

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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**Thursday 6 June 2019**

Morning (Time: 2 hours)

Paper Reference **4MA1/2HR**

**Mathematics A**

**Level 1/2**

**Paper 2HR**

**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 ►

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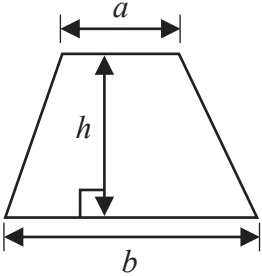
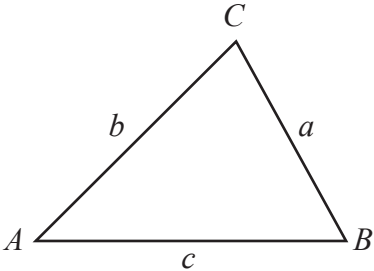
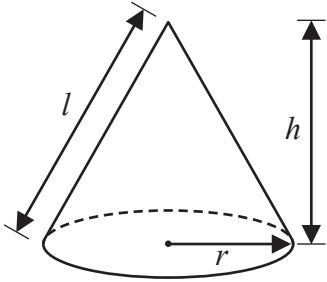
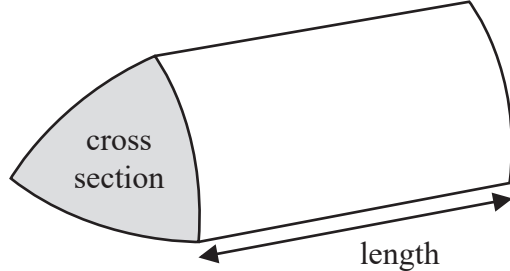
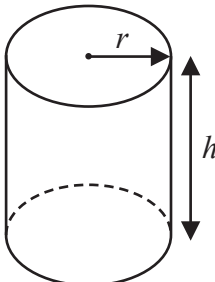
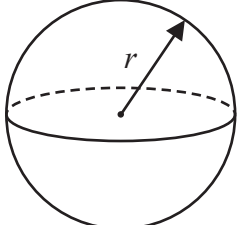
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Pearson

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></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> = 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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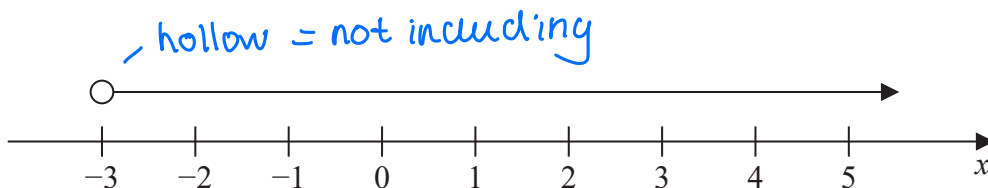
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Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a)



Write down the inequality shown on the number line.

$$x > -3$$

(1)

(b) Solve the inequality  $4y - 13 \leq y + 8$

$$4y - 13 \leq y + 8$$

$$3y - 13 \leq 8$$

$$3y \leq 21$$

$$y \leq 7$$

$$y \leq 7$$

(2)

(Total for Question 1 is 3 marks)

2 Show that  $5\frac{2}{3} - 2\frac{3}{4} = 2\frac{11}{12}$

$$5\frac{2}{3} = \frac{17}{3}$$

~~$$\frac{17}{3} - \frac{11}{4}$$~~

$$2\frac{3}{4} = \frac{11}{4}$$

$$= \frac{68 - 33}{12}$$

$$= \frac{35}{12}$$

35 - 24 = 11

$$\frac{24}{12} = 2$$

$$\frac{24 + 11}{12}$$

$$= 2\frac{11}{12}$$

(Total for Question 2 is 3 marks)



