

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	

Pearson Edexcel International GCSE

Wednesday 7 June 2023

Morning (Time: 2 hours)

Paper reference **4MA1/2H**

Mathematics A
PAPER 2H
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 ►

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International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

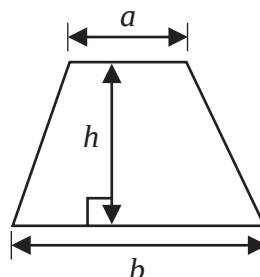
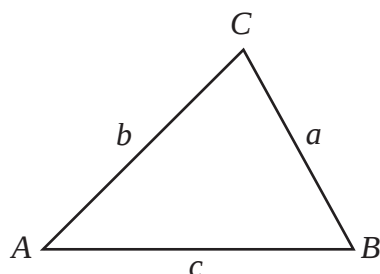
Sum to n terms, $S_n = \frac{n}{2} [2a + (n-1)d]$

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

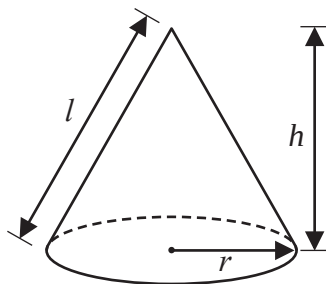
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

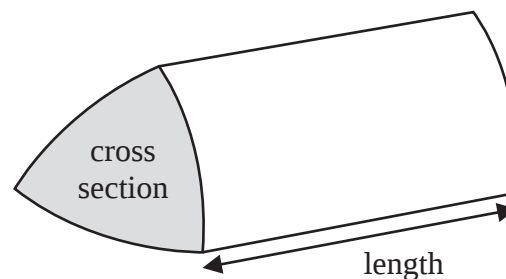
Volume of cone $= \frac{1}{3}\pi r^2 h$

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



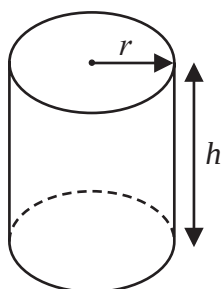
Volume of prism

$= \text{area of cross section} \times \text{length}$



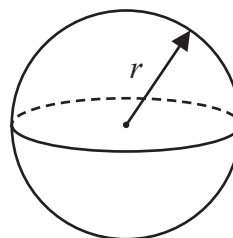
Volume of cylinder $= \pi r^2 h$

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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Answer ALL TWENTY FIVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Show that $4\frac{2}{3} \div 1\frac{1}{5} = 3\frac{8}{9}$

$$\frac{14}{3} \div \frac{6}{5} \quad (1)$$

$$= \frac{14}{3} \times \frac{5}{6} = \frac{70}{18} \div 2$$

$$= \frac{35}{9}$$

$$= \frac{9}{9} + \frac{9}{9} + \frac{9}{9} + \frac{8}{9} \quad (1)$$

$$= 3\frac{8}{9}$$

(Total for Question 1 is 3 marks)



- 2 A biased spinner can land on green or on yellow or on brown or on pink.

The table gives the probabilities that, when the spinner is spun, it will land on green or on yellow or on brown.

Colour	green	yellow	brown	pink
Probability	0.32	0.13	0.28	

Timucin spins the spinner 200 times.

Work out an estimate for the number of times the spinner lands on pink.

$$P(\text{pink}) = 1 - 0.32 - 0.13 - 0.28$$

$$= 0.27 \quad (1)$$

$$0.27 \times 200 = 54 \quad (1)$$

54

(Total for Question 2 is 3 marks)

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3 $ABCD$ is a trapezium.

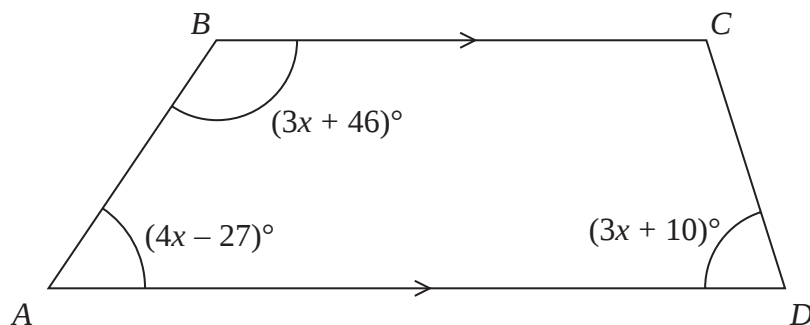


Diagram **NOT** accurately drawn

BC is parallel to AD

Find the size of the largest angle inside the trapezium.

$$(4x - 27) + (3x + 46) = 180 \quad (1)$$

$$7x = 180 - 19$$

$$7x = 161$$

$$x = 23 \quad (1)$$

$$ABC = 3(23) + 46 = 115$$

$$BAD = 4(23) - 27 = 65 \quad (1)$$

$$ADC = 3(23) + 10 = 79$$

$$BCD = 180 - 79 = 101$$

(1) 115

(Total for Question 3 is 4 marks)

