

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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## 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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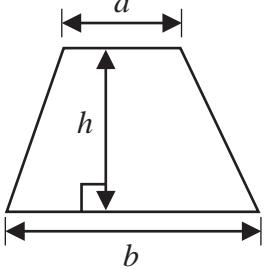
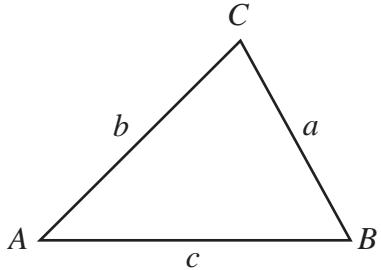
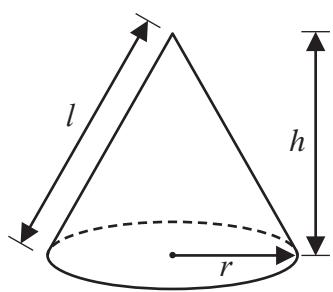
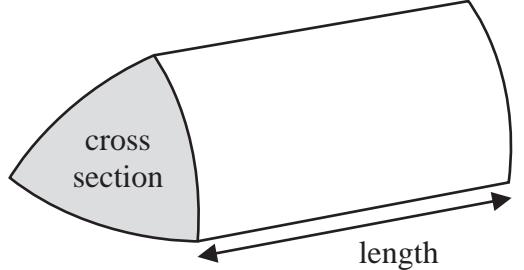
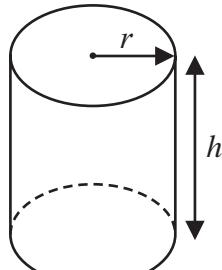
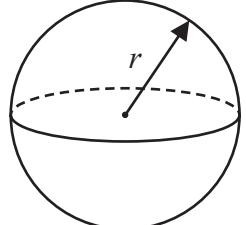


Pearson

**International GCSE Mathematics**  
**Formulae sheet – Higher Tier**

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|   |   |
|---|---|
| <p><b>Arithmetic series</b></p> <p>Sum to <math>n</math> terms, <math>S_n = \frac{n}{2} [2a + (n - 1)d]</math></p> <p><b>The quadratic equation</b></p> <p>The solutions of <math>ax^2 + bx + c = 0</math> where <math>a \neq 0</math> are given by:</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ | <p><b>Area of trapezium</b> <math>= \frac{1}{2}(a + b)h</math></p>    |
| <p><b>Trigonometry</b></p>    | <p><b>In any triangle <math>ABC</math></b></p> <p><b>Sine Rule</b> <math>\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}</math></p> <p><b>Cosine Rule</b> <math>a^2 = b^2 + c^2 - 2bc \cos A</math></p> <p><b>Area of triangle</b> <math>= \frac{1}{2}ab \sin C</math></p> |
| <p><b>Volume of cone</b> <math>= \frac{1}{3}\pi r^2 h</math></p> <p><b>Curved surface area of cone</b> <math>= \pi r l</math></p>    | <p><b>Volume of prism</b><br/> = area of cross section <math>\times</math> length</p>   |
| <p><b>Volume of cylinder</b> <math>= \pi r^2 h</math></p> <p><b>Curved surface area of cylinder</b> <math>= 2\pi r h</math></p>    | <p><b>Volume of sphere</b> <math>= \frac{4}{3}\pi r^3</math></p> <p><b>Surface area of sphere</b> <math>= 4\pi r^2</math></p>   |



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

$$\begin{aligned}
 & \frac{14}{3} \div \frac{6}{5} \quad (1) \\
 & = \frac{14}{3} \times \frac{5}{6} = \frac{70 \div 2}{18 \div 2} \\
 & \quad : \quad \frac{35}{9} \\
 & = \frac{9}{9} + \frac{9}{9} + \frac{9}{9} + \frac{8}{9} \quad (1) \\
 & = 3\frac{8}{9}
 \end{aligned}$$

(Total for Question 1 is 3 marks)



P 7 2 8 2 8 A 0 3 2 8

- 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.

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

$$\approx 0.27 \quad (1)$$

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

54

(Total for Question 2 is 3 marks)



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- 3  $ABCD$  is a trapezium.

