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Centre Number					Candidate Number				
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Pearson Edexcel International GCSE

Wednesday 7 June 2023

Morning (Time: 2 hours) Paper reference **4MA1/2HR**

Mathematics A

PAPER 2HR

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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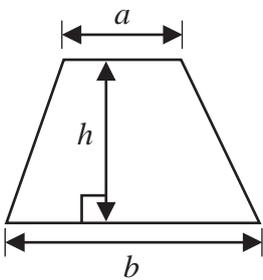
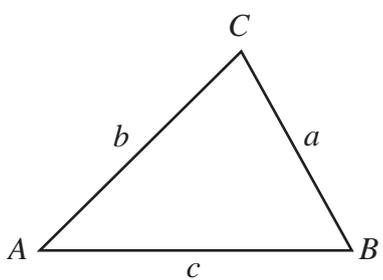
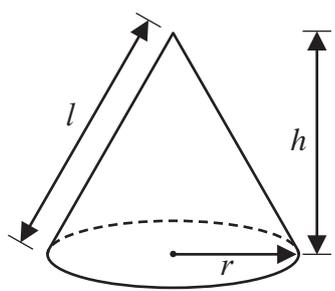
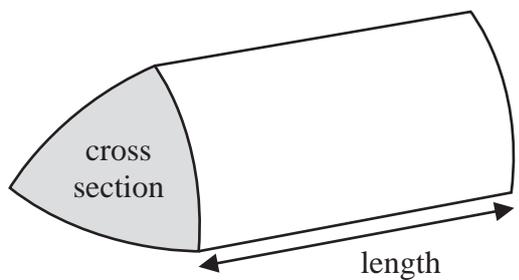
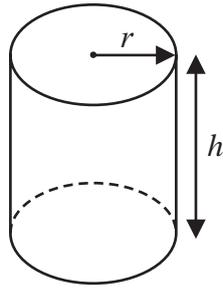
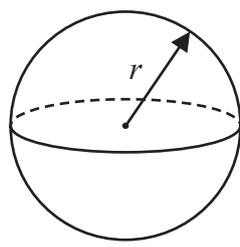
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International GCSE Mathematics

Formulae sheet – Higher Tier

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

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Answer ALL TWENTY SIX questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $P = m^2 - 4c$

(a) Work out the value of P when $m = -5$ and $c = 3$

$$\begin{aligned} P &= (-5)^2 - 4(3) \\ &= 25 - 12 \quad (1) \\ &= 13 \quad (1) \end{aligned}$$

$$P = \frac{13}{\dots\dots\dots} \quad (2)$$

(b) Expand and simplify $(x + 5)(x - 7)$

$$\begin{aligned} &x^2 - 7x + 5x - 35 \quad (1) \\ &= x^2 - 2x - 35 \quad (1) \end{aligned}$$

$$\frac{x^2 - 2x - 35}{\dots\dots\dots} \quad (2)$$

(Total for Question 1 is 4 marks)

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- 2 Sandeep wants to buy some packets of pens and some boxes of pencils for his stationery shop.

Each packet of pens contains 9 pens.

Each box of pencils contains 12 pencils.

Each packet of pens costs £7.60

Each box of pencils costs £4.80

Sandeep can only buy full packets of pens and full boxes of pencils.

He wants to buy exactly the same number of pens as pencils.

Work out the minimum amount Sandeep needs to pay.

Multiples of 9 and 12 :

pens : 9 , 18 , 27 , (36) (4 packets)

pencils: 12 , 24 , (36) (1) (3 boxes)

$$4(7.60) + 3(4.80) \quad (1)$$

$$= 30.40 + 14.40 \quad (1)$$

$$= 44.80 \quad (1)$$

£ 44.80

(Total for Question 2 is 4 marks)



- 3 Anjali travels on the Eurostar train from Paris to Amsterdam.

The distance the train travels between Paris and Amsterdam is 515 km.
The time taken by the train to travel between Paris and Amsterdam is 3 hours 18 minutes.

Work out the average speed of the train.