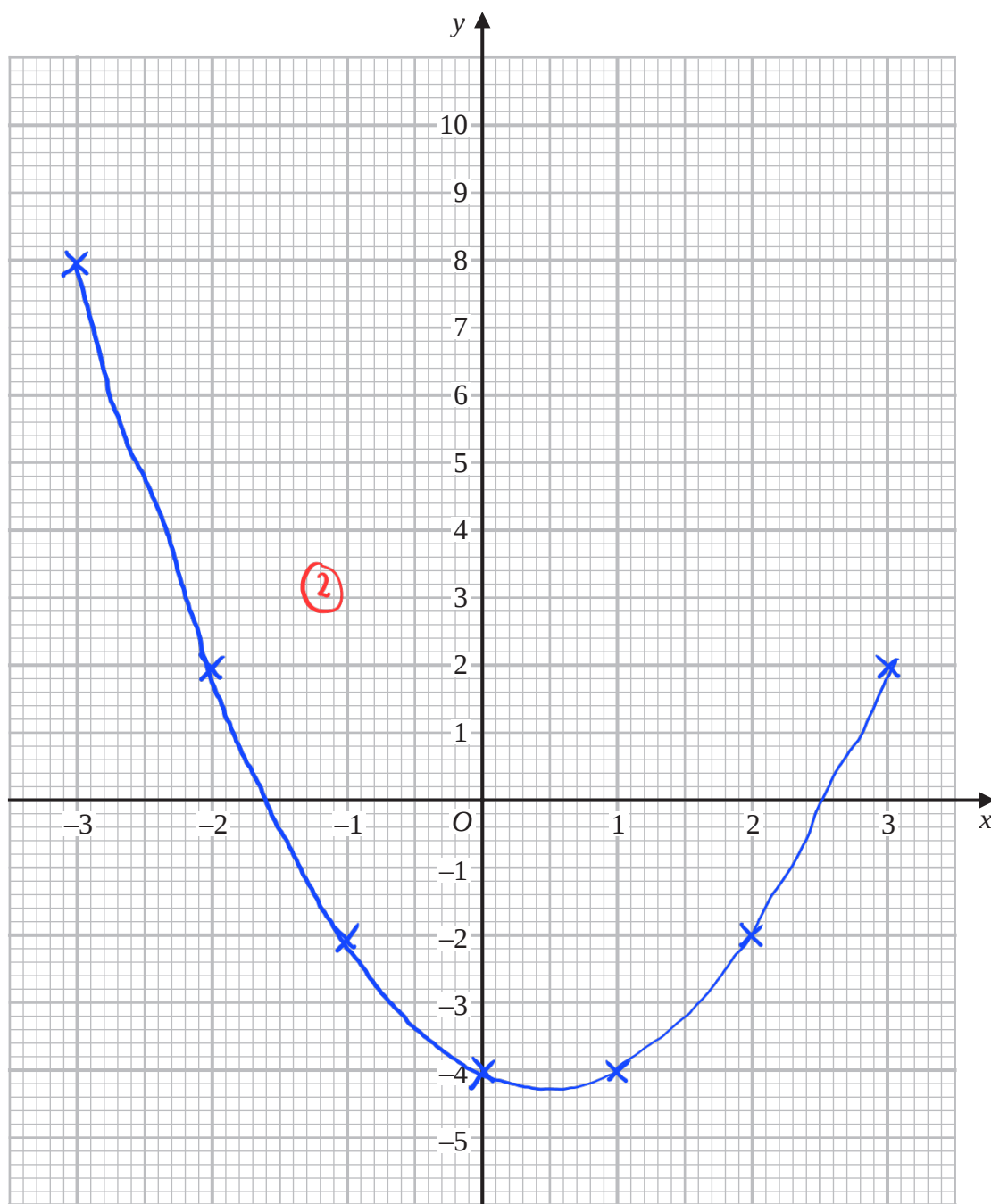
- 4 (a) Complete the table of values for $y = x^2 - x - 4$

x	-3	-2	-1	0	1	2	3
y	8	2	-2	-4	-4	-2	2

(2)

(2)

- (b) On the grid below, draw the graph of $y = x^2 - x - 4$ for values of x from -3 to 3



(2)

(Total for Question 4 is 4 marks)



- 5 Nancy has some coins with a total value of 85 pence.
She has only 2 pence coins and 5 pence coins.
The ratio

$$\text{number of 2 pence coins} : \text{number of 5 pence coins} = 1 : 3$$

Nancy has more 5 pence coins than 2 pence coins.

How many more?

$$\text{let no. of 2 pence coins} = x$$

$$5 \text{ pence coins} = 3x$$

$$2x + 5(3x) = 85 \quad (1)$$

$$17x = 85$$

$$x = \frac{85}{17} = 5 \quad (1)$$

$$2 \text{ pence} = 5 \text{ coins}$$

$$5 \text{ pence} = 15 \text{ coins} \quad (1)$$

$$15 - 5 = 10$$

$$10 \quad (1)$$

(Total for Question 5 is 4 marks)

- 6 (a) Write 76000000 in standard form.

$$7.6 \times 10^7 \quad (1)$$

(1)

- (b) Write 5.4×10^{-4} as an ordinary number.