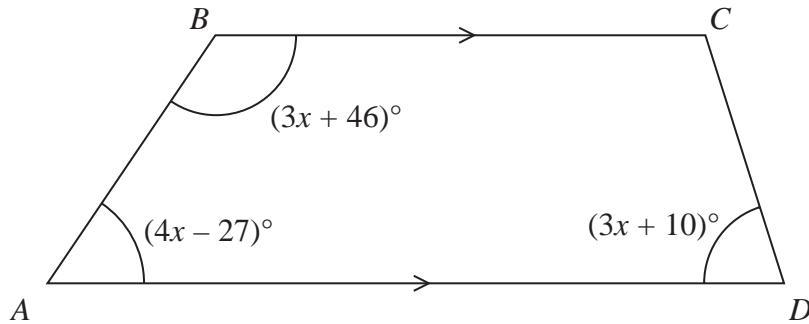


Diagram NOT  
accurately drawn

$BC$  is parallel to  $AD$

Find the size of the largest angle inside the trapezium.

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

$$7x = 180 - 19$$

$$7x = 161$$

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

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

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

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

$$\angle BCD = 180^\circ - 79 = 101$$

(1) 115

(Total for Question 3 is 4 marks)



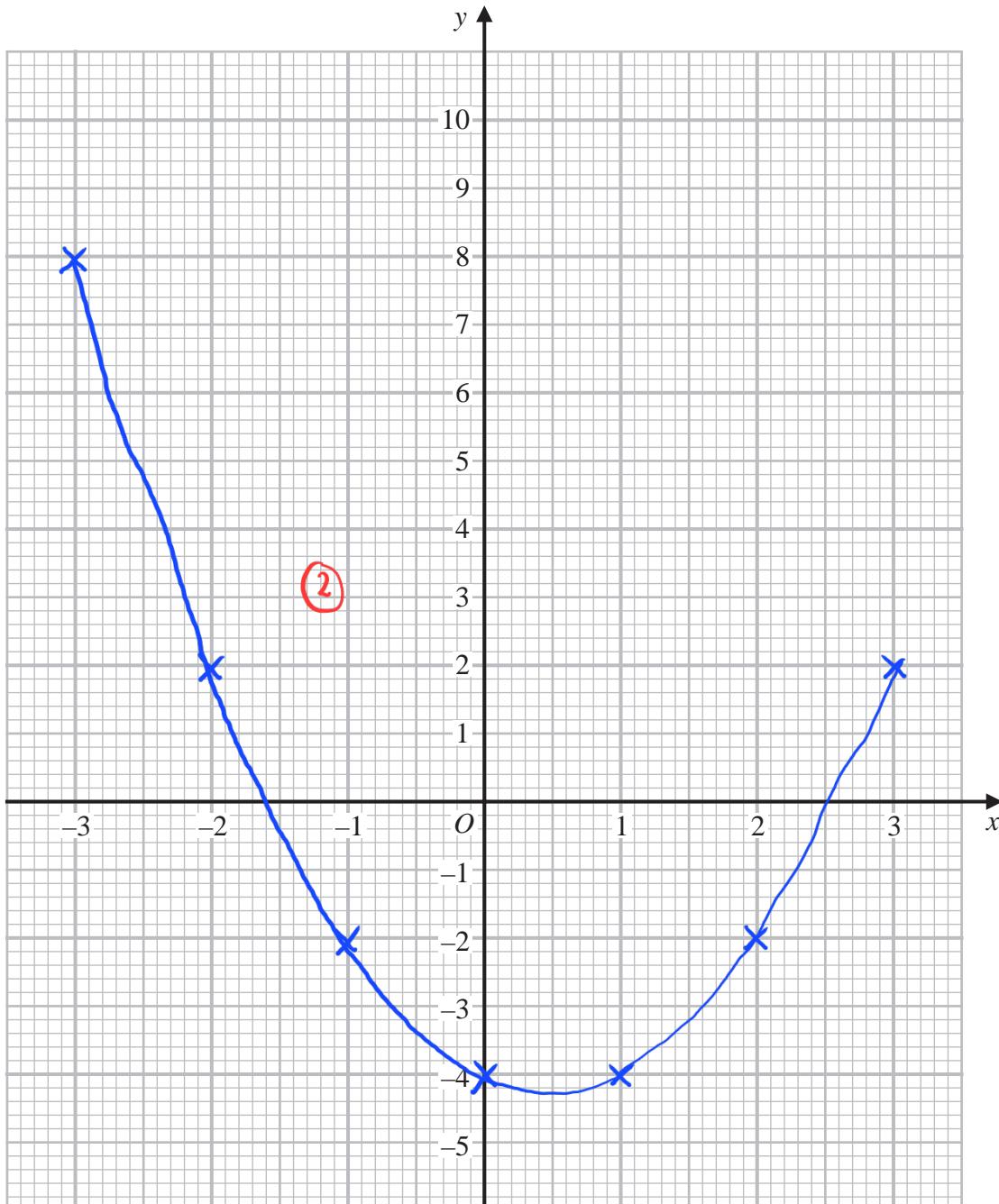
- 4 (a) Complete the table of values for  $y = x^2 - x - 4$