3 (a) Complete the table of values for  $y = 1 + 5x - x^2$

x	-1	0	1	2	3	4	5	6
y	-5	1	5	7	7	5	1	-5

$$1 + 5(-1) - (-1)^2$$

$$1 - 5 - 1 = -5$$

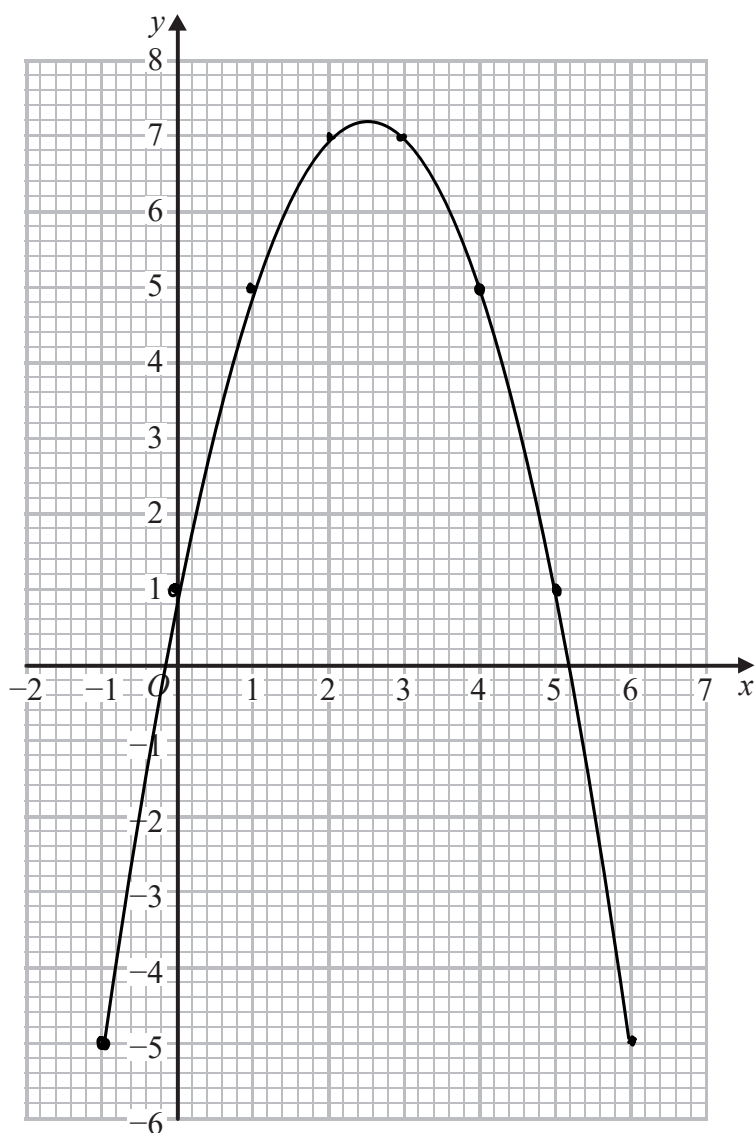
$$1 + 5(1) - (1)^2$$

$$1 + 5(4) - 4^2$$

$$1 + 5(6) - 6^2$$

(2)

(b) On the grid, draw the graph of  $y = 1 + 5x - x^2$  for values of  $x$  from -1 to 6



(2)

(Total for Question 3 is 4 marks)



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4  $ABC$  and  $DEF$  are similar triangles.

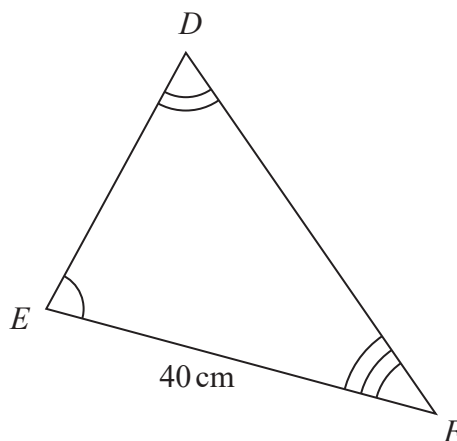
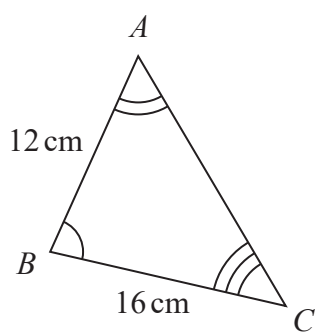


Diagram **NOT** accurately drawn

(a) Work out the length of  $DE$ .

$$\text{Scale factor: } \frac{40}{16} = 2.5$$

$$12 \times 2.5 = DE \\ = 30$$

$$\underline{\hspace{2cm} 30 \hspace{2cm}} \text{ cm} \\ (2)$$

The area of triangle  $DEF$  is  $525 \text{ cm}^2$

(b) Find the area of triangle  $DEF$  in  $\text{m}^2$

$$\text{cm} \xrightarrow{\div 100} \text{m} \\ \text{cm}^2 \xrightarrow{\div 100^2} \text{m}^2$$

$$525 \div 100^2 =$$

$$\underline{\hspace{2cm} 0.0525 \hspace{2cm}} \text{ m}^2 \\ (2)$$

(Total for Question 4 is 4 marks)

5 Factorise  $x^2 - 5x - 36$

$$\begin{array}{l} \times \text{ to } -36 \\ + \text{ to } -5 \end{array}$$

$-9$  and  $+4$

$$\begin{array}{l} \rightarrow x^2 + 4x - 9x - 36 \\ x(x+4) - 9(x+4) \\ (x+4)(x-9) \end{array} \quad \underline{\hspace{2cm} (x+4)(x-9) \hspace{2cm}}$$

(Total for Question 5 is 2 marks)



P 6 0 2 6 1 A 0 5 2 4

- 6 There are some ice lollies in a freezer.