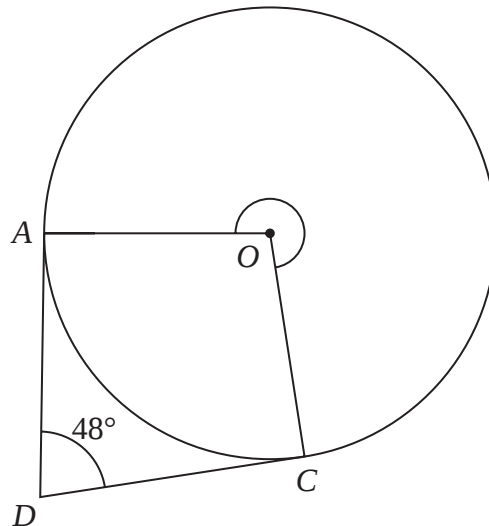
$$0.00054 \quad (1)$$

(1)

(Total for Question 6 is 2 marks)



7

Diagram **NOT**
accurately drawn

A and C are points on a circle, centre O

DA is the tangent to the circle at A and DC is the tangent to the circle at C

Angle $ADC = 48^\circ$

Work out the size of reflex angle AOC

$$DO = DA = 90^\circ \text{ ①}$$

$$\begin{aligned} AOC &= 360^\circ - 48^\circ - 90^\circ - 90^\circ \\ &= 132^\circ \text{ ①} \end{aligned}$$

$$\begin{aligned} AOC \text{ (reflex)} &= 360^\circ - 132^\circ \\ &= 228^\circ \text{ ①} \end{aligned}$$

228

(Total for Question 7 is 3 marks)

8



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- 8 Charlotte buys a painting for \$680
The value of the painting increases by 4% each year.

Work out the value of the painting at the end of 3 years.
Give your answer correct to the nearest \$

$$680 \times 1.04^3 = 764.91$$

$$\textcircled{2} \approx 765 \textcircled{1}$$

\$ 765

(Total for Question 8 is 3 marks)

- 9 Change a speed of 27 kilometres per hour to a speed in metres per second.

$$\frac{27 \text{ km}}{1 \text{ hour}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hour}}{3600 \text{ s}} \textcircled{1}$$

$$= \frac{27000 \text{ m}}{3600 \text{ s}} = 7.5 \text{ m/s} \textcircled{1}$$

7.5 m/s

(Total for Question 9 is 3 marks)



10 Team A and Team B take part in a quiz league.

After 11 rounds, Team A has a mean score per round of 17

After 9 rounds, Team B has a mean score per round of 18

Both teams take part in a further round.

After this round, both teams have a mean score per round of 18.5

In the further round, Team A scored more points than Team B.

How many more?

$$\text{Total score (Team A)} : 17 \times 11 = 187$$

$$\text{Total score (Team B)} : 18 \times 9 = 162$$

①

$$\text{Team A : } \frac{187 + x}{12} = 18.5$$

$$187 + x = 18.5 \times 12$$

$$x = 222 - 187 = 35$$

①

$$\text{Team B : } \frac{162 + y}{10} = 18.5$$

$$162 + y = 185$$

$$y = 185 - 162 = 23$$

$$35 - 23 = 12$$

①

12

①

(Total for Question 10 is 4 marks)

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11 Here is a 9-sided regular polygon $ABCDEFGHIJ$, with centre O

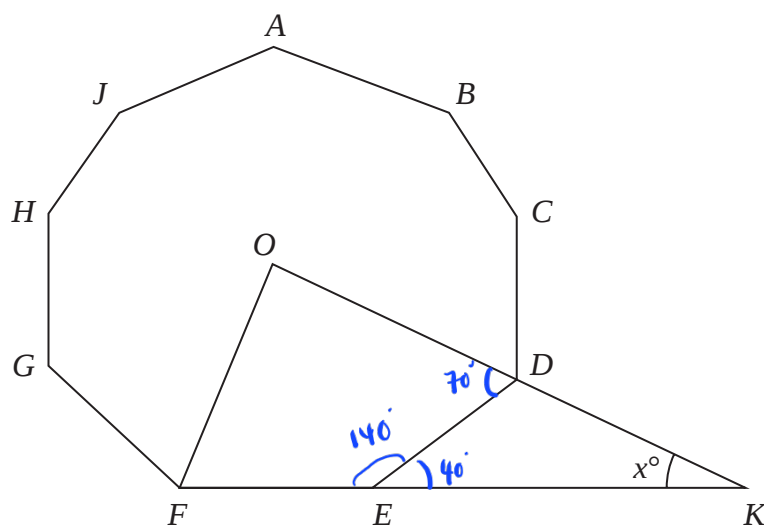


Diagram **NOT** accurately drawn

ODK and FEK are straight lines.

