

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

Time 2 hours Paper reference **4MA1/1HR**

# Mathematics A

## PAPER 1HR

### 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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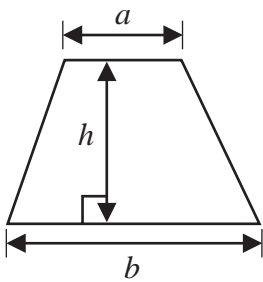
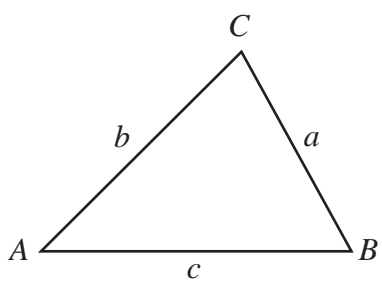
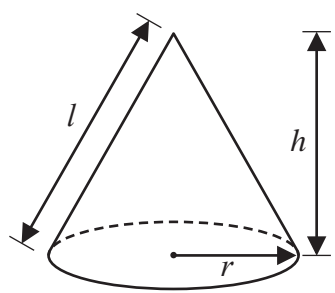
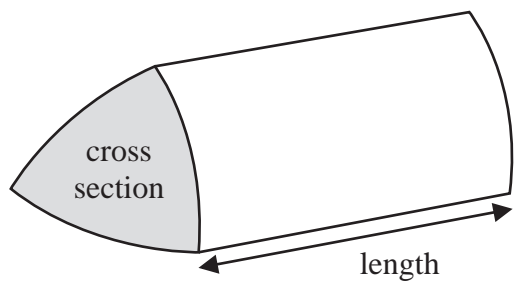
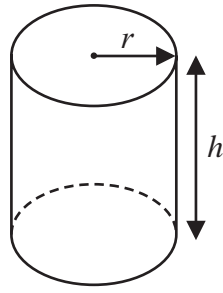
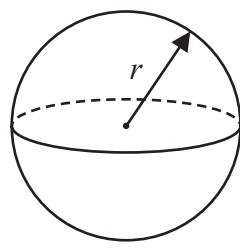
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**Pearson**

**International GCSE Mathematics**

**Formulae sheet – Higher Tier**

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

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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 frame size, in cm, of 60 bicycles sold in a shop.

Frame size ( $S$ cm)	Frequency
$30 < S \leq 36$	4
$36 < S \leq 42$	14
$42 < S \leq 48$	18
$48 < S \leq 54$	19
$54 < S \leq 60$	5

- (a) Write down the modal class.

$$48 < S \leq 54 \quad (1)$$

(1)

- (b) Work out an estimate for the mean frame size.

$$\frac{33 \times 4 + 39 \times 14 + 45 \times 18 + 51 \times 19 + 57 \times 5}{60} \quad (1)$$

$$= \frac{132 + 546 + 810 + 969 + 285}{60} \quad (1)$$

$$= \frac{2742}{60} \quad (1)$$

$$= 45.7 \quad (1)$$

$$45.7$$

cm

(4)

(Total for Question 1 is 5 marks)

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2 The diagram shows a solid triangular prism.

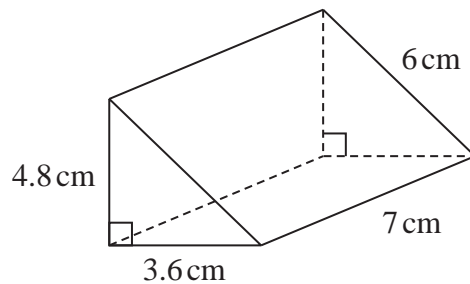


Diagram NOT  
accurately drawn

Work out the **total** surface area of the triangular prism.  
Give your answer correct to 3 significant figures.

$$\begin{aligned}
 & \left( 2 \times \frac{1}{2} \times 4.8 \times 3.6 \right) + (7 \times 6) + (7 \times 3.6) + (4.8 \times 7) \\
 & = 17.28 + 42 + 25.2 + 33.6 \\
 & = 118.08 \\
 & \approx 118
 \end{aligned}$$

..... 118 cm<sup>2</sup>

(Total for Question 2 is 3 marks)



3 Here is a list of six numbers written in order of size.

$\begin{matrix} 3 & & 6 & 10 \\ x & 5 & y & z & 10 & 12 \end{matrix}$

The numbers have

a range of 9

a median of 8

a mode of 10

Find the value of  $x$ , the value of  $y$  and the value of  $z$ .

$$\text{mode} = 10, \text{ hence } z = 10$$

$$\text{median } 8, \quad \frac{y + 10}{2} = 8$$

$$y = 6$$

$$\text{range} = 9, \quad 12 - 9 = 3$$

$$x = 3$$

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

$$y = \dots \dots \dots 6$$

$$z = \dots \dots \dots 10$$

(Total for Question 3 is 3 marks)



- 4 Divya and Yuan each pay for a holiday at a special offer price.