The flavour of each ice lolly is banana or strawberry or mint or chocolate.

Julius takes at random an ice lolly from the freezer.

The table shows the probabilities that the flavour of the ice lolly that Julius takes is banana or strawberry or chocolate.

Flavour	banana	strawberry	mint	chocolate
Probability	0.35	0.32	0.21	0.12

Work out the probability that the flavour of the ice lolly that Julius takes is either strawberry or mint.

Probability adds to 1

$$0.35 + 0.32 + 0.12 + P(\text{Mint}) = 1$$

$$0.79 + P(\text{Mint}) = 1$$

$$P(\text{Mint}) = 1 - 0.79 = 0.21$$

$$P(\text{Strawberry}) + P(\text{Mint}) = 0.32 + 0.21 = 0.53$$

(Total for Question 6 is 3 marks)

- 7 A football team played 55 games.  
Each game was won, drawn or lost.

number of games won : number of games drawn : number of games lost = 6 : 3 : 2

Work out how many more games the team won than the team lost.

	Win	:	draw	:	lost	Total	
x5	6	:	3	:	2	11	
↘	30	:	15	:	10	55	↖ ÷5

$$\begin{array}{r} \text{Win} = 30 \\ \text{lose} = 10 \\ \hline 20 \end{array}$$

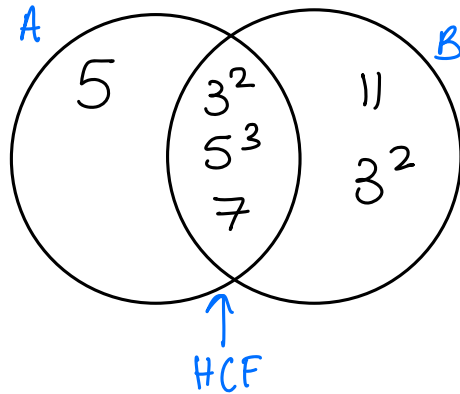
20

(Total for Question 7 is 3 marks)



8

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

(a) Find the highest common factor (HCF) of  $A$  and  $B$ .

$$\text{HCF} = 3^2 \times 5^3 \times 7$$

$$\underline{7875}$$

(2)

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

LCM = Multiply all values in Venn Diagram

$$= 7875 \times 5 \times 11 \times 3^2$$

$$= \underline{3898125}$$

(2)

(Total for Question 8 is 4 marks)

9 (a) Write 840 000 in standard form.

840000  
1 2 3 4 5

$$\underline{8.4 \times 10^5}$$

(1)

(b) Work out  $(6 \times 10^7) \div (8 \times 10^{-2})$   
Give your answer in standard form.

$$\frac{6 \times 10^7}{8 \times 10^{-2}} = \frac{6}{8} \times 10^{7-(-2)}$$

$$= 0.75 \times 10^9$$

$$= 7.5 \times 10^8$$

$$\underline{7.5 \times 10^8}$$

(2)

between  
1 and 10

(Total for Question 9 is 3 marks)



P 6 0 2 6 1 A 0 7 2 4

10 Henri buys a yacht for 150 000 euros.

The yacht depreciates in value by 18% each year.

Work out the value of the yacht at the end of 3 years.

Give your answer correct to the nearest euro.

$$\text{Depreciates: } 100 - 18 = 82\% \div 100 = \times 0.82$$

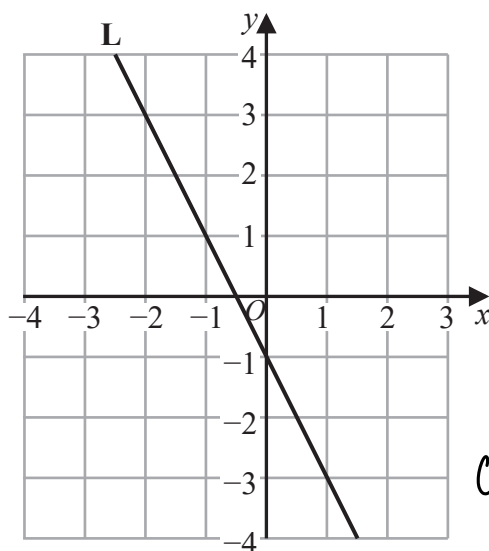
$$150,000 \times 0.82^3 = 82705.2 \quad \begin{array}{l} \text{Starting} \\ \text{value} \end{array} \quad \begin{array}{l} \text{multiplier} \\ \text{time} \end{array} \quad \begin{array}{l} \text{round} \\ \text{down} \end{array}$$

$$= 82705$$

..... 82705 euros

(Total for Question 10 is 3 marks)

11 Line L is drawn on the grid.



(0, 1)

(1, -3)

$$y = mx + c$$

Find an equation for L.