Give your answer in km/h correct to the nearest whole number.

$$\frac{18 \text{ minutes}}{60} = 0.3 \text{ hours}$$

$$\text{Time taken} = 3.3 \text{ hours} \quad (1)$$

$$\text{speed} = \frac{515 \text{ km}}{3.3 \text{ hours}} \quad (1) = 156 \text{ km/h} \quad (1)$$

156

..... km/h

(Total for Question 3 is 3 marks)

- 4 Here are the first four terms of an arithmetic sequence.

$$38 \quad \overset{-7}{\curvearrowright} \quad 31 \quad 24 \quad 17$$

Find an expression, in terms of n , for the n th term of the sequence.

$$a = 38$$

$$d = -7$$

$$T_n = 38 + (n-1)(-7)$$

$$= 38 - 7n + 7$$

$$= 45 - 7n \quad (2)$$

45 - 7n

(Total for Question 4 is 2 marks)



- 5 A field is in the shape of a trapezium.

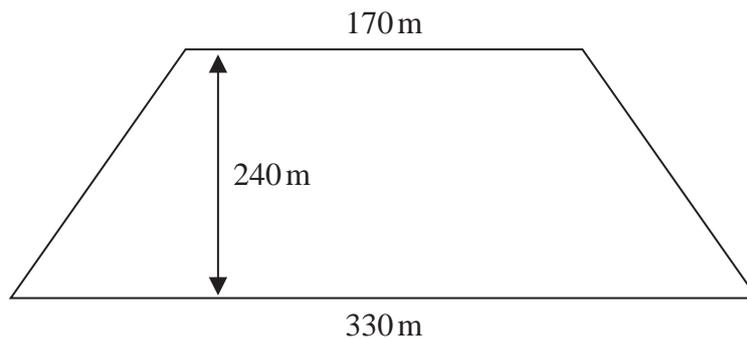


Diagram **NOT** accurately drawn

The field is sold for a price of \$49 650

Given that 1 hectare = 10 000 m²

work out the average price of the field per hectare.

$$\text{Area} = \frac{1}{2} \times 240 \times (170 + 330) \quad (1)$$

$$= 120 \times 500$$

$$= 60\,000 \text{ m}^2$$

$$\text{in hectare} = \frac{60\,000}{10\,000} \quad (1)$$

$$= 6 \text{ hectares}$$

$$\text{price per hectare} = \frac{49\,650}{6} = 8275 \quad (1)$$

\$ 8275

(Total for Question 5 is 4 marks)



- 6 In his previous job, Pierre was paid 400 euros in total for working a 5-day week.

In his new job, Pierre is paid 14 euros per hour.

In his new job, Pierre works for 7 hours each day for a 5-day week.

- (a) Work out the percentage increase in the amount that Pierre is paid for a 5-day week.

$$\text{New job pay} : 14 \times 7 \times 5 = 490 \text{ euros } \textcircled{1}$$

$$\text{increase in pay} = 490 - 400 = 90 \text{ euros } \textcircled{1}$$

$$\% \text{ increase} = \frac{90}{400} \times 100\% = 22.5\% \textcircled{1}$$

$$\frac{22.5}{\dots\dots\dots} \% \textcircled{4}$$

Marie changes her job.

Her salary decreases by 6%

Her new salary is 23 030 euros.

- (b) Work out Marie's salary before she changes her job.

$$\text{Let Salary before} = x$$

$$1 - 0.06 = 0.94 \textcircled{1}$$

$$x \times 0.94 = 23030$$

$$x = \frac{23030 \textcircled{1}}{0.94} = 24500 \textcircled{1}$$

$$\frac{24500}{\dots\dots\dots} \text{ euros } \textcircled{3}$$

(Total for Question 6 is 7 marks)

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7 (a) Simplify $(4^{-2})^0$

1 (1)

(1)

$$3^{-14} \times 3^8 = 3^m$$

(b) Find the value of m

$$3^{-14+8} = 3^m$$

$$-14+8 = m$$

$$-6 = m \quad (1)$$

$$m = -6 \quad (1)$$

(Total for Question 7 is 2 marks)