Work out the value of x

$$\text{interior angle of polygon} = \frac{(9-2)(180)}{9} = 140^\circ \quad (1)$$

$$DEK = 180^\circ - 140^\circ = 40^\circ$$

$$EDK = 180^\circ - \left(\frac{140}{2}\right) = 110^\circ \quad (1)$$

$$x = 180^\circ - 110^\circ - 40^\circ$$

$$= 30^\circ \quad (1)$$

$$x = \underline{\quad 30 \quad}$$

(Total for Question 11 is 3 marks)



12 The diagram shows right-angled triangle ABD

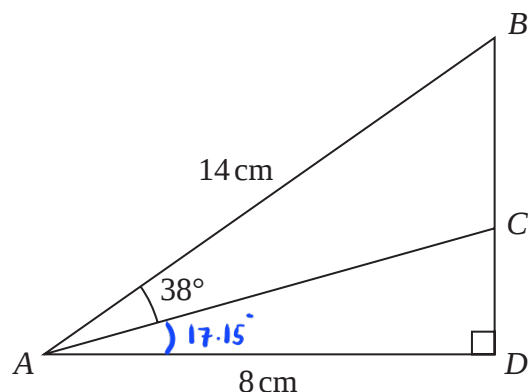


Diagram **NOT** accurately drawn

$$AB = 14 \text{ cm} \quad AD = 8 \text{ cm}$$

C is the point on BD such that angle $BAC = 38^\circ$

Work out the length of CD

Give your answer correct to 3 significant figures.

$$\cos \angle BAD = \frac{8}{14} \quad (1)$$

$$\angle BAD = \cos^{-1} \frac{8}{14} = 55.15^\circ \dots \quad (1)$$

$$\angle CAD = 55.15^\circ - 38^\circ = 17.15^\circ$$

$$\tan 17.15^\circ = \frac{CD}{8} \quad (1)$$

$$\begin{aligned} CD &= 8 \tan 17.15^\circ \\ &= 2.47 \quad (1) \end{aligned}$$

2.47 cm

(Total for Question 12 is 4 marks)



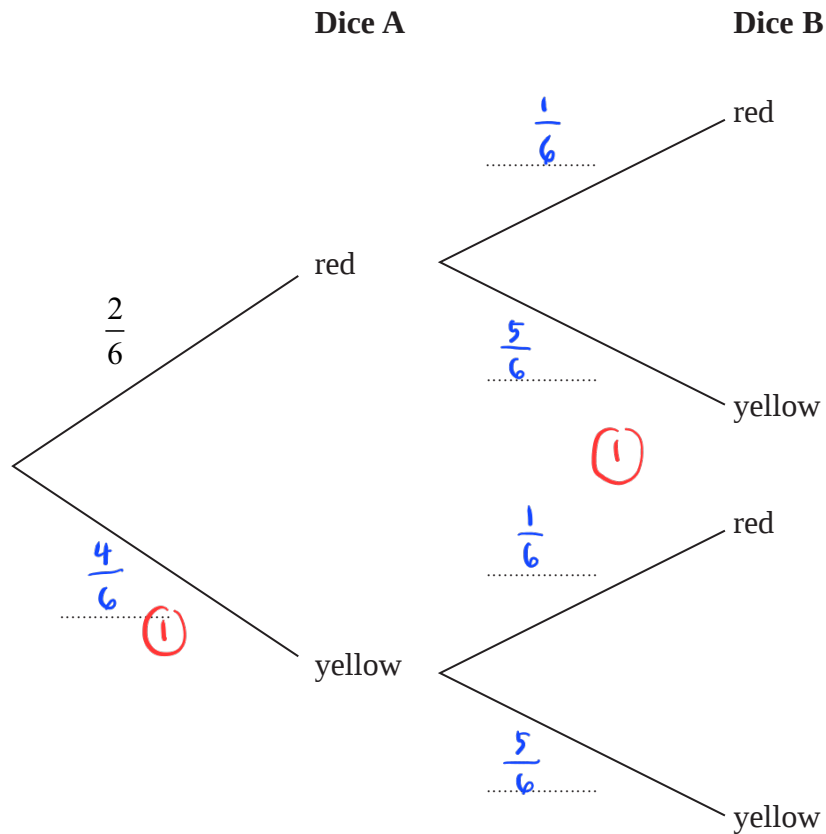
13 Narin has two fair 6-sided dice.

Dice **A** has 2 red faces and 4 yellow faces.

Dice **B** has 1 red face and 5 yellow faces.

Narin is going to throw each dice once.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that both dice land on yellow.

$$\frac{4}{6} \times \frac{5}{6} = \frac{20}{36} = \frac{5}{9}$$

(1)

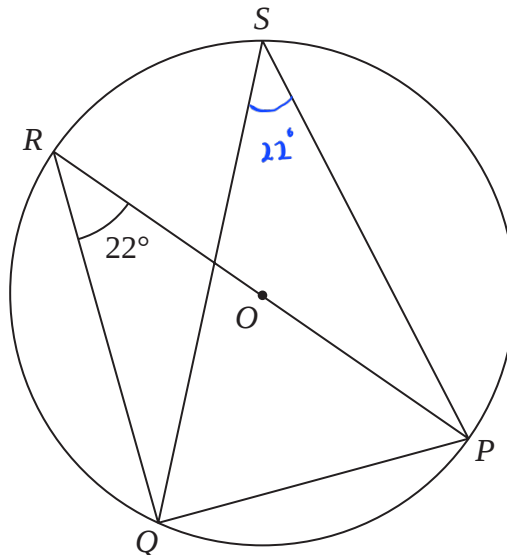
$$\frac{5}{9}$$

(2)

(Total for Question 13 is 4 marks)



14

Diagram **NOT** accurately drawn

P , Q , R and S are points on a circle, centre O
 ROP is a diameter of the circle.