Divya's holiday
Normal price: \$1600
Special offer: 16% off the normal price

Yuan's holiday
Normal price: \$1400
Special offer: $k\%$ off the normal price

The amount that Divya pays is the same as the amount that Yuan pays.

Work out the value of  $k$

$$1 - 0.16 = 0.84 \quad (1)$$

$$\text{Divya pays} : \frac{84}{100} \times 1600 = 1344 \quad (1)$$

$$1400 - 1344 = 56 \quad (1)$$

$$\frac{56}{1400} \times 100\% = 4\% \quad (1)$$

$$k = 4$$

$$k = \dots\dots\dots 4$$

(Total for Question 4 is 4 marks)

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- 5  $C$  grams of chocolate is shared in the ratios 2:5:8  
The difference between the largest share and the smallest share is 390 grams.

Work out the value of  $C$

$$\frac{390}{8-2} = 65 \quad (1)$$

$$65 \times (2+5+8) \quad (1)$$

$$65 \times 15 = 975 \quad (1)$$

$$C = \dots\dots\dots 975$$

(Total for Question 5 is 3 marks)

- 6 Solve the simultaneous equations

$$\begin{aligned} x + 2y &= 15 & x &= 15 - 2y \quad (1) \\ 4x - 6y &= 4 & & (2) \end{aligned}$$

Show clear algebraic working.

subs (1) into (2) :

$$4(15 - 2y) - 6y = 4$$

$$60 - 8y - 6y = 4 \quad (1)$$

$$56 = 14y$$

$$y = 4$$

$$x = 15 - 2(4) \quad (1)$$

$$= 7$$

$$x = \dots\dots\dots 7 \quad (1)$$

$$y = \dots\dots\dots 4$$

(Total for Question 6 is 3 marks)

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- 7 (a) Write  $9.32 \times 10^{-5}$  as an ordinary number.

$$0.0000932 \quad \textcircled{1}$$

(1)

- (b) Work out  $3 \times 10^5 - 6 \times 10^4$

Give your answer in standard form.

$$\begin{aligned} & 3 \times 10^5 - 0.6 \times 10^5 \\ & = 2.4 \times 10^5 \end{aligned}$$

$$2.4 \times 10^5 \quad \textcircled{2}$$

(2)

- (c) Work out  $(3 \times 10^{55}) \times (6 \times 10^{65})$

Give your answer in standard form.

$$\begin{aligned} & 3 \times 6 \times 10^{55+65} \\ & = 18 \times 10^{120} \\ & = 1.8 \times 10^{121} \end{aligned}$$

$$1.8 \times 10^{121} \quad \textcircled{2}$$

(2)

(Total for Question 7 is 5 marks)

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8 (a) Factorise fully  $18c^3d^2 - 21c^2$

$$3(6c^3d^2 - 7c^2)$$

$$3c^2(6cd^2 - 7)$$

$$3c^2(6cd^2 - 7) \quad (2)$$

(2)

(b) (i) Factorise  $y^2 - 3y - 18$

$$(y - 6)(y + 3)$$

(2)

$$(y - 6)(y + 3)$$

(2)

(ii) Hence, solve  $y^2 - 3y - 18 = 0$

$$6, -3 \quad (1)$$

(1)

(Total for Question 8 is 5 marks)

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P 7 2 4 3 8 A 0 9 2 8

- 9 The diagram shows an isosceles triangle  $ABC$

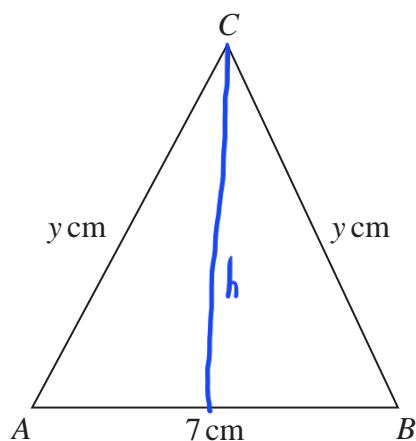


Diagram **NOT**  
accurately drawn

$$AB = 7 \text{ cm} \quad AC = BC = y \text{ cm}$$

The area of the triangle is  $42 \text{ cm}^2$

Work out the value of  $y$

$$\begin{aligned} \text{Area} &: \frac{1}{2} \times 7 \times h = 42 \\ h &= 12 \quad \textcircled{1} \end{aligned}$$