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8 (a) Solve $9 - 4x > 17$

$$-4x > 17 - 9 \quad (1)$$

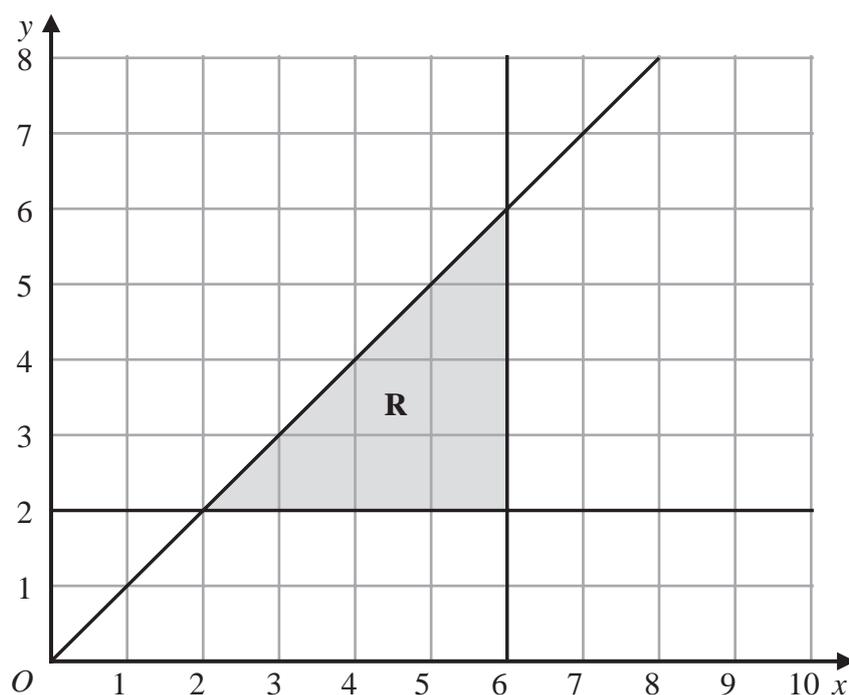
$$-4x > 8$$

$$x < \frac{8}{-4}$$

$$x < -2 \quad (1)$$

$$x < -2$$

(2)



(b) Write down the three inequalities that represent the shaded region **R**

$$x \leq 6 \quad (3)$$

$$y \geq 2$$

$$y \leq x$$

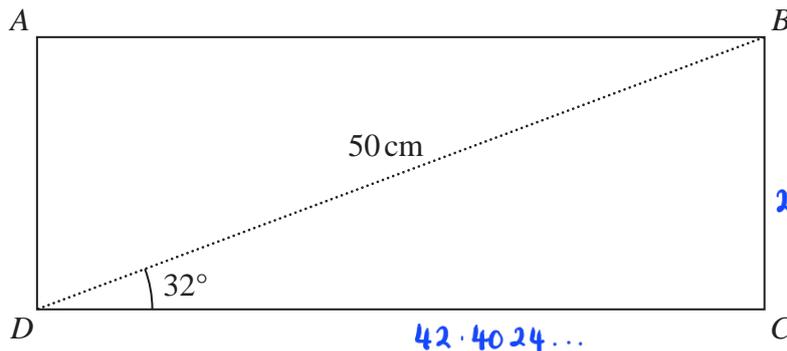
(3)

(Total for Question 8 is 5 marks)



P 7 2 8 2 9 A 0 9 2 8

- 9 The diagram shows a rectangular sheet of metal $ABCD$



$BD = 50$ cm and angle $BDC = 32^\circ$

Nasser joins side AD to side BC to form a cylinder.

BC is the height of the cylinder.

DC is the circumference of the cross section of the cylinder.

Work out the volume, in cm^3 , of the cylinder.