|     |    |    |    |    |    |    |   |
|-----|----|----|----|----|----|----|---|
| $x$ | -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)



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

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

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 (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  $5.4 \times 10^{-4}$  as an ordinary number.

$$0.00054$$

$$0.00054 \quad (1)$$

(1)

(Total for Question 6 is 2 marks)



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7

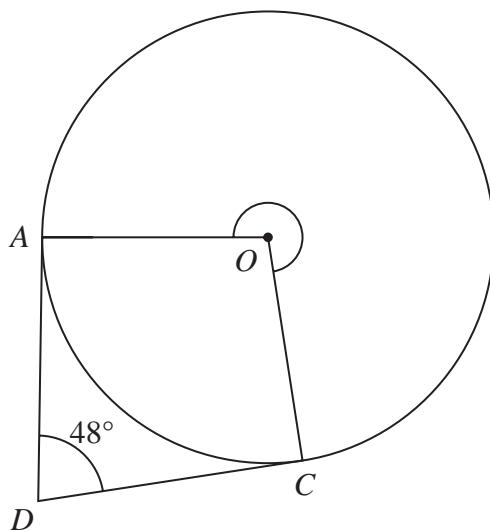


Diagram NOT  
accurately drawn

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$A$  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  $AOC$

$$\angle DCB = \angle DAO = 90^\circ \text{ (1)}$$

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

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

228

(Total for Question 7 is 3 marks)

8



P 7 2 8 2 8 A 0 8 2 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 \$

$$680 \times 1.04^3 = 764.91 \\ \textcircled{1} \\ \approx 765 \textcircled{1}$$

\$ ..... **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)



P 7 2 8 2 8 A 0 9 2 8

**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?

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

(1)

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

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

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

$$x = 222 - 187 = 35 \quad (1)$$

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

$$162 + y = 185$$

$$y = 185 - 162 = 23$$

$$35 - 23 = 12 \quad (1)$$

12

(1)

(Total for Question 10 is 4 marks)



- DO NOT WRITE IN THIS AREA**
- 11 Here is a 9-sided regular polygon  $ABCDEFGHIJ$ , with centre  $O$

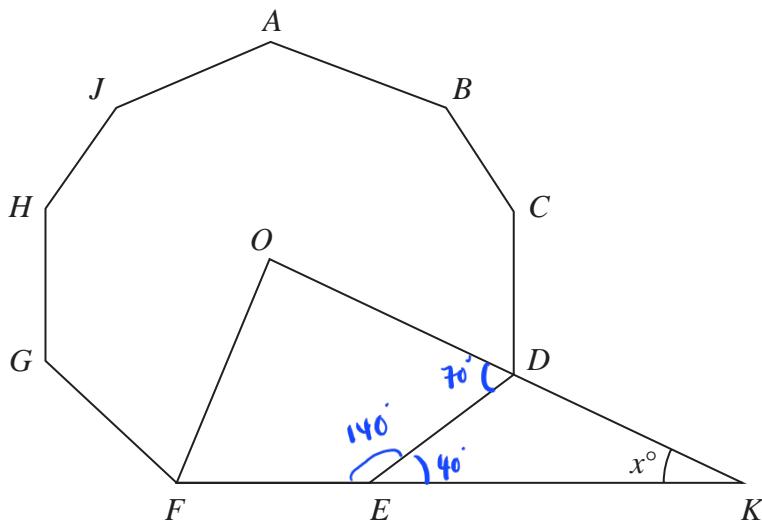


Diagram **NOT**  
accurately drawn

$ODK$  and  $FEK$  are straight lines.