$$y^2 = 12^2 + 3.5^2 \quad \textcircled{1}$$

$$y = \sqrt{12^2 + 3.5^2} \quad \textcircled{1}$$

$$= 12.5 \quad \textcircled{1}$$

$$y = \dots\dots\dots 12.5$$

(Total for Question 9 is 4 marks)

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10  $R$  and  $T$  are points on a circle, centre  $O$

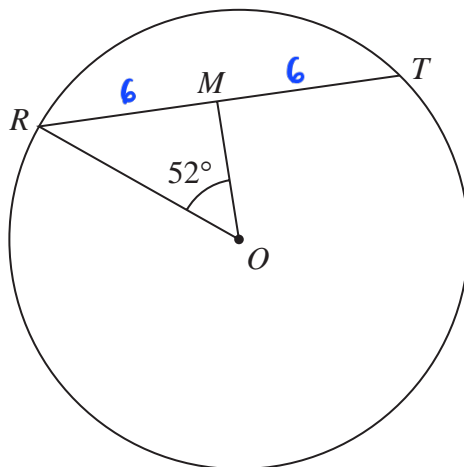


Diagram NOT  
accurately drawn

$$RT = 12 \text{ cm}$$

$M$  is the midpoint of  $RT$

$$\text{Angle } ROM = 52^\circ$$

Work out the area of the circle.

Give your answer correct to 3 significant figures.

$$\sin 52^\circ = \frac{6}{r} \quad (1)$$

$$r = \frac{6}{\sin 52^\circ} \quad (1)$$

$$= 7.614$$

$$\text{Area} = \pi \times 7.614^2 \quad (1)$$

$$= 182 \quad (1)$$

182 ..... cm<sup>2</sup>

(Total for Question 10 is 4 marks)



- 11 The table shows information about the times, in minutes, that 80 patients had to wait to see a doctor.

Time ( $W$ minutes)	Frequency
$0 < W \leq 10$	7
$10 < W \leq 20$	10
$20 < W \leq 30$	15
$30 < W \leq 40$	32
$40 < W \leq 50$	16

- (a) Complete the cumulative frequency table below.

Time ( $W$ minutes)	Cumulative frequency
$0 < W \leq 10$	7
$0 < W \leq 20$	17
$0 < W \leq 30$	32
$0 < W \leq 40$	64
$0 < W \leq 50$	80

(1)