Give your answer correct to 3 significant figures.

$$\sin 32^\circ = \frac{BC}{50} \quad (1)$$

$$BC = 50 \sin 32^\circ = 26.4959\dots \quad (1)$$

$$\cos 32^\circ = \frac{CD}{50} \quad (1)$$

$$CD = 50 \cos 32^\circ = 42.4024\dots$$

$$42.4024\dots = 2\pi r$$

$$r = \frac{42.4024\dots}{2\pi} = 6.74855\dots \quad (1)$$

$$\text{Volume} = \pi \times 6.74855\dots^2 \times 26.4959\dots \quad (1)$$

$$= 3796 \quad (1)$$

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3 790

..... cm³

(Total for Question 9 is 6 marks)



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

10 Gemara works as a taxi driver.

Last week, he recorded the following information about the distances he drove.

For the 5 days from Monday to Friday, the mean number of kilometres he drove was 104

For the 7 days from Monday to Sunday, the mean number of kilometres he drove was 127

On Saturday, Gemara drove 132 kilometres.

Work out the number of kilometres he drove on Sunday.

Total distance :

$$\text{Monday to Friday} = 5 \times 104 = 520 \text{ km} \quad (1)$$

$$\text{Monday to Sunday} = 7 \times 127 = 889 \text{ km}$$

$$\text{Saturday and Sunday} = 889 - 520 = 369 \text{ km} \quad (1)$$

$$\text{Sunday} = 369 - 132 = 237 \text{ km} \quad (1)$$

237

..... kilometres

(Total for Question 10 is 3 marks)

11 Express $\left(\frac{m^6 k^{10}}{25}\right)^{\frac{3}{2}}$ in the form $\frac{m^a k^b}{c}$ where a , b and c are integers to be found.

$$\frac{m^{6\left(\frac{3}{2}\right)} \times k^{10\left(\frac{3}{2}\right)}}{25^{\frac{3}{2}}} = \frac{m^9 \times k^{15}}{125}$$

$$= \frac{m^9 k^{15}}{125}$$

(2)

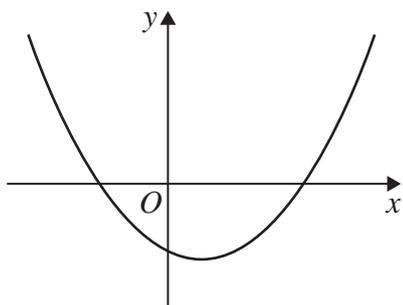
$$\frac{m^9 k^{15}}{125}$$

(Total for Question 11 is 2 marks)