Work out the value of  $x$

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

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

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

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

$$= 30^\circ \quad \textcircled{1}$$

$$x = 30$$

$x = \dots$

(Total for Question 11 is 3 marks)

12 The diagram shows right-angled triangle  $ABD$

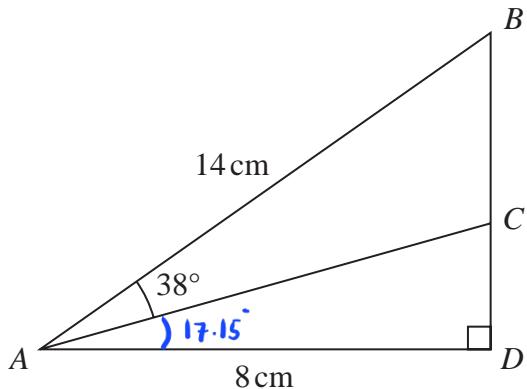


Diagram NOT  
accurately drawn

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

$C$  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.

$$\cos B A D = \frac{8}{14} \quad (1)$$

$$B A D = \cos^{-1} \frac{8}{14} = 55.15^\circ \dots \quad (1)$$

$$C A D = 55.15^\circ - 38^\circ = 17.15^\circ$$

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

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

..... cm

(Total for Question 12 is 4 marks)



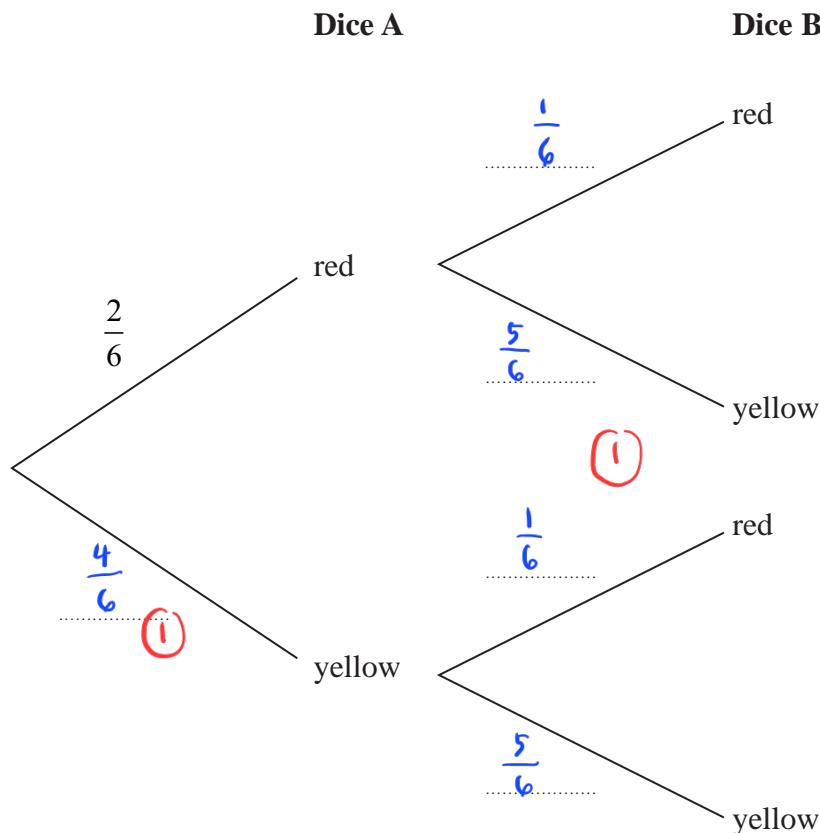
**13** Narin has two fair 6-sided dice.

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.

$$\frac{4}{6} \times \frac{5}{6} = \frac{20}{36} = \frac{5}{9} \quad (1)$$

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

(2)

**(Total for Question 13 is 4 marks)**



14

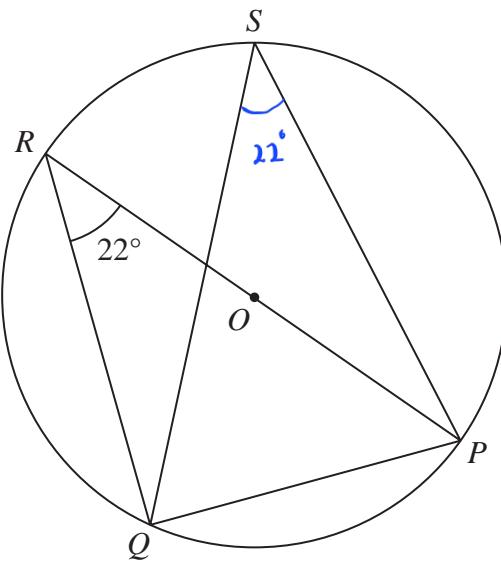


Diagram NOT  
accurately drawn

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$P, Q, R$  and  $S$  are points on a circle, centre  $O$

$ROP$  is a diameter of the circle.

