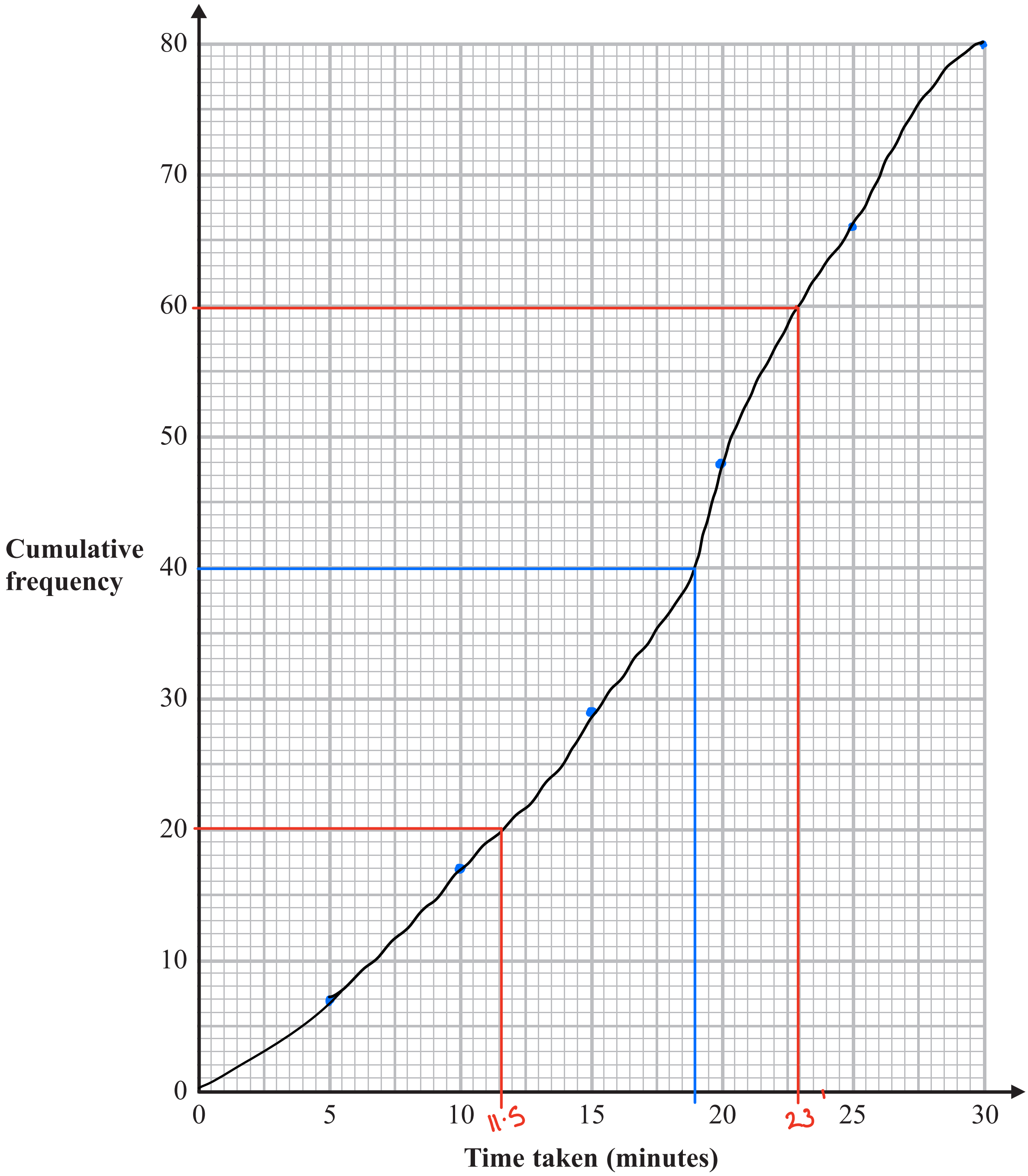

(2)

(c) Use your graph to find an estimate for the median.