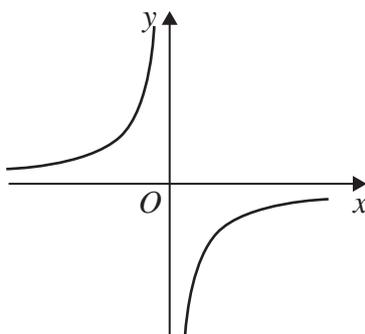


12 Here are six graphs.

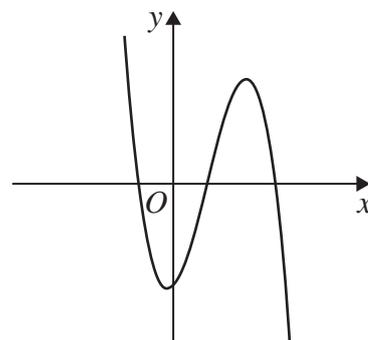
Graph A



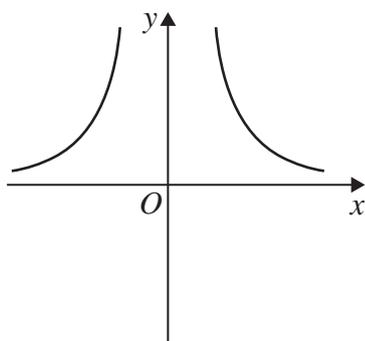
Graph B



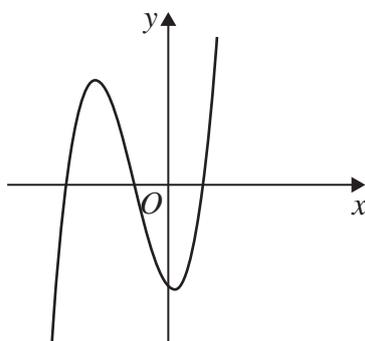
Graph C



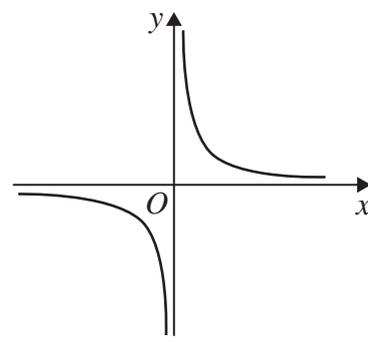
Graph D



Graph E



Graph F



Write down the letter of the graph of

(a) $y = \frac{10}{x^2}$ (reciprocal with positive values of y)

D (1)

(1)

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

C (1)

(1)

(c) $y = -\frac{3}{x}$

B (1)

(1)

(Total for Question 12 is 3 marks)

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13 Feruzi invests 80 000 Kenyan shillings (KES)

He invests the money for 3 years at $x\%$ compound interest each year.

At the end of 3 years, the total interest he receives is 6151.25 KES

Work out the value of x

$$80\,000 \times \left(\frac{100+x}{100}\right)^3 = 80\,000 + 6151.25 \quad (1)$$

$$\left(\frac{100+x}{100}\right)^3 = \frac{86151.25}{80\,000}$$

$$= 1.07689\dots$$

$$\frac{100+x}{100} = \sqrt[3]{1.07689\dots}$$

$$\frac{100+x}{100} = 1.025 \quad (1)$$

$$100+x = 102.5$$

$$x = 2.5 \quad (1)$$

$$x = \dots\dots\dots 2.5$$

(Total for Question 13 is 3 marks)

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- 15 Osvaldo has a biased coin.
He spins the coin three times.

The probability that the coin lands on a head three times is $\frac{27}{64}$

Work out the probability that the coin will land on a tail three times.

$$P(\text{head}) = \sqrt[3]{\frac{27}{64}}$$
$$= \frac{3}{4} \quad (1)$$

$$P(\text{tail}) = 1 - \frac{3}{4} = \frac{1}{4}$$

$$P(\text{tail 3 times}) = \left(\frac{1}{4}\right)^3 \quad (1)$$
$$= \frac{1}{64} \quad (1)$$

$$\frac{1}{64}$$

(Total for Question 15 is 3 marks)

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- 16 Show that $\frac{2\sqrt{3}}{\sqrt{3}-1}$ can be written in the form $a + \sqrt{a}$ where a is an integer.

Show your working clearly.

$$\begin{aligned} & \frac{2\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} \quad (1) \\ & = \frac{2(3) + 2\sqrt{3}}{3-1} \\ & = \frac{6 + 2\sqrt{3}}{2} \quad (1) \\ & = 3 + \sqrt{3} \quad (1) \end{aligned}$$

(Total for Question 16 is 3 marks)

- 17 Make x the subject of $y = \sqrt[3]{\frac{6+5x}{x+4}}$

$$\begin{aligned} y^3 &= \frac{6+5x}{x+4} \quad (1) \\ y^3x + 4y^3 &= 6+5x \quad (1) \\ y^3x - 5x &= 6 - 4y^3 \quad (1) \\ x(y^3 - 5) &= 6 - 4y^3 \\ x &= \frac{6 - 4y^3}{y^3 - 5} \quad (1) \end{aligned}$$

$$x = \frac{6 - 4y^3}{y^3 - 5}$$

(Total for Question 17 is 4 marks)