Angle $PRQ = 22^\circ$

(a) (i) Find the size of angle RQP

90 (1) °
 (1)

(ii) Give a reason for your answer.

angle in a semicircle is 90° (1)

(1)

(b) (i) Find the size of angle PSQ

22 (1) °
 (1)

(ii) Give a reason for your answer.

Angles in the same segment are equal. (1)

(1)

(Total for Question 14 is 4 marks)



15 (a) Simplify fully $(32a^{15})^{\frac{3}{5}}$

$$32^{\frac{3}{5}} \times a^{15(\frac{3}{5})}$$

$$= 8 \times a^9$$

$$8a^9 \quad (2)$$

(2)

(b) Express $\left(\frac{1}{10x}\right)^{-3}$ in the form px^n where p and n are integers.

$$\left((10x)^{-1}\right)^{-3} = (10x)^3$$

$$= 1000x^3$$

$$1000x^3 \quad (2)$$

(2)

(c) Solve $\frac{1-2y}{3} = \frac{4}{5} - \frac{2y-1}{2}$

Show clear algebraic working.

$$(5)(2)(1-2y) = 4(3)(2) - (3)(5)(2y-1) \quad (1)$$

$$10 - 20y = 24 - 30y + 15 \quad (1)$$

$$10y = 29$$

$$y = 2.9 \quad (1)$$

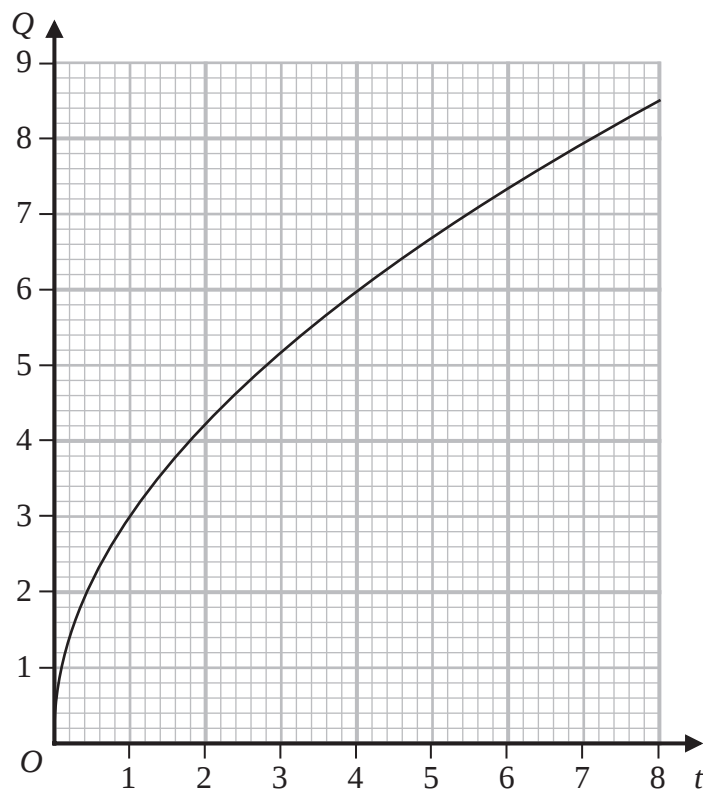
$$y = 2.9 \quad (3)$$

(Total for Question 15 is 7 marks)



16 Q is directly proportional to $\sqrt{t}$

The graph shows the relationship between Q and t for $0 < t < 8$



(a) Find a formula for Q in terms of t

$$Q = k\sqrt{t} \quad (1)$$

$$\text{At point } (1, 3) : 3 = k\sqrt{1}$$

$$k = 3 \quad (1)$$

$$Q = 3\sqrt{t} \quad (1)$$

$$Q = 3\sqrt{t}$$

(3)

Q is increased by 20%

(b) Find the percentage increase in t

$$20\% \text{ increase of } Q = 1.2Q$$

$$\frac{1.44 - 1}{1} \times 100\% = 44\% \quad (1)$$

$$\text{At point } (1, 3) : 1.2(3) = 3\sqrt{t}$$

$$\frac{3.6}{3} = \sqrt{t}$$

$$t = 1.2^2 = 1.44 \quad (1)$$

$$44\% \quad (2)$$

(Total for Question 16 is 5 marks)



17 (a) Expand and simplify $(x + 6)(3x - 2)(x + 6)$

$$\begin{aligned}(x+6)(3x-2) &= 3x^2 - 2x + 18x - 12 \\ &= 3x^2 + 16x - 12 \quad (1)\end{aligned}$$

$$\begin{aligned}(3x^2 + 16x - 12)(x+6) &= 3x^3 + 18x^2 + 16x^2 + 96x - 12x - 72 \quad (1) \\ &= 3x^3 + 34x^2 + 84x - 72 \quad (1)\end{aligned}$$

$$3x^3 + 34x^2 + 84x - 72$$

(3)