$\frac{80}{2} = 40$ 40 th value

19 ....minutes

(1)

(d) Use your graph to find an estimate for the interquartile range.

25% of 80 = 20th value – 11.5

75% of 80 = 60th value – 23

23 – 11.5

11.5 ....minutes

(2)

(Total for Question 13 is 6 marks)

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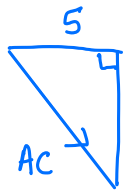
14 Here are two vectors.

$$\overrightarrow{AB} = \begin{pmatrix} 6 \\ -9 \end{pmatrix} \qquad \overrightarrow{CB} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$$

Find the magnitude of $\overrightarrow{AC}$.

$$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$$
$$= \overrightarrow{AB} - \overrightarrow{CB}$$
$$= \begin{pmatrix} 6 \\ -9 \end{pmatrix} - \begin{pmatrix} 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ -12 \end{pmatrix}$$



we can use Pythagoras' Theorem
$a^2 + b^2 = c^2$

$$\text{Magnitude} = \sqrt{5^2 + (-12)^2} = \sqrt{169}$$

13

(Total for Question 14 is 3 marks)

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15 Make x the subject of the formula $y = \sqrt{\dfrac{3x-2}{x+1}}$

isolate x

$$y = \sqrt{\frac{3x-2}{x+1}}$$

square each side

$$y^2 = \frac{3x-2}{x+1}$$

$\times (x+1)$

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

$-y^2x$
$+2$

rearrange to have all x terms on one side and non x terms on the other

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

Factorise x

$$y^2 + 2 = x(3 - y^2)$$

$\div (3 - y^2)$

$$\frac{y^2+2}{3-y^2} = x$$

$x = \dfrac{y^2+2}{3-y^2}$

(Total for Question 15 is 4 marks)

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16 Show that $\frac{4+\sqrt{8}}{\sqrt{2}-1}$ can be written in the form $a + b\sqrt{2}$, where a and b are integers.

Show each stage of your working clearly and give the value of a and the value of b.

$\sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}$

$: \frac{4 + 2\sqrt{2}}{\sqrt{2} - 1}$

Rationalise the denominator
$\times (\sqrt{2}+1)$

$2 \times \sqrt{2 \times 2} = 2 \times \sqrt{4}$
$= 2 \times 2$

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

$\sqrt{2} - \sqrt{2}$
terms cancel

$= \frac{6\sqrt{2} + 8}{1}$ - Simplify

$= 8 + 6\sqrt{2}$

$a = 8$
$b = 6$

(Total for Question 16 is 3 marks)

17 y is directly proportional to the cube of x
$y = 20h$ when $x = h$ $\quad (h \neq 0)$

(a) Find a formula for y in terms of x and h

$y \propto x^3$

$y = kx^3$ $\quad x = h$ $\quad y = 20h$

$y = kh^3$ — substitute $x = h$

equate equations

$kh^3 = 20h$

$k = \frac{20h}{h^3} = \frac{20}{h^2}$

calculate k value

substitute into $y = kx^3$

$y = \frac{20}{h^2} \times x^3$

$y = \frac{20x^3}{h^2}$

(3)

(b) Find x in terms of h when $y = 67.5h$
Give your answer in its simplest form.