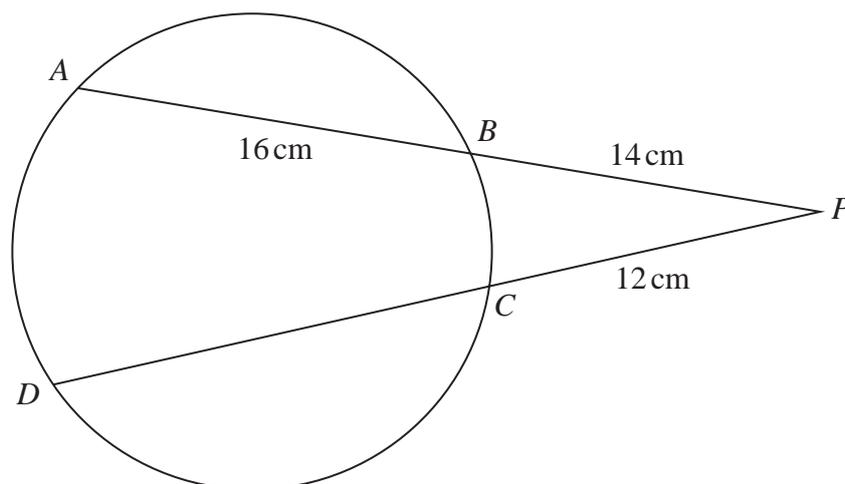
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18

Diagram **NOT** accurately drawn

A , B , C and D are points on a circle.

ABP and DCP are straight lines.

$$AB = 16 \text{ cm} \quad BP = 14 \text{ cm} \quad CP = 12 \text{ cm}$$

Work out the length of DC

$$DP \times 12 = (16 + 14) \times 14 \quad (1)$$

$$DP = \frac{30 \times 14}{12} = 35$$

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

$$= 23 \quad (1)$$

23 cm

(Total for Question 18 is 3 marks)

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19 30 adults booked to stay in a hotel.

19 adults booked breakfast

15 adults booked dinner

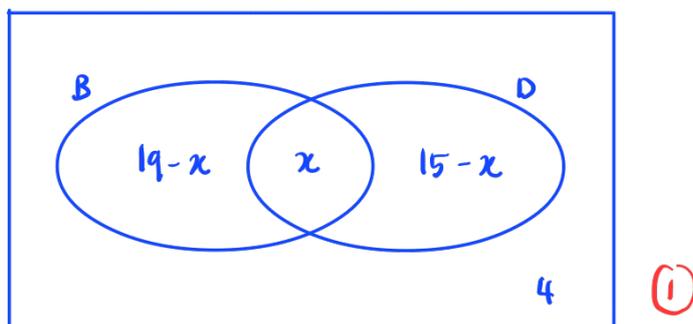
4 adults did not book breakfast or dinner

Some adults booked breakfast **and** dinner.

Meihui chooses at random two of the 30 adults.

Work out the probability that these two adults each booked breakfast **and** dinner.

x = breakfast and dinner



$$19-x + x + 15-x + 4 = 30$$

$$38-x = 30$$

$$x = 8 \quad (1)$$

$$\frac{8}{30} \times \frac{7}{29} = \frac{56 \div 2}{870 \div 2} = \frac{28}{435} \quad (1)$$

(1)

$$\frac{28}{435}$$

(Total for Question 19 is 4 marks)