(b) Make e the subject of $w = \sqrt{\frac{e+g}{ef-d}}$

$$w^2 = \frac{e+g}{ef-d} \quad (1)$$

$$w^2(ef-d) = e+g$$

$$w^2ef - w^2d = e+g \quad (1)$$

$$w^2ef - e = g + w^2d \quad (1)$$

$$e(w^2f - 1) = g + w^2d$$

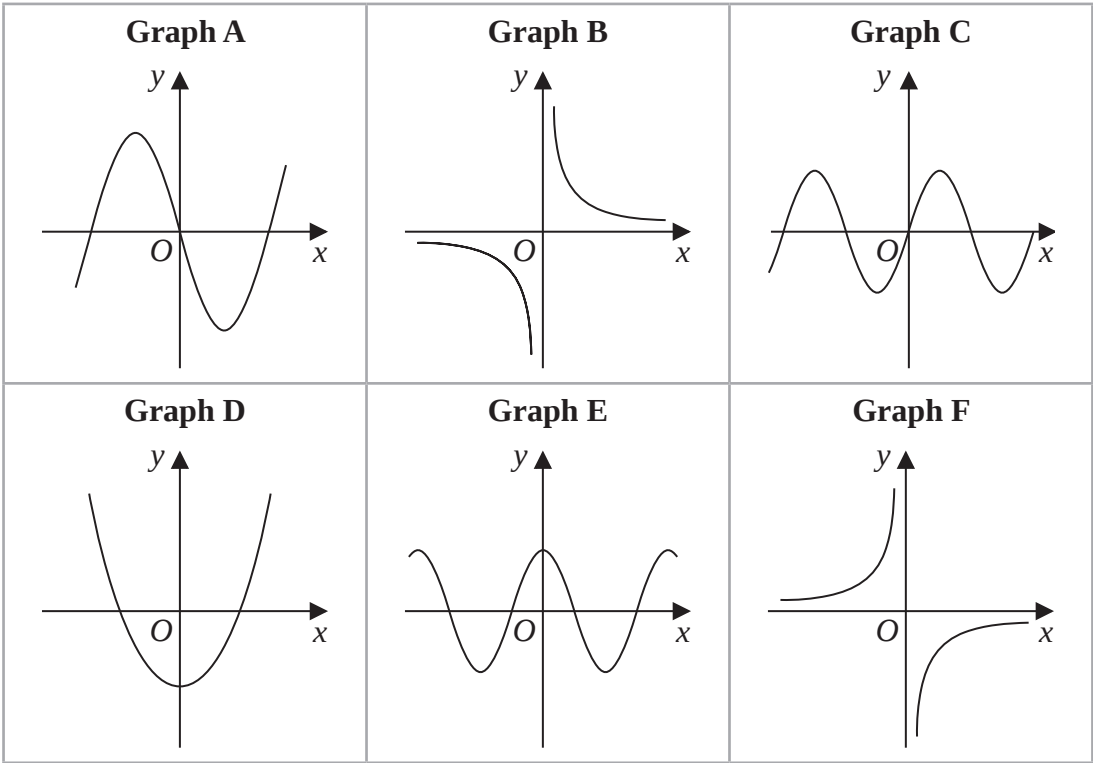
$$e = \frac{g + w^2d}{w^2f - 1} \quad (1)$$

$$e = \frac{g + w^2d}{w^2f - 1}$$

(4)

(Total for Question 17 is 7 marks)

18 Here are 6 graphs.



Complete the table below with the letter of the graph that could represent each given equation.

Write your answers on the dotted lines.

Equation	Graph
$y = \sin x$	C ①
$y = -\frac{3}{x}$	F ①
$y = 4x^3 - 5x$	A ①

(Total for Question 18 is 3 marks)



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19 Express $3x^2 - 6x + 5$ in the form $a(x - b)^2 + c$

$$3(x^2 - 2x) + 5 \quad (1)$$

$$= 3\left[(x-1)^2 - 1\right] + 5$$

$$= 3(x-1)^2 - 3 + 5 \quad (1)$$

$$= 3(x-1)^2 + 2 \quad (1)$$

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

(Total for Question 19 is 3 marks)



20 There are 12 counters in a bag.

3 of the counters are red

9 of the counters are green

Ameya, Jack and Ella each take at random one counter from the bag.