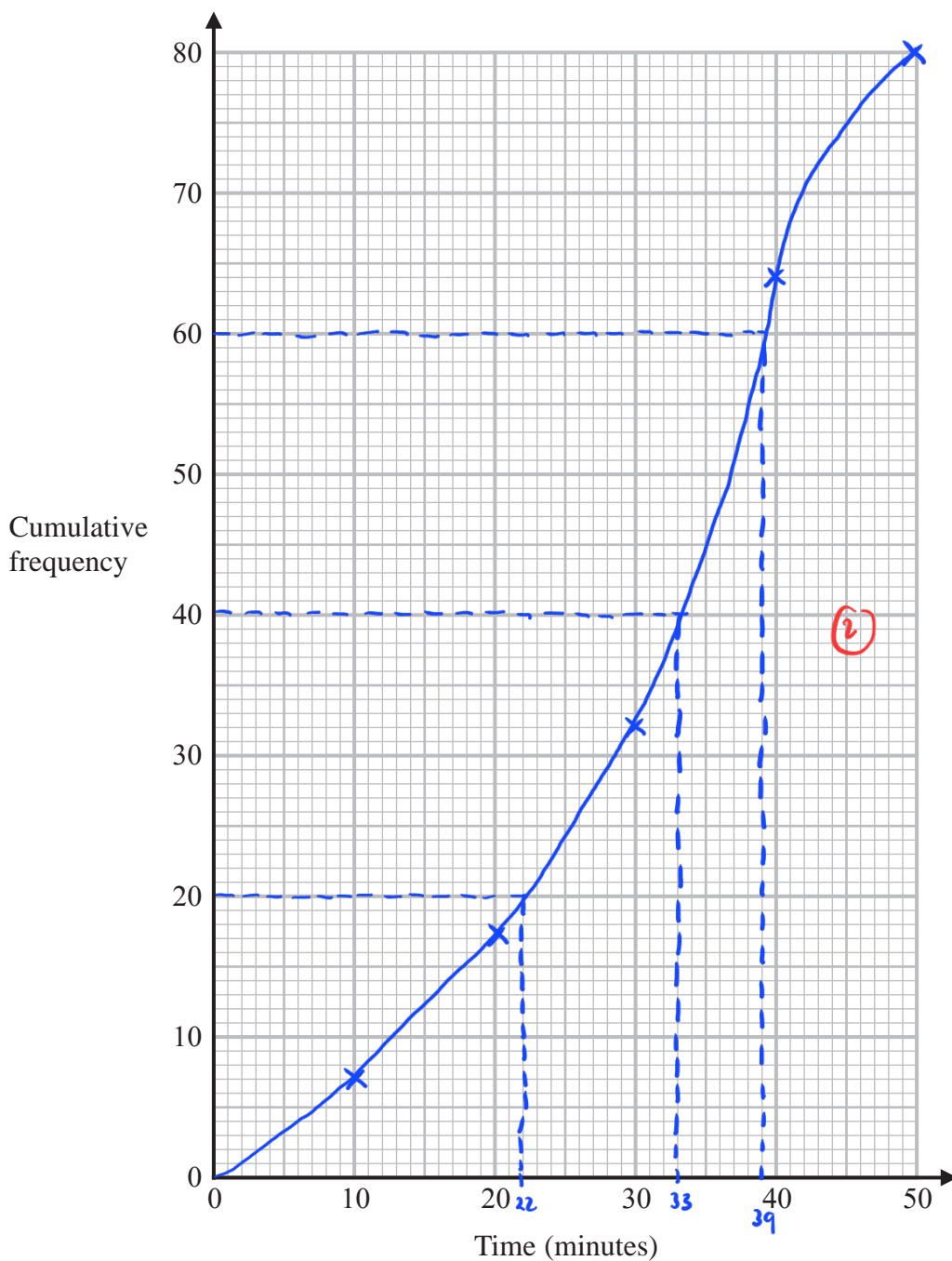
- (b) On the grid opposite, draw a cumulative frequency graph for your table.

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(2)

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

..... 33 (1) minutes  
(1)

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

$Q_1 = 22$  ,  $Q_3 = 39$

$39 - 22 = 17$

..... 17 (2) minutes  
(2)

(Total for Question 11 is 6 marks)



12 Solve  $2^{-4x} = 32$

$$2^{-4x} = 2^5$$

$$-4x = 5 \quad (1)$$

$$x = -\frac{5}{4} \quad (1)$$

$$x = \dots\dots\dots -\frac{5}{4}$$

(Total for Question 12 is 2 marks)

13 Use algebra to show that  $0.3\dot{8}\dot{1} = \frac{21}{55}$

$$\text{let } x = 0.3818\dots$$

$$\text{let } 100x = 38.1818\dots \quad (1)$$

$$100x - x = 38.1818\dots - 0.3818\dots$$

$$99x = 37.8 \quad (1)$$

$$x = \frac{37.8}{99}$$

$$= \frac{21}{55} \quad (\text{shown})$$

(Total for Question 13 is 2 marks)

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$$14 \quad T = \frac{p}{r}$$

$p = 0.51$  correct to 2 significant figures.

$r = 6.3$  correct to 2 significant figures.

Work out the upper bound for the value of  $T$

Show your working clearly.

$$p_{UB} = 0.515$$

$$p_{LB} = 0.505$$

$$r_{UB} = 6.35$$

$$r_{LB} = 6.25$$

$$\begin{aligned} T_{UB} &= \frac{p_{UB}}{r_{LB}} \\ &= \frac{0.515}{6.25} \quad (1) \\ &= 0.0824 \quad (1) \end{aligned}$$

0.0824

(Total for Question 14 is 2 marks)