$\text{Angle } PRQ = 22^\circ$

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

90 (1)

(1)

(ii) Give a reason for your answer.

angle in a semicircle is  $90^\circ$  (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)



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

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

$$= 8 \times a^9$$

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

(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.

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

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

$$10y = 29$$

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

$$2.9$$

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

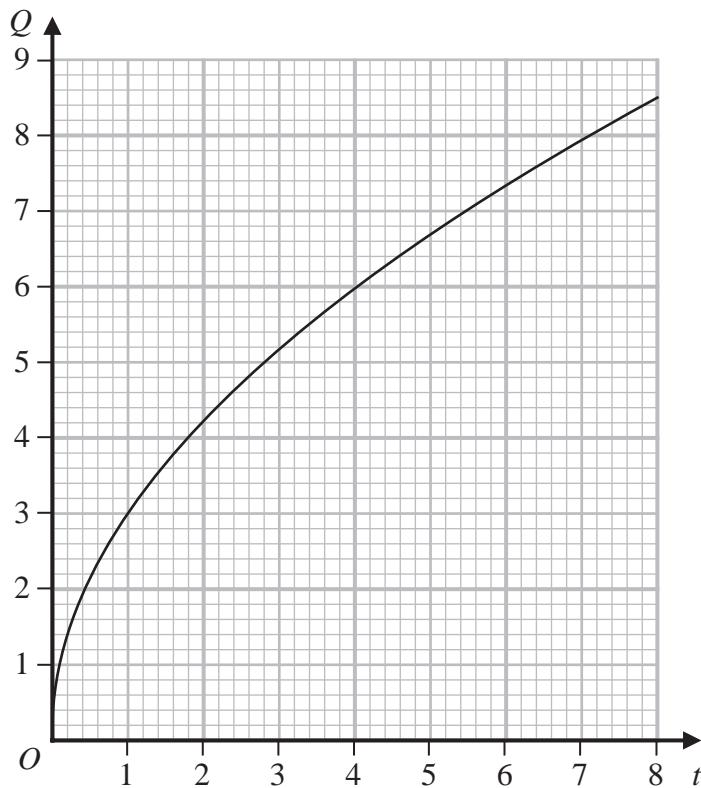
(Total for Question 15 is 7 marks)



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

- 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  $t$

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

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

$$k = 3 \quad (2)$$

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

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

(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

%  
(2)

(Total for Question 16 is 5 marks)



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

$$(x+6)(3x-2) = 3x^2 - 2x + 18x - 12 \\ = 3x^2 + 16x - 12 \quad (1)$$

$$(3x^2 + 16x - 12)(x+6) = 3x^3 + 18x^2 + 16x^2 + 96x - 12x - 72 \quad (1) \\ = 3x^3 + 34x^2 + 84x - 72 \quad (1)$$

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

.....  
(3)