Work out the probability that at least one red counter is still in the bag.

$$P(GGG) = \frac{9}{12} \times \frac{8}{11} \times \frac{7}{10} = \frac{84}{220}$$

$$P(GGR) = \frac{9}{12} \times \frac{8}{11} \times \frac{3}{10} = \frac{36}{220} \quad (1)$$

$$P(GRR) = \frac{9}{12} \times \frac{3}{11} \times \frac{2}{10} = \frac{9}{220}$$

$$P(\text{at least one red}) = \frac{84}{220} + 3 \times \frac{36}{220} + 3 \times \frac{9}{220} \quad (1)$$

$$= \frac{219}{220} \quad (1)$$

$$\frac{219}{220}$$

(Total for Question 20 is 3 marks)



21 Solve the simultaneous equations

$$\begin{aligned} 2x^2 + 3y^2 &= 11 \\ x &= 3y - 1 \end{aligned}$$

Show clear algebraic working.

$$2(3y-1)^2 + 3y^2 = 11 \quad (1)$$

$$2(9y^2 - 6y + 1) + 3y^2 = 11$$

$$18y^2 - 12y + 2 + 3y^2 = 11$$

$$21y^2 - 12y - 9 = 0 \quad (1)$$

$$7y^2 - 4y - 3 = 0$$

$$(7y + 3)(y - 1) = 0 \quad (1)$$

$$y = -\frac{3}{7} \text{ and } y = 1$$

$$x = 3\left(-\frac{3}{7}\right) - 1 \text{ and } x = 3(1) - 1$$

$$x = -\frac{16}{7} \text{ and } x = 2 \quad (1)$$

(1)

$$x = 2, y = 1 \text{ and } x = -\frac{16}{7}, y = -\frac{3}{7}$$

(Total for Question 21 is 5 marks)

22 The diagram shows a triangle ABC and a flagpole BF

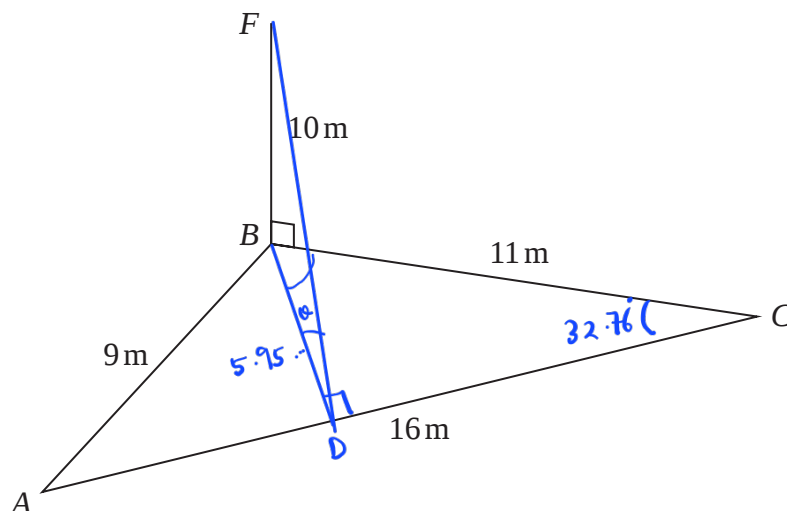


Diagram **NOT** accurately drawn

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A , B and C are points on horizontal ground.

BF is vertical.

$$AB = 9\text{ m} \quad BC = 11\text{ m} \quad AC = 16\text{ m} \quad BF = 10\text{ m}$$

D is the point on AC such that angle $BDC = 90^\circ$

Work out the size of the angle of elevation of the point F from the point D
Give your answer correct to one decimal place.

$$9^2 = 11^2 + 16^2 - 2(11)(16) \cos BCA \quad (1)$$

$$\frac{9^2 - 11^2 - 16^2}{-2(11)(16)} = \cos BCA$$

$$BCA = 32.763 \dots \quad (1)$$

$$\frac{BD}{\sin 32.763 \dots} = \frac{11}{\sin 90}$$

$$BD = 11 \sin 32.763$$

$$= 5.95 \dots \quad (1)$$

$$\tan FDB = \frac{10}{5.95 \dots} \quad (1)$$

$$FDB = \tan^{-1} \frac{10}{5.95 \dots} = 59.2 \quad (1)$$



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59.1

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(Total for Question 22 is 5 marks)

Turn over for Question 23



23 The diagram shows a cuboid with a square cross section.

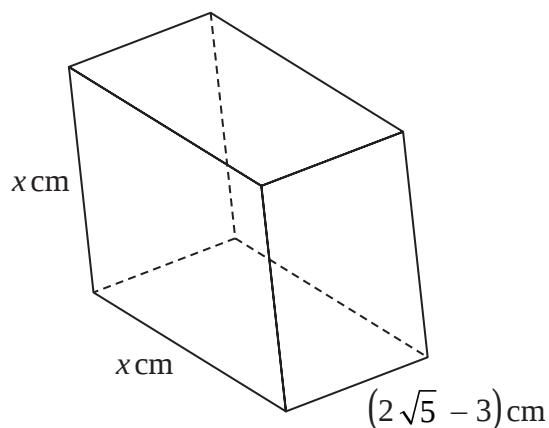


Diagram **NOT** accurately drawn

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The volume of the cuboid is $(13 + 6\sqrt{5})\text{cm}^3$

Without using a calculator, find the value of x

Give your answer in the form $a + \sqrt{b}$ where a and b are integers.