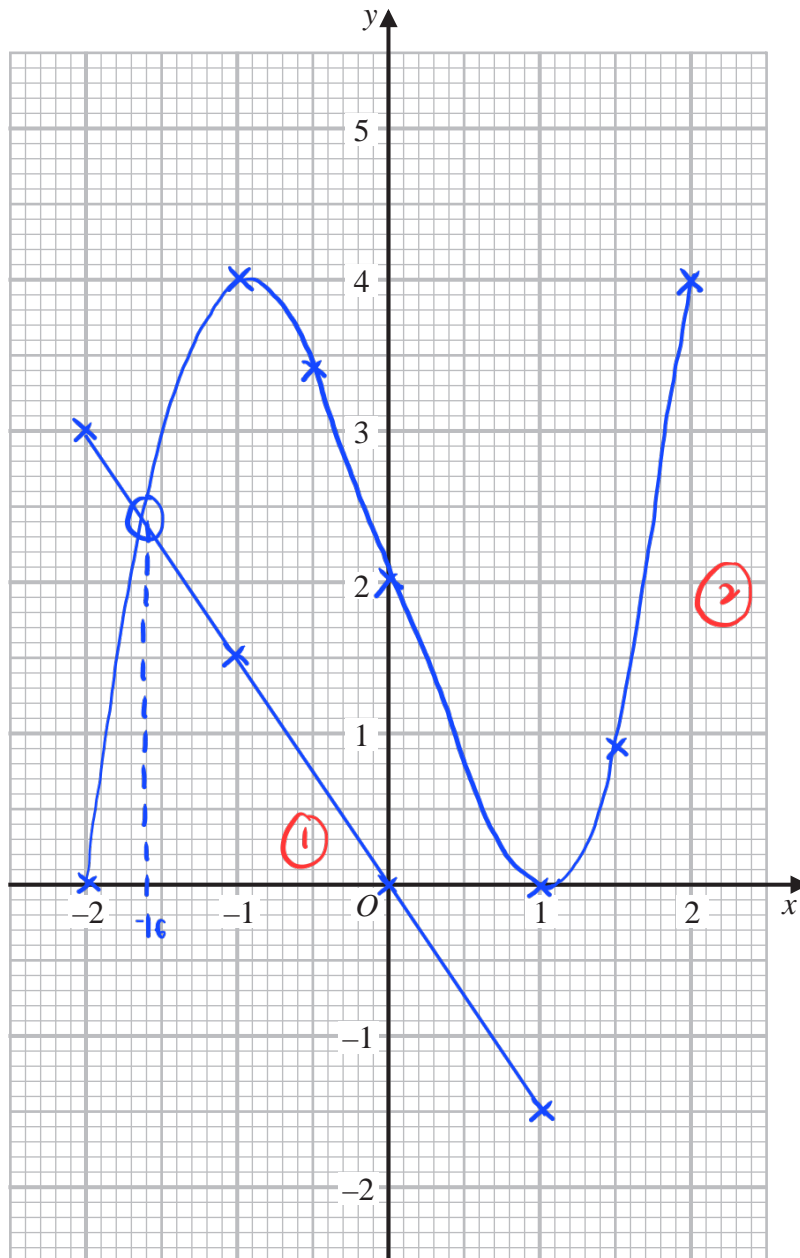
15 (a) Complete the table of values for  $y = x^3 - 3x + 2$

$x$	-2	-1	-0.5	0	1	1.5	2
$y$	0	4	3.4	2	0	0.9	4

(2)

(2)

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



(2)

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- (c) By drawing a suitable straight line on the grid, use your graph to find an estimate for the solution of

$$2x^3 - 3x + 4 = 0$$

Give your answer correct to one decimal place.

$$\begin{aligned} 2 \times y &= (x^3 - 3x + 2) \times 2 \\ 2y &= 2x^3 - 6x + 4 \\ &\ominus \\ 2x^3 - 3x + 4 &= 0 \end{aligned}$$

$$2y = -3x$$

$$y = -\frac{3}{2}x \quad \textcircled{1}$$

$$-1.6 \quad \textcircled{1}$$

(3)

(Total for Question 15 is 7 marks)

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16 The function  $f$  is such that

$$f(x) = \frac{2}{3x-5} \quad \text{where } x \neq \frac{5}{3}$$

(a) Find  $f\left(\frac{1}{3}\right)$

$$f\left(\frac{1}{3}\right) = \frac{2}{3\left(\frac{1}{3}\right)-5} = \frac{2}{-4} = -0.5$$

$$\underline{-0.5} \quad (1)$$

(b) Find  $f^{-1}(x)$

$$\text{let } f(x) = y,$$

$$y = \frac{2}{3x-5}$$

$$3x-5 = \frac{2}{y} \quad (1)$$

$$3x = \frac{2}{y} + 5$$

$$x = \frac{2+5y}{3y} \quad f^{-1}(x) = \frac{2+5x}{3x} \quad (1)$$

$$f^{-1}(x) = \frac{2+5x}{3x} \quad (2)$$

The function  $g$  is such that

$$g(x) = 5x^2 - 20x + 23$$

(c) Express  $g(x)$  in the form  $a(x-b)^2 + c$

$$g(x) = 5(x^2 - 4x) + 23 \quad (1)$$

$$= 5[(x-2)^2 - 4] + 23 \quad (1)$$

$$= 5(x-2)^2 - 20 + 23$$

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

$$\underline{5(x-2)^2 + 3}$$

(3)