$y = \frac{20}{h^2} x^3$

equate equations

$67.5h = \frac{20}{h^2} x^3$

$\div \left(\frac{20}{h^2}\right)$

$\frac{67.5h^3}{20} = x^3$

$\sqrt[3]{}$

$\sqrt[3]{\frac{67.5}{20} h^3} = x$

$x = 1.5h$

$x = 1.5h$

(2)

(Total for Question 17 is 5 marks)

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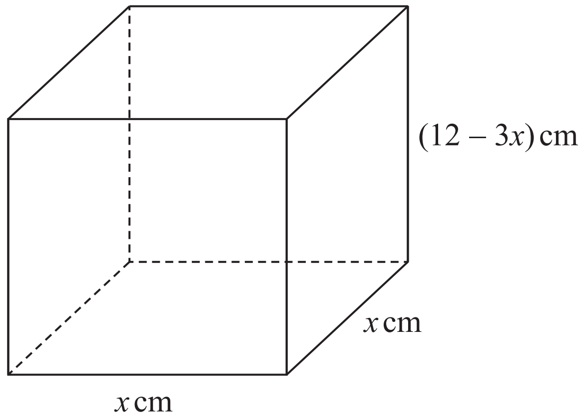
18 The diagram shows a solid cuboid.

Diagram **NOT** accurately drawn



The total surface area of the cuboid is A cm^2

Find the maximum value of A.

Surface Area (A) = $x \times x \times 2 = 2x^2$

$x(12 - 3x) \times 4 = 48x - 12x^2$

$= 2x^2 + 48x - 12x^2$

$A = 48x - 10x^2$

differentiate x

Max value : $\frac{dA}{dx} = 48 - 20x = 0$

max value is at stationary point

$48 - 20x = 0$

+20

$20x = 48$

÷20

$x = \frac{48}{20} = 2.4$

substitute into surface area

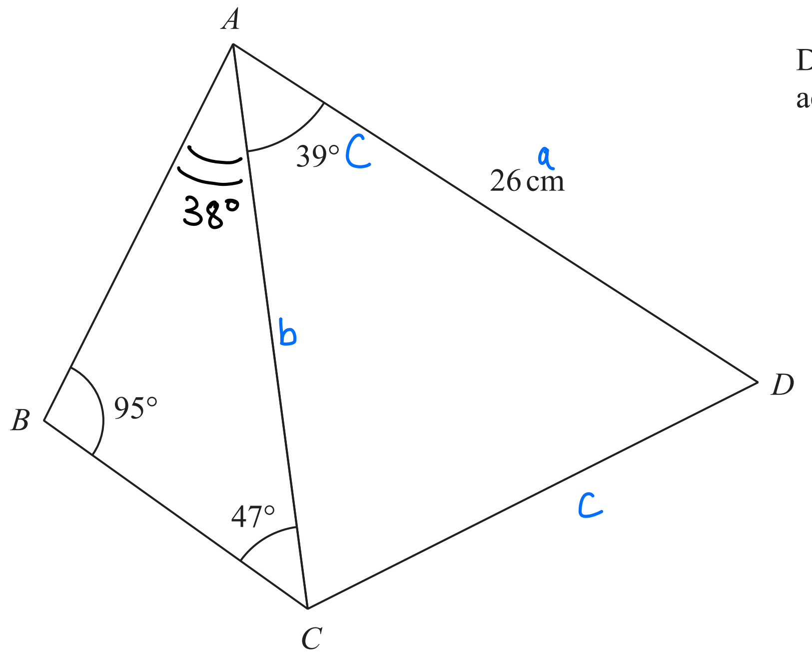
$A = 48(2.4) - 10(2.4)^2$

$= 115.2 - 57.6 =$

57.6

(Total for Question 18 is 5 marks)

19 *ABCD* is a quadrilateral.



$\frac{a}{\sin A} = \frac{b}{\sin B}$

The area of triangle *ACD* is 250 cm^2

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

Calculate the area of the quadrilateral *ABCD*.
Show your working clearly.
Give your answer correct to 3 significant figures.