$$\text{gradient (m)} = \frac{y_1 - y_2}{x_1 - x_2}$$

$$= \frac{-1 - 1}{0 - 1} = \frac{-2}{-1} = 2$$

$$\text{y intercept (c)} = -1$$

$$y = 2x - 1$$

(Total for Question 11 is 3 marks)





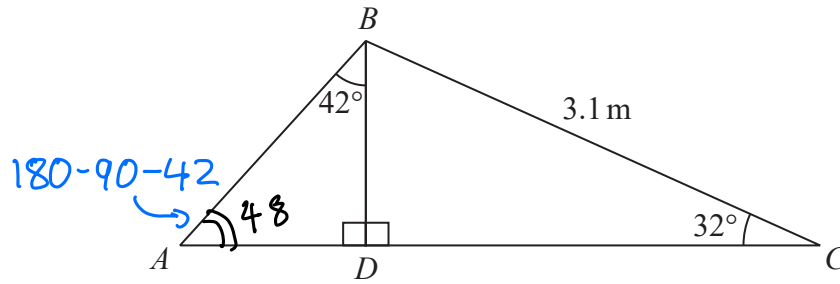


Diagram NOT  
accurately drawn

Calculate the length of  $AB$ .  
Show your working clearly.  
Give your answer correct to 3 significant figures.

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

Triangle ABC:

$$\frac{AB}{\sin 32} = \frac{3.1}{\sin 48}$$

$$AB = \frac{3.1 \sin 32}{\sin 48}$$

$$= 2.2105\dots \text{ m}$$

= 3sf round down

2.21 m

(Total for Question 12 is 5 marks)

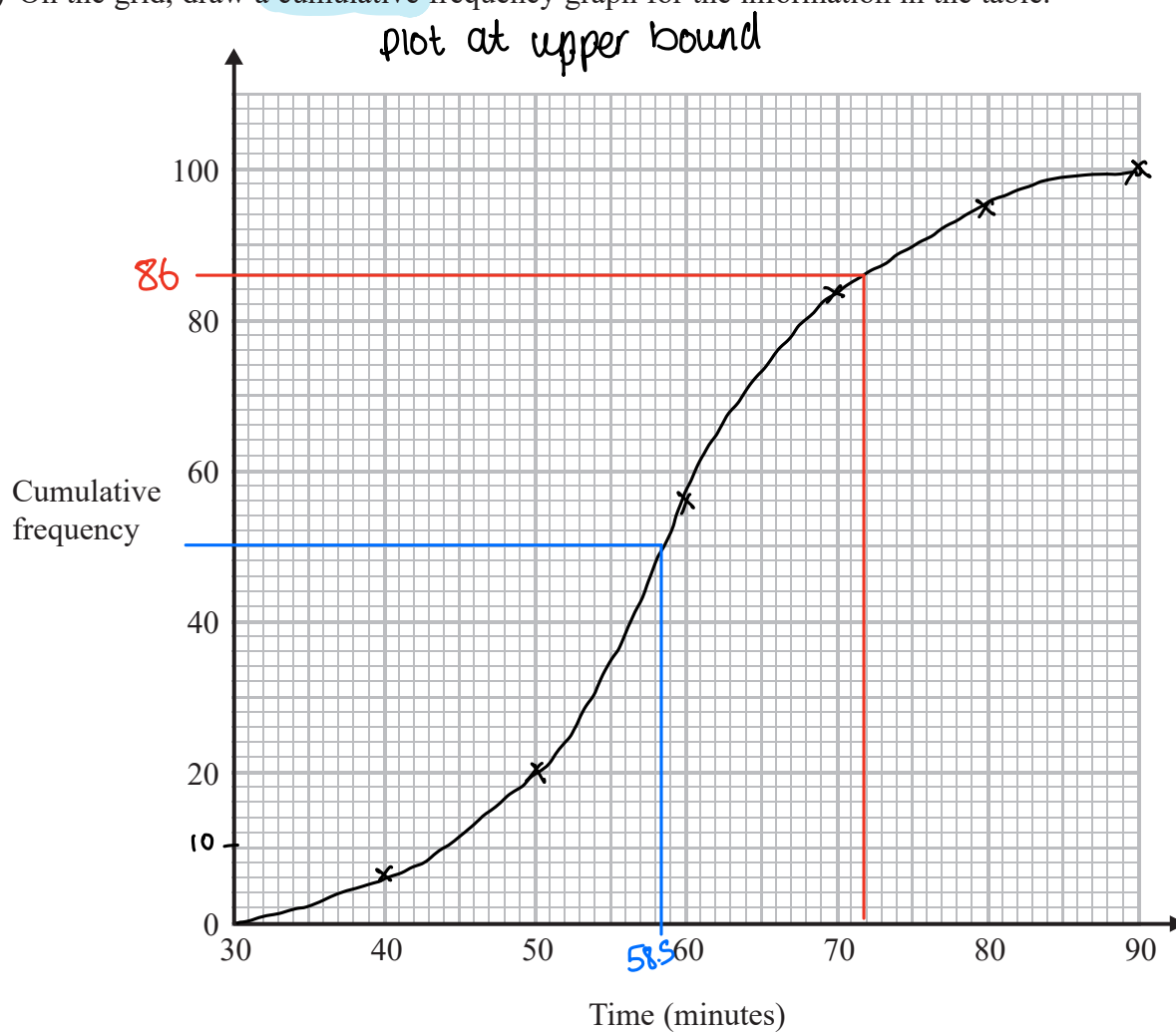


- 13 Sandeep recorded the length of time, in minutes, that each of 100 adults went for a walk one Saturday afternoon.