Show your working clearly.

$$x \times x \times (2\sqrt{5} - 3) = 13 + 6\sqrt{5}$$

$$x^2 = \frac{13 + 6\sqrt{5}}{2\sqrt{5} - 3} \times \frac{2\sqrt{5} + 3}{2\sqrt{5} + 3} \quad (1)$$

$$= \frac{26\sqrt{5} + 39 + 12(5) + 18\sqrt{5}}{4(5) - 9}$$

$$= \frac{39 + 60 + 26\sqrt{5} + 18\sqrt{5}}{11}$$

$$= \frac{99 + 44\sqrt{5}}{11} \quad (1)$$

$$x^2 = 9 + 4\sqrt{5}$$

$$x = a + \sqrt{b}$$

$$x^2 = a^2 + 2a\sqrt{b} + b$$



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$$a^2 + b = 9$$

$$2a\sqrt{b} = 4\sqrt{5}$$

$$2a = 4$$

$$a = 2, b = 5$$

$$x = 2 + \sqrt{5} \quad (1)$$

(Total for Question 23 is 4 marks)

Turn over for Question 24



24 ABCD is a kite with $AB = AD$ and $CB = CD$

A is the point with coordinates $(-2, 10)$

B is the point with coordinates $\left(-\frac{27}{5}, 4\right)$

C is the point with coordinates $(4, -5)$

Work out the coordinates of D

$$\text{gradient AC} : \frac{-5-10}{4-(-2)} = \frac{-15}{6} = -\frac{5}{2} \quad (1)$$

$$\text{equation of AC} : 10 = -\frac{5}{2}(-2) + c$$

$$c = 10 - 5 = 5$$

$$\therefore y = -\frac{5}{2}x + 5 \quad (1)$$

$$\text{gradient BD} : \frac{2}{5}$$

$$\text{equation of BD} : 4 = \frac{2}{5}\left(-\frac{27}{5}\right) + c$$

$$4 = -\frac{54}{25} + c$$

$$c = \frac{154}{25}$$

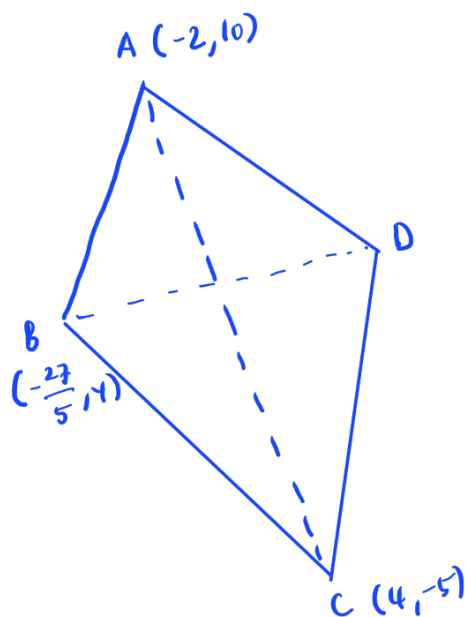
$$\therefore y = \frac{2}{5}x + \frac{154}{25} \quad (1)$$

$$-\frac{5}{2}x + 5 = \frac{2}{5}x + \frac{154}{25} \quad (1)$$

$$\frac{2}{5}x + \frac{5}{2}x = 5 - \frac{154}{25}$$

$$2.9x = -\frac{29}{25} \quad (1)$$

$$x = -\frac{10}{25} = -\frac{2}{5}, \quad y = -\frac{5}{2}\left(-\frac{2}{5}\right) + 5 = 6$$



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intersection between AC and BD is $(-\frac{2}{5}, 6)$

$$\left(-\frac{2}{5}, 6\right) = \left(\frac{-\frac{27}{5} + x_D}{2}, \frac{4 + y_D}{2}\right)$$

$$x_D : \frac{-4}{5} + \frac{27}{5} = \frac{23}{5}$$

$$y_D : 12 - 4 = 8$$

①

$$\left(\frac{23}{5}, 8\right)$$

(Total for Question 24 is 6 marks)

Turn over for Question 25



- 25 A solid sphere has a radius of 2.8 centimetres, correct to 1 decimal place.
The sphere has a mass of $M\pi$ grams, where $M = 260$ correct to 2 significant figures.

Work out the upper bound for the density of the sphere.

Give your answer in g/cm^3 correct to 2 decimal places.

Show your working clearly.

$$M_{\text{UB}} = 265, \quad M_{\text{LB}} = 255, \quad r_{\text{UB}} = 2.85, \quad r_{\text{LB}} = 2.75$$

$$\text{density}_{\text{UB}} = \frac{\text{mass}_{\text{UB}}}{\text{Volume}_{\text{LB}}}$$

$$\begin{aligned} \text{Volume}_{\text{LB}} &= \frac{4}{3} \times \pi \times 2.75^3 \\ &= \frac{1331}{48} \pi \end{aligned}$$

$$\text{mass}_{\text{UB}} = 265 \pi$$

$$\begin{aligned} \text{density}_{\text{UB}} &= \frac{265 \pi}{\frac{1331}{48} \pi} \\ &= 9.56 \end{aligned}$$

9.56

..... g/cm^3

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