Area : $\frac{1}{2} \times 26 \times b \times \sin 39 = 250$

$b \times 13\sin 39 = 250$

$b = \frac{250}{13\sin 39} = AC = 30.55\ldots$

$\angle BAC$: $180 - 95 - 47 = 38°$

$\frac{AB}{\sin 47} = \frac{AC}{\sin 95}$

$AB = \frac{30.5\ldots \sin 47}{\sin 95} = 22.434\ldots$

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P 5 8 3 7 1 A 0 2 0 2 8

Area of ABC :

$\frac{1}{2} \times 30.55... \times 22.43.. \times \sin 38$

$= 211.03...$

Area of quad : $211.03... + 250$

$= 461.\underline{\underline{0}}3...$

round down

$= 461$ (3sf)

461 cm^2

(Total for Question 19 is 6 marks)

20 The equation of the line **L** is $y = 9 - x$ ①
The equation of the curve **C** is $x^2 - 3xy + 2y^2 = 0$ ②

L and **C** intersect at two points.

Find the coordinates of these two points.
Show clear algebraic working.

Substitute ① into ②

$$x^2 - 3x(9-x) + 2(9-x)(9-x) = 0$$

$$x^2 - 27x + 3x^2 + 162 - 36x + 2x^2 = 0$$

$$6x^2 - 63x + 162 = 0$$

$\div 3$

$$\underset{a}{2}x^2 \underset{b}{- 21x} \underset{c}{+ 54} = 0$$

Quadratic Equation: $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{21 \pm \sqrt{(-21)^2 - 4 \times 2 \times 54}}{2 \times 2}$$

$$= \frac{21 \pm \sqrt{9}}{4} = \frac{21+3}{4} = 6$$

or

$$= \frac{21-3}{4} = \frac{18}{4} = 4.5$$

$x = 6$ or $x = 4.5$

$y = 9 - 6 = 3$ $\quad$ $y = 9 - 4.5 = 4.5$

$y = 3$ $\quad$ $y = 4.5$

(6 , 3) and (4.5 , 4.5)

(Total for Question 20 is 5 marks)

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21 The diagram shows cuboid *ABCDEFGH*.

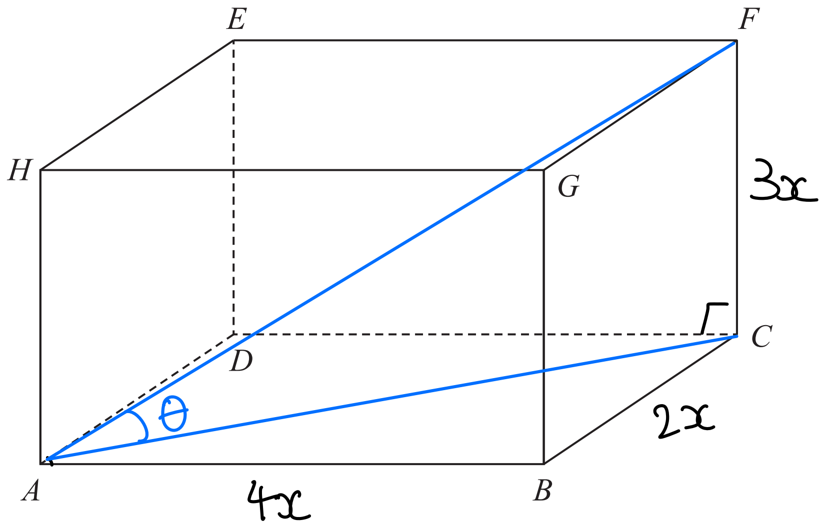

Diagram **NOT** accurately drawn

For this cuboid

the length of *AB* : the length of *BC* : the length of *CF* = 4 : 2 : 3

Calculate the size of the angle between *AF* and the plane *ABCD*.
Give your answer correct to one decimal place.