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

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

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

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

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

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

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

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

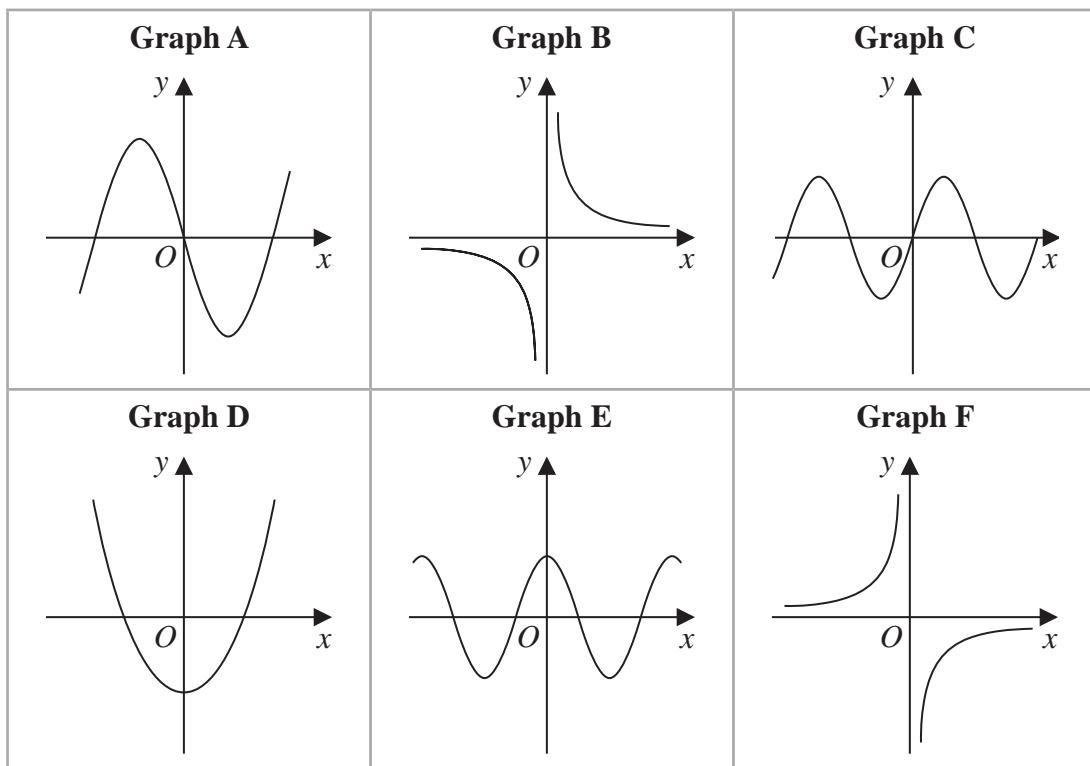
.....  
(4)

(Total for Question 17 is 7 marks)



P 7 2 8 2 8 A 0 1 7 2 8

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<br>..... |
| $y = -\frac{3}{x}$ | F ①<br>..... |
| $y = 4x^3 - 5x$    | A ①<br>..... |

(Total for Question 18 is 3 marks)



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

$$\begin{aligned} & 3(x^2 - 2x) + 5 \quad (1) \\ & = 3[(x-1)^2 - 1] + 5 \\ & = 3(x-1)^2 - 3 + 5 \quad (1) \\ & = 3(x-1)^2 + 2 \quad (1) \end{aligned}$$

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

(Total for Question 19 is 3 marks)



P 7 2 8 2 8 A 0 1 9 2 8

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)



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**21** Solve the simultaneous equations

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

Show clear algebraic working.

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

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

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

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

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

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

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

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

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

(1)

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

(Total for Question 21 is 5 marks)



P 7 2 8 2 8 A 0 2 1 2 8

- 22 The diagram shows a triangle  $ABC$  and a flagpole  $BF$

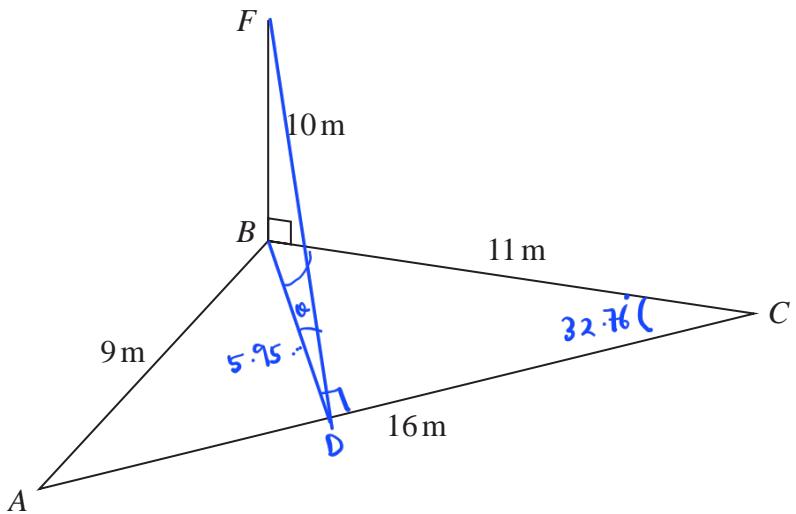


Diagram NOT  
accurately drawn

$A, B$  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.