The cumulative frequency table gives information about these times.

Time ( $t$ minutes)	Cumulative frequency
$30 < t \leq 40$	6
$30 < t \leq 50$	20
$30 < t \leq 60$	56
$30 < t \leq 70$	84
$30 < t \leq 80$	95
$30 < t \leq 90$	100

- (a) On the grid, draw a cumulative frequency graph for the information in the table.



(b) Use your graph to find an estimate for the median length of time that these adults went for a walk.

$$\text{median freq} : \frac{100}{2} = 50$$

..... 58.5 ..... minutes  
(2)

One of the 100 adults is chosen at random.

(c) Use your graph to find an estimate for the probability that this adult went for a walk for more than 72 minutes.

86 adults took up to 72min

$$100 - 86 = 14 \text{ took more than 72}$$

$$\frac{14}{100} =$$

..... 0.14 .....  
(3)

(Total for Question 13 is 7 marks)

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14 (a) Simplify fully  $(x^{12}y^8)^{\frac{3}{4}}$

$$= x^{12 \times \frac{3}{4}} y^{8 \times \frac{3}{4}}$$

$$(a^b)^c = a^{b \times c}$$

$$x^9 y^6$$

(2)

Given that  $3^n = \frac{3^x}{9^y}$

(b) find an expression for  $n$  in terms of  $x$  and  $y$ .

$$3^n = \frac{3^x}{(3^2)^y} = \frac{3^x}{3^{2y}}$$

$9 = 3^2$

$$\frac{a^b}{a^c} = a^{b-c}$$

$$= 3^{x-2y}$$

$-n$

$$n = x - 2y$$

(2)

(Total for Question 14 is 4 marks)

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15  $A, B, C$  and  $D$  are points on a circle, centre  $O$ .

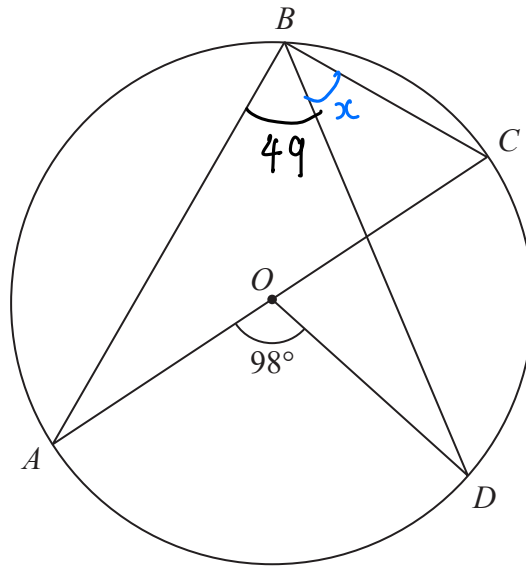


Diagram NOT accurately drawn

$AOC$  is a diameter of the circle.

Angle  $AOD = 98^\circ$

Work out the size of angle  $DBC$ .

Give a reason for each stage in your working.

$$\angle ABD = 98 \div 2 = 49^\circ$$

angle at centre is twice the circumference angle

$$\angle ABC = 90^\circ$$

Angle in a semicircle =  $90^\circ$   
( $AC = \text{diameter}$ )

$$\begin{aligned} \angle DBC &= 90 - 49 \\ &= 41 \end{aligned}$$

..... 41 °

(Total for Question 15 is 4 marks)



16 The following table gives values of  $x$  and  $y$  where  $y$  is inversely proportional to the square of  $x$ .

$x$	1.5	2	3	4
$y$	16	9	4	2.25

(a) Find a formula for  $y$  in terms of  $x$ .

$$y \propto \frac{1}{x^2}$$

$$y = \frac{k}{x^2}$$

$$y = \frac{36}{x^2}$$

$$9 = \frac{k}{2^2}$$

$$9 = \frac{k}{4}$$

$$36 = k$$

$$y = \frac{36}{x^2} \quad (3)$$

Given that  $x > 0$

(b) find the value of  $x$  when  $y = 144$

$$y = \frac{36}{x^2}$$

$$144 = \frac{36}{x^2}$$

$$144x^2 = 36$$

$$x^2 = \frac{36}{144}$$

$$x = \sqrt{\frac{36}{144}}$$

$$x = \pm \frac{6}{12}$$

$x > 0$   
reject  
negative  
value

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

$$\frac{1}{2}$$

(2)

(Total for Question 16 is 5 marks)

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17 The table gives information about the first six terms of a sequence of numbers.