Pythagorous : $a^2 + b^2 = c^2$

$(4x)^2 + (2x)^2 = AC^2$

$16x^2 + 4x^2 = AC^2 = 20x^2$

$AC = \sqrt{20x^2}$

$= 2x\sqrt{5}$

$\tan\theta = \frac{opp}{adj}$

$\tan\theta = \frac{3\cancel{x}}{2\cancel{x}\sqrt{5}}$

$\theta = \tan^{-1}\left(\frac{3}{2\sqrt{5}}\right) = 33.854\ldots = 33.9\ (3sf)$

round up

33.9 °

(Total for Question 21 is 3 marks)

22 Simplify fully $\dfrac{6x^3 + 13x^2 - 5x}{4x^2 - 25}$ – Difference of two square

$6x^3 + 13x^2 - 5x = x(6x^2 + 13x - 5)$

Two numbers that × to $(6x-5) = -30$

and + to 13

15, −2

Split and factorise each side

$6x^2 + 15x \mid -2x - 5$

$3x(2x+5) \mid -(2x+5)$ ⟶ $(3x-1)(2x+5)$

$= x(3x-1)(2x+5)$

$4x^2 - 25 = (2x+5)(2x-5)$

$\sqrt{4}$ $\sqrt{25}$

change sign

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

....

(Total for Question 22 is 3 marks)

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23 Boris has a bag that only contains red sweets and green sweets.

Boris takes at random 2 sweets from the bag.

The probability that Boris takes exactly 1 red sweet from the bag is $\frac{12}{35}$

Originally there were 3 red sweets in the bag.

Work out how many green sweets there were originally in the bag.
Show your working clearly.

Total sweets = x
(R) Red sweets = 3
(G) Green sweets = $x - 3$

multiply

Exactly 1 red = R and G or G and R

P(Red and Green) $\frac{3}{x} \times \frac{x-3}{x-1} = \frac{3x-9}{x(x-1)}$

P(Green and Red) $\frac{x-3}{x} \times \frac{3}{x-1} = \frac{3x-9}{x(x-1)}$

P(1 red exactly) $= \frac{3x-9}{x(x-1)} + \frac{3x-9}{x(x-1)} = \frac{6x-18}{x^2-x}$

Equate Probabilities $\frac{6x-18}{x^2-x} = \frac{12}{35}$ cross multiply

$210x - 630 = 12x^2 - 12x$ All terms on one side
$-210x$
$+630$
$12x^2 - 222x + 630 = 0$
$\div 6$
$2x^2 - 37x + 105 = 0$ factorise

$\times$ to 210
$+$ to -37
$-30, -7$

$2x^2 - 30x + 7x + 105 = 0$
$2x(x-15) \; -7(x-15)$

$(2x-7)(x-15) = 0$

~~$x = 7/2$~~ $x = 15$

can't be 1/2 a sweet

$x = 15$
green = $15 - 3$

12

(Total for Question 23 is 5 marks)

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24 The function f is such that $f(x) = 3x - 2$

(a) Find f(5)

$3(5) - 2 = 15 - 2 = 13$

substitute 5 into f(x) by replacing x with 5

13

(1)

The function g is such that $g(x) = 2x^2 - 20x + 9$ where $x \geqslant 5$

(b) Express the inverse function g^{-1} in the form $g^{-1}(x) = \ldots$

complete the square

$g(x) = 2x^2 - 20x + 9$

$= 2(x^2 - 10x) + 9$

$-10/2 = -5$

$= 2[(x-5)^2 - 25] + 9$

$g(x) = 2(x-5)^2 - 41$ — $-50+9$

Find inverse

1) swap x and y
2) rearrange to make x the subject
3) swap y to x and x to $g^{-1}(x)$

$y = 2(x-5)^2 - 41$

+41

$y + 41 = 2(x-5)^2$

÷2

$\frac{y+41}{2} = (x-5)^2$

$\sqrt{\ }$

$\pm\sqrt{\frac{y+41}{2}} = x - 5$

$x \geqslant 5$ — discount −

+5

$5 + \sqrt{\frac{y+41}{2}} = x$

$g^{-1}(x) = 5 + \sqrt{\frac{x+41}{2}}$

$g^{-1}(x) =$ $5 + \sqrt{\frac{x+41}{2}}$

(4)

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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