(Total for Question 16 is 6 marks)



17

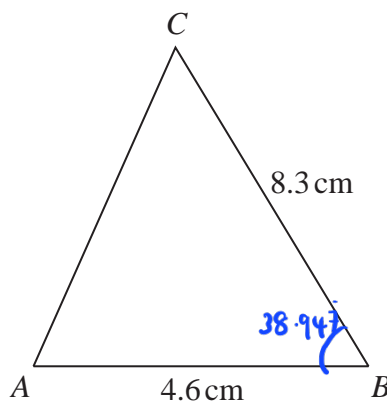


Diagram NOT  
accurately drawn

$AB = 4.6 \text{ cm}$        $BC = 8.3 \text{ cm}$       angle  $ABC$  is acute

The area of triangle  $ABC$  is  $12 \text{ cm}^2$

Work out the perimeter of triangle  $ABC$

Give your answer correct to 3 significant figures.

$$12 = \frac{1}{2} \times 8.3 \times 4.6 \times \sin ABC \quad (1)$$

$$ABC = \sin^{-1} \frac{12}{\frac{1}{2} \times 8.3 \times 4.6} \quad (1)$$

$$= 38.947 \dots$$

$$AC^2 = 4.6^2 + 8.3^2 - 2(4.6)(8.3) \cos 38.947 \quad (1)$$

$$AC^2 = 30.6627 \dots$$

$$AC = \sqrt{30.6627 \dots} \quad (1)$$

$$= 18.4 \quad (1)$$

.....  $18.4$  ..... cm

(Total for Question 17 is 5 marks)



18 Solve  $\sqrt{3}(x - 2\sqrt{3}) = x + 2\sqrt{3}$

Give your answer in the form  $a + b\sqrt{3}$  where  $a$  and  $b$  are integers.  
Show your working clearly.

$$\sqrt{3}x - 2(3) = x + 2\sqrt{3}$$

$$\sqrt{3}x - x = 6 + 2\sqrt{3} \quad (1)$$

$$x(\sqrt{3} - 1) = 6 + 2\sqrt{3}$$

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

$$= \frac{6\sqrt{3} + 6 + 2(3) + 2\sqrt{3}}{3 - 1}$$

$$= \frac{12 + 8\sqrt{3}}{2}$$

$$= 6 + 4\sqrt{3} \quad (1)$$

$$x = \dots 6 + 4\sqrt{3}$$

(Total for Question 18 is 4 marks)

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19  $P$  is inversely proportional to  $y^2$

When  $y = 4$ ,  $P = a$

(a) Find a formula for  $P$  in terms of  $y$  and  $a$

$$P = \frac{k}{y^2} \quad (1)$$

$$a = \frac{k}{4^2} \quad (1)$$

$$k = 16a$$

$$P = \frac{16a}{y^2} \quad (1)$$

$$P = \frac{16a}{y^2} \quad (3)$$

Given also that  $y$  is directly proportional to  $\sqrt{x}$   
and when  $x = a$ ,  $P = 4a$

(b) find a formula for  $P$  in terms of  $x$  and  $a$

$$y = m\sqrt{x}$$

$$4a = \frac{16x}{m^2 a} \quad (1)$$

$$4am^2 = 16$$

$$m = \sqrt{\frac{4}{a}} \quad (1)$$

$$y = \sqrt{\frac{4x}{a}}$$

$$P = \frac{16a}{\frac{4x}{a}}$$

$$= \frac{16a^2}{4x} = \frac{4a^2}{x} \quad (1)$$

$$P = \frac{4a^2}{x} \quad (3)$$

(Total for Question 19 is 6 marks)