Term number	1	2	3	4	5	6
Term of sequence	$\frac{1 \times 2}{2}$	$\frac{2 \times 3}{2}$	$\frac{3 \times 4}{2}$	$\frac{4 \times 5}{2}$	$\frac{5 \times 6}{2}$	$\frac{6 \times 7}{2}$

Prove algebraically that the sum of any two consecutive terms of this sequence is always a square number.

$$\text{Term } n : \frac{n \times (n+1)}{2} = \frac{n^2 + n}{2}$$

$$\text{Term } n+1 : \frac{(n+1)(n+2)}{2} = \frac{n^2 + 3n + 2}{2}$$

$$\text{Sum: } \frac{n^2 + n}{2} + \frac{n^2 + 3n + 2}{2}$$

$$= \frac{2n^2 + 4n + 2}{2}$$

$$= n^2 + 2n + 1$$

$$= (n+1)(n+1)$$

$$= (n+1)^2$$

← squared

Therefore the sum is  
always a square

(Total for Question 17 is 4 marks)



18 The functions  $f$  and  $g$  are defined as

$$f(x) = \frac{x}{4x-3} \quad \text{and} \quad g(x) = x - 5$$

(a) State which value of  $x$  must be excluded from any domain of the function  $f$ .

$$\begin{array}{l}
 +3 \left( \begin{array}{l} 4x - 3 \neq 0 \\ 4x \neq 3 \\ x \neq \frac{3}{4} \end{array} \right) \left. \begin{array}{l} \text{cannot divide by } 0 \\ \\ \end{array} \right) \div 4 \\
 \dots\dots\dots \frac{3}{4} \quad (1)
 \end{array}$$

(b) Find  $fg(x)$ .

Simplify your answer.

input  $g(x)$  in place of  $x$ .

$$\frac{x-5}{4(x-5)-3} = \frac{x-5}{4x-20-3} = \frac{x-5}{4x-23}$$

$$fg(x) = \frac{x-5}{4x-23} \quad (2)$$

(c) Express the inverse function  $f^{-1}$  in the form  $f^{-1}(x) = \dots$

$$y = \frac{x}{4x-3}$$

Subject  $x$  and replace 'x' with 'f(x)' and 'y' with 'x'

$$4xy - 3y = x$$

$$4xy - x = 3y$$

$$x(4y - 1) = 3y$$

$$x = \frac{3y}{4y-1}$$

$$f^{-1}(x) = \frac{3x}{4x-1}$$

$$f^{-1}(x) = \frac{3x}{4x-1} \quad (3)$$



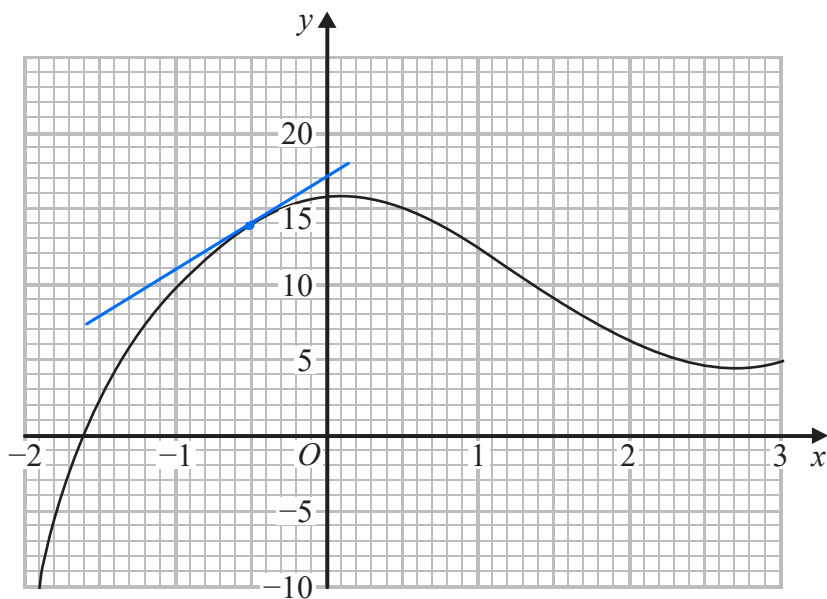


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Part of the curve with equation  $y = h(x)$  is shown on the grid.