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

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

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

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

$$BD = 11 \sin 32.763$$

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

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

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



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5q.2

(Total for Question 22 is 5 marks)

Turn over for Question 23



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

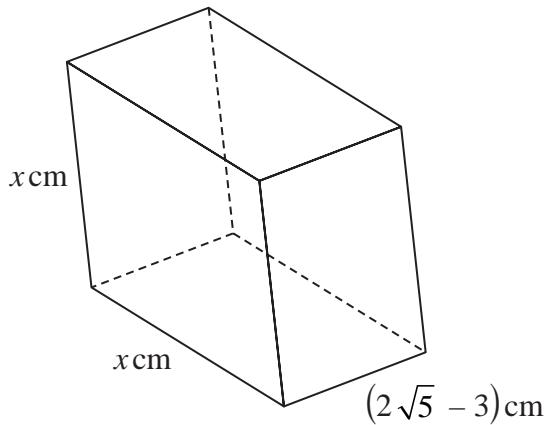


Diagram NOT  
accurately drawn

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.

$$\begin{aligned}
 x \times x \times (2\sqrt{5} - 3) &= 13 + 6\sqrt{5} \\
 x^2 &= \frac{13 + 6\sqrt{5}}{2\sqrt{5} - 3} \times \frac{2\sqrt{5} + 3}{2\sqrt{5} + 3} \quad (1) \\
 &= \frac{26\sqrt{5} + 39 + 12(5) + 18\sqrt{5}}{4(5) - 9} \\
 &= \frac{39 + 60 + 26\sqrt{5} + 18\sqrt{5}}{11} \\
 &= \frac{99 + 44\sqrt{5}}{11} \quad (1) \\
 x^2 &= 9 + 4\sqrt{5} \\
 x &= a + \sqrt{b} \\
 x^2 &= a^2 + 2a\sqrt{b} + b
 \end{aligned}$$

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DO NOT WRITE IN THIS AREA



$$a^2 + b = 9$$

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

$$2a = 4$$

$$a = 2, b = 5$$

$$x = \frac{2 + \sqrt{5}}{1}$$

(Total for Question 23 is 4 marks)

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Turn over for Question 24



P 7 2 8 2 8 A 0 2 5 2 8

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

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

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

$$c = 10 - 5 = 5$$

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

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

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

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

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

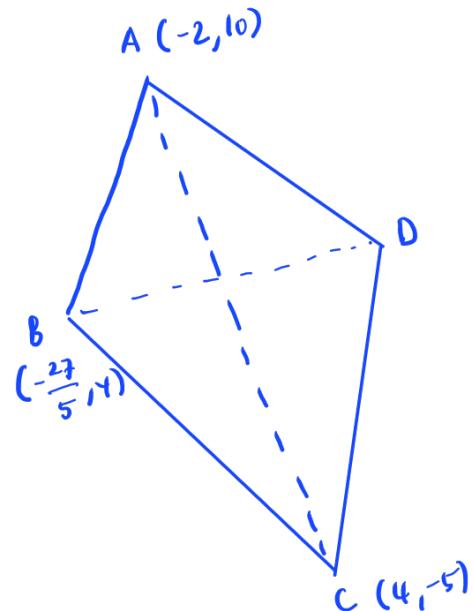
$$\therefore y = \frac{2}{5}x + \frac{154}{25} \quad (1)$$

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

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

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

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



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

$$\left(-\frac{2}{5}, 6\right) = \left(\frac{-\frac{27}{5} + x_0}{2}, \frac{4 + y_0}{2}\right)$$

$$x_0 : -\frac{4}{5} + \frac{27}{5} = \frac{23}{5}$$

$$y_0 : 12 - 4 = 8$$

(1)

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

---

(Total for Question 24 is 6 marks)

DO NOT WRITE IN THIS AREA

Turn over for Question 25



P 7 2 8 2 8 A 0 2 7 2 8

- 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<sup>3</sup> correct to 2 decimal places.

Show your working clearly.

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

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

$$\text{Volume}_{LB} = \frac{4}{3} \times \pi \times 2.75^3$$

$$= \frac{1331}{48} \pi \quad (1)$$

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

$$\text{density}_{UB} = \frac{265 \pi}{\frac{1331}{48} \pi} \quad (1)$$

$$= 9.56 \quad (1)$$

9.56

..... g/cm<sup>3</sup>

(Total for Question 25 is 4 marks)

**TOTAL FOR PAPER IS 100 MARKS**