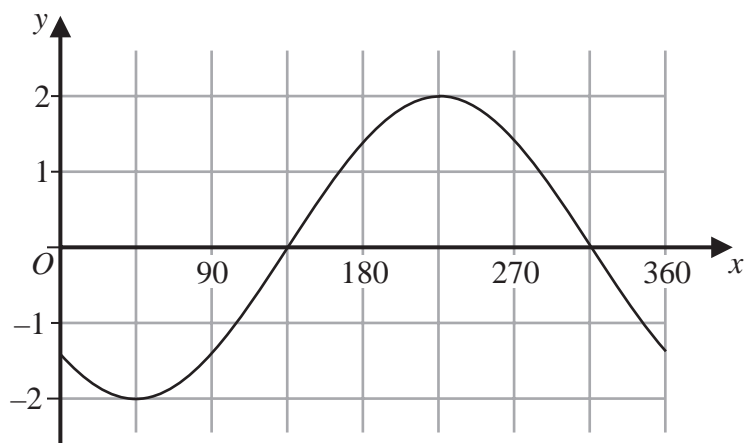
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20 Here is a sketch of the curve  $y = a \cos(x + b)^\circ$  for  $0 \leq x \leq 360$



Given that  $0 < b < 180$

find the value of  $a$  and the value of  $b$

$a = \dots\dots\dots 2 \quad (2)$

$b = \dots\dots\dots 135$

(Total for Question 20 is 2 marks)

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21 The diagram shows a triangular prism,  $ABCDEF$ , with a rectangular base  $ABCD$

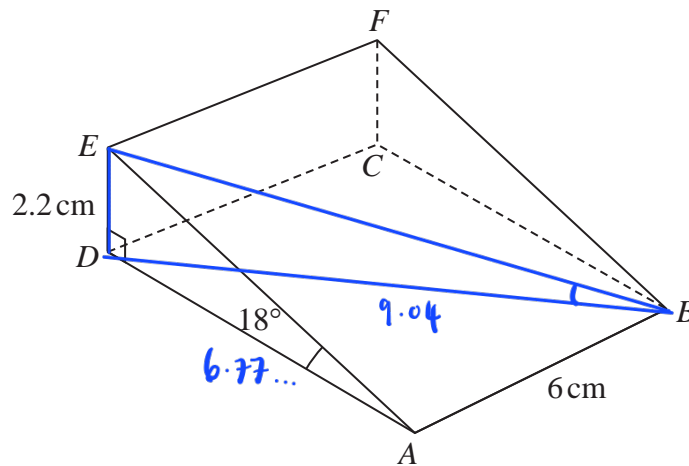


Diagram NOT  
accurately drawn

$$AB = 6 \text{ cm}$$

$$DE = 2.2 \text{ cm}$$

$$\text{angle } DAE = 18^\circ$$

$$\text{angle } ADE = 90^\circ$$

Work out the angle that  $BE$  makes with the plane  $ABCD$

Give your answer correct to one decimal place.

$$\tan 18^\circ = \frac{2.2}{AD}$$

$$AD = \frac{2.2}{\tan 18^\circ} = 6.77... \quad (1)$$

$$BD = \sqrt{6.77...^2 + 6^2}$$

$$= 9.04... \quad (1)$$

$$\tan \text{DBE} = \frac{2.2}{9.04...} \quad (1)$$

$$\text{DBE} = \tan^{-1} \frac{2.2}{9.04...}$$

$$= 13.7 \quad (1)$$

13.7

(Total for Question 21 is 4 marks)



22 The diagram shows triangle  $OAB$  with  $OA$  extended to  $E$

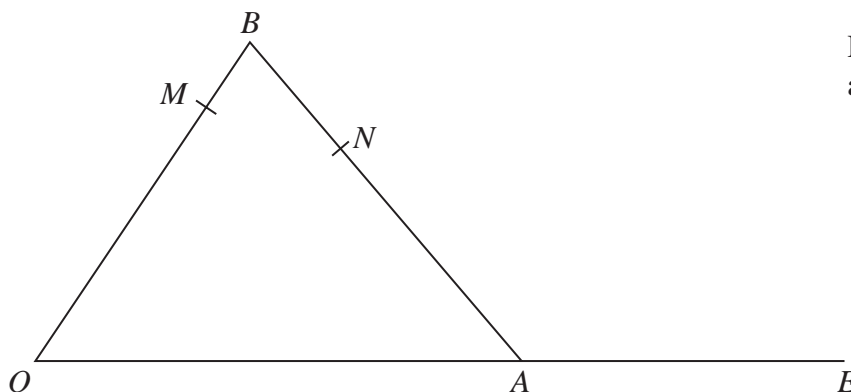


Diagram NOT accurately drawn

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$$\vec{OA} = \mathbf{a} \quad \vec{OB} = \mathbf{b}$$