- (d) Find an estimate for the gradient of the curve at the point where  $x = -0.5$ .  
Show your working clearly.

draw a tangent at -0.5

$$\text{gradient} = \frac{y_1 - y_2}{x_1 - x_2} \quad \begin{matrix} (0, 17) \\ (-1, 11) \end{matrix}$$

$$= \frac{17 - 11}{0 - (-1)} = \frac{6}{1}$$

6

(3)

(Total for Question 18 is 9 marks)



P 6 0 2 6 1 A 0 1 7 2 4

19 The diagram shows a sector  $OAPB$  of a circle, centre  $O$ .

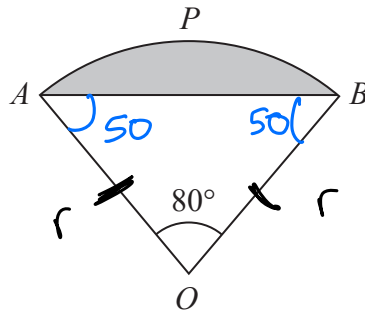


Diagram NOT accurately drawn

$$\frac{180 - 80}{2} = 50$$

Isosceles triangles → 2

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

$AB$  is a chord of the circle.  
Angle  $AOB = 80^\circ$

The area of sector  $OAPB$  is  $\frac{25}{2}\pi \text{ cm}^2$

Work out the perimeter of the shaded segment.  
Give your answer correct to 3 significant figures.

$$\text{Area of sector} = \pi r^2 \times \frac{\theta}{360}$$

$$\frac{25}{2}\pi = \pi r^2 \times \frac{80}{360}$$

$$\frac{25}{2} = \frac{2}{9} r^2$$

$$\frac{225}{4} = r^2$$

$$r = \frac{15}{2}$$

Straight line  $AB$ :

$$\frac{AB}{\sin 80} = \frac{7.5}{\sin 50}$$

$$AB = \frac{7.5 \sin 80}{\sin 50}$$

$$\approx 9.6418\dots$$

Circumference of sector:

$$2\pi \times \frac{15}{2} \times \frac{80}{360}$$

$$= \frac{10}{3}\pi$$

Perimeter:

$$\frac{10}{3}\pi + AB$$

$$20.1 \underline{1} 37\dots$$

3sf  
round down

$$\dots\dots\dots 20.1 \dots\dots \text{cm}$$

(Total for Question 19 is 6 marks)

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$$x = \frac{6a}{b-a}$$

$a = 3.46$  correct to 3 significant figures.

$b = 6.3$  correct to 1 decimal place.

Work out the upper bound for the value of  $x$ .

Give your answer as a decimal correct to 3 significant figures.

Show your working clearly.

Bounds for  $a$ :  $3.455 \leq a < 3.465$

all values round to 3.46

Bounds for  $b$ :  $6.25 \leq b < 6.35$

all values round to 6.3

Upper bound for  $x$ :  $\frac{UB}{LB} = \frac{UB}{LB-UB}$

$$= \frac{6 \times 3.465}{6.25 - 3.465} = 7.4649\dots$$

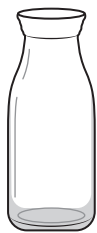
3sf round down

7.46

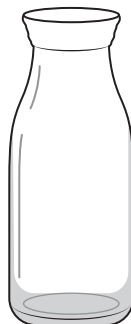
(Total for Question 20 is 3 marks)



21 The diagram shows two similar bottles, A and B.



A



B

Diagram **NOT** accurately drawn

Bottle A has surface area  $240 \text{ cm}^2$

Bottle B has surface area  $540 \text{ cm}^2$  and volume  $2025 \text{ cm}^3$

Work out the volume of bottle A.

$$\text{Area scale factor } A \text{ to B} : \frac{540}{240} = \times 2.25$$

$$\text{Linear Scale} = \sqrt{2.25} = \times 1.5$$

$$\text{Volume Scale} = 1.5^3 = \times \frac{27}{8}$$

$$\text{Volume of A} : 2025 \div \frac{27}{8}$$

B to A ( $\div$ )

..... 600 .....  $\text{cm}^3$

(Total for Question 21 is 3 marks)

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22 Write  $5 + 12x - 2x^2$  in the form  $a + b(x + c)^2$  where  $a$ ,  $b$  and  $c$  are integers.

$5 - 2(x^2 - 6x)$  Factorise the 2 out

$5 - 2[(x - 3)^2 - 9]$  complete the square  
 $-6 \div 2 = 3$

$5 - 2(x - 3)^2 + 18$  Expand out the  $[\ ]$   
brackets

$23 - 2(x - 3)^2$  Simplify

$23 - 2(x - 3)^2$

(Total for Question 22 is 4 marks)