$M$  is the point on  $OB$  such that  $OM:MB = 4:1$

$N$  is the point on  $AB$  such that  $AN:NB = 3:2$

$OA:AE = 5:3$

- (a) Find an expression for  $\vec{ON}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$   
Give your answer in its simplest form.

$$\begin{aligned} \vec{ON} &= \vec{OB} + \vec{BN} \\ &= \underline{\mathbf{b}} + \frac{2}{5} \vec{BA} \quad (1) \\ &= \underline{\mathbf{b}} + \frac{2}{5} (\vec{BO} + \vec{OA}) \\ &= \underline{\mathbf{b}} + \frac{2}{5} (-\underline{\mathbf{b}} + \underline{\mathbf{a}}) \\ &= \frac{2}{5} \underline{\mathbf{a}} + \frac{3}{5} \underline{\mathbf{b}} \quad (1) \end{aligned}$$

$$\vec{ON} = \frac{2}{5} \underline{\mathbf{a}} + \frac{3}{5} \underline{\mathbf{b}} \quad (2)$$





(b) Use a vector method to show that  $MNE$  is a straight line.

$$\begin{aligned}\vec{ME} &= \vec{MO} + \vec{OA} + \vec{AE} \\ &= \frac{4}{5}(\vec{BO}) + \underline{a} + \frac{3}{5}\underline{a} \\ &= \frac{4}{5}\underline{b} + \frac{8}{5}\underline{a} \\ &= \frac{8}{5}\underline{a} - \frac{4}{5}\underline{b} = 4\left(\frac{2}{5}\underline{a} - \frac{1}{5}\underline{b}\right) \quad (1)\end{aligned}$$

$$\begin{aligned}\vec{NE} &= \vec{NA} + \vec{AE} \\ &= \frac{3}{5}(\vec{BA}) + \frac{3}{5}\underline{a} \quad (1) \\ &= \frac{3}{5}(-\underline{b} + \underline{a}) + \frac{3}{5}\underline{a} \\ &= \frac{6}{5}\underline{a} - \frac{3}{5}\underline{b} = 3\left(\frac{2}{5}\underline{a} - \frac{1}{5}\underline{b}\right)\end{aligned}$$

$$\vec{ME} = \frac{4}{3}\vec{NE} \quad (1)$$

(3)

(Total for Question 22 is 5 marks)

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- 23  $G$  is the point on the curve with equation  $y = 8x^2 - 14x - 6$  where the gradient is 10  
The straight line  $Q$  passes through the point  $G$  and is perpendicular to the tangent at  $G$

Find an equation for  $Q$

Give your answer in the form  $ax + by + c = 0$  where  $a$ ,  $b$  and  $c$  are integers.

$$\text{gradient, } \frac{dy}{dx} = 16x - 14 \quad (1)$$

$$16x - 14 = 10 \quad (1)$$

$$x = \frac{24}{16} = 1.5$$

$$y = 8(1.5)^2 - 14(1.5) - 6$$

$$= -9 \quad (1)$$

$$G(1.5, -9)$$

$$m_Q = -\frac{1}{10}$$

$$-9 = -\frac{1}{10} \left(\frac{3}{2}\right) + c$$

$$-9 + \frac{3}{20} = c$$

$$\frac{-177}{20} = c \quad (1)$$

$$y = -\frac{1}{10}x - \frac{177}{20}$$

$$20y = -2x - 177$$

$$2x + 20y + 177 = 0 \quad (1)$$

$$2x + 20y + 177 = 0$$

(Total for Question 23 is 5 marks)

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- 24 An arithmetic sequence has first term 8 and common difference 11  
The sequence has  $k$  terms, where  $k > 21$

The sum of the last 20 terms of the sequence is 10 170

Find the value of  $k$

Show clear algebraic working.

$$S_{20} = \frac{20}{2} [2A + (19)(11)] = 10170 \quad (1)$$

$$2A + 209 = 1017$$

$$2A = 808$$

$$A = 404 \quad (1), \text{ where } A \text{ is the first of the last 20 terms}$$

$$T_A = 8 + (N_A - 1)11 = 404 \quad (1)$$

$$N_A - 1 = \frac{404 - 8}{11}$$

$$N_A = 37 \quad (1)$$

$$k = 37 + 19$$

$$= 56 \quad (1)$$

$$k = \dots\dots\dots 56$$

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER = 100 MARKS



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