23 The diagram shows a solid pyramid  $ABCDE$  with a horizontal base.

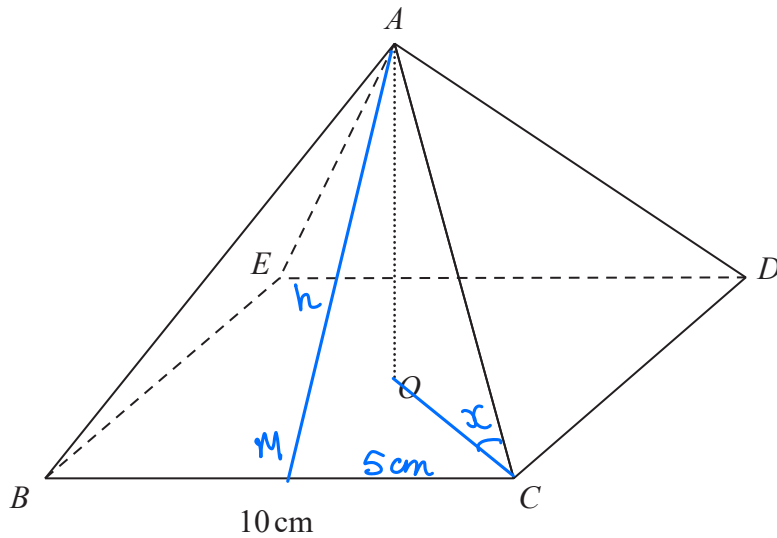


Diagram **NOT** accurately drawn

The base,  $BCDE$ , of the pyramid is a square of side 10 cm.

The vertex  $A$  of the pyramid is vertically above the centre  $O$  of the base so that  $AB = AC = AD = AE$

The **total** surface area of the pyramid is  $360 \text{ cm}^2$

Work out the size of the angle between  $AC$  and the base  $BCDE$ .  
Give your answer correct to 3 significant figures.

Surface Area = Sum of all area of faces

Base + 4 triangles:  $\frac{1}{2} \times b \times h$

$$10 \times 10 + 4 \times \frac{1}{2} \times 10 \times h = 360$$

$$100 + 20h = 360$$

$$20h = 260$$

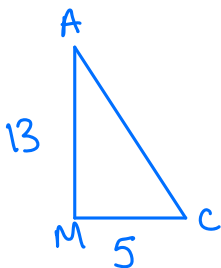
$$h = 13$$

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

$$13^2 + 5^2 = AC^2$$

$$AC^2 = 194$$

$$AC = \sqrt{194}$$



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

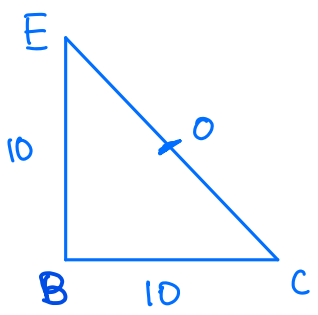
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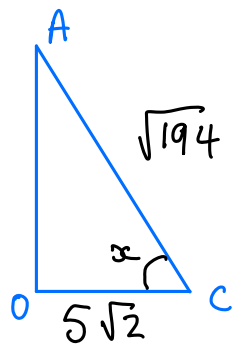


$$10^2 + 10^2 = EC^2$$

$$EC^2 = 200$$

$$EC = 10\sqrt{2}$$

$$OC = \frac{10\sqrt{2}}{2} = 5\sqrt{2}$$



$$\cos x = \frac{\text{adj}}{\text{hyp}}$$

$$\cos x = \frac{5\sqrt{2}}{\sqrt{194}}$$

$$x = \cos^{-1} \left( \frac{5\sqrt{2}}{\sqrt{194}} \right)$$

$$= 59.49\dots$$

*= 3sf round up*

59.5 °

(Total for Question 23 is 6 marks)

Turn over for Question 24



24 A box contains marbles.

4 of the marbles are red.

The rest of the marbles are yellow.

Antonia takes at random a marble from the box and does not replace it.

Sergio then takes at random a marble from the box.

The probability that Antonia and Sergio both take a yellow marble is 0.7

Work out how many marbles were originally in the box.

Show your working clearly.

$x$  marbles in the box

Antonia:  $P(\text{Yellow})$

$$\frac{x-4}{x}$$

Sergio:  $P(\text{Yellow})$

$$\frac{x-4-1}{x-1} = \frac{x-5}{x-1}$$

does not replace

$P(\text{Both choose Yellow})$

$$\frac{x-4}{x} \times \frac{x-5}{x-1} = \frac{7}{10}$$

$$\frac{x^2 - 9x + 20}{x^2 - x} = \frac{7}{10}$$

$$10x^2 - 90x + 200 = 7x^2 - 7x$$

$$\underbrace{3x^2}_a - \underbrace{83x}_b + \underbrace{200}_c = 0$$

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

$$\frac{-(-83) \pm \sqrt{83^2 - 4 \times 3 \times 200}}{2 \times 3}$$

$$= \frac{83 \pm \sqrt{4489}}{6} = \begin{matrix} \oplus 25 \\ \ominus 8/3 \end{matrix}$$

can't have  
a fraction of  
a marble

25

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