20 A , B and C are points on a circle.

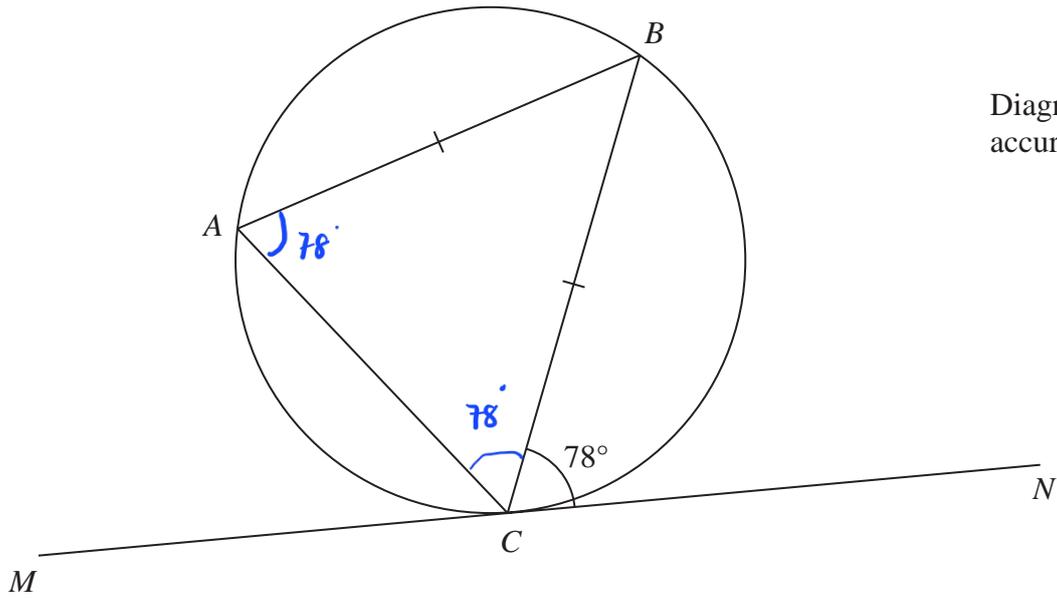


Diagram NOT
accurately drawn

MN is the tangent to the circle at C

$AB = CB$

Angle $BCN = 78^\circ$

Find the size of angle ABC

$$\text{angle } BAC = \text{angle } BCA = 78^\circ$$

$$\begin{aligned} \text{angle } ABC &= 180 - 78 - 78 \quad \textcircled{1} \\ &= 24 \quad \textcircled{1} \end{aligned}$$

24

(Total for Question 20 is 2 marks)

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21 Work out the coordinates of the points of intersection of

$$y - 2x = 1 \quad \text{and} \quad y^2 + xy = 7 \quad \text{--- (2)}$$

Show clear algebraic working.

$$y = 2x + 1 \quad \text{--- (1)}$$

substitute (1) into (2)

$$(2x+1)^2 + (2x+1)x = 7 \quad \text{(1)}$$

$$4x^2 + 4x + 1 + 2x^2 + x = 7$$

$$6x^2 + 5x - 6 = 0 \quad \text{(1)}$$

$$(2x+3)(3x-2) = 0 \quad \text{(1)}$$

$$x = -\frac{3}{2} \quad \text{and} \quad x = \frac{2}{3}$$

substitute x values into (1) :

$$y = 2\left(-\frac{3}{2}\right) + 1 \quad \text{and} \quad y = 2\left(\frac{2}{3}\right) + 1 \quad \text{(1)}$$

$$= -2 \quad \text{and} \quad \frac{7}{3}$$

$$\begin{array}{l} \text{(1)} \\ \left(-\frac{3}{2}, -2\right) \\ \left(\frac{2}{3}, \frac{7}{3}\right) \end{array}$$

(Total for Question 21 is 5 marks)



22 Here is a cuboid $ABCDEFGH$

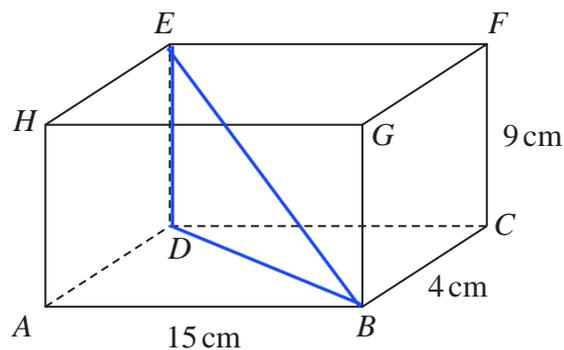


Diagram NOT
accurately drawn

$$AB = 15 \text{ cm} \quad BC = 4 \text{ cm} \quad CF = 9 \text{ cm}$$

- (a) Work out the length of BE
Give your answer correct to 3 significant figures.

$$\begin{aligned} BD &= \sqrt{15^2 + 4^2} \\ &= \sqrt{225 + 16} \\ &= \sqrt{241} \\ BE &= \sqrt{(\sqrt{241})^2 + 9^2} \\ &= \sqrt{241 + 81} \\ &= \sqrt{322} \quad (1) \\ &= 17.9 \quad (3 \text{ s.f.}) \quad (1) \end{aligned}$$

$$\begin{aligned} &17.9 \text{ cm} \\ &\text{.....} \\ &(2) \end{aligned}$$

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Here is a cuboid $PQRSTUWV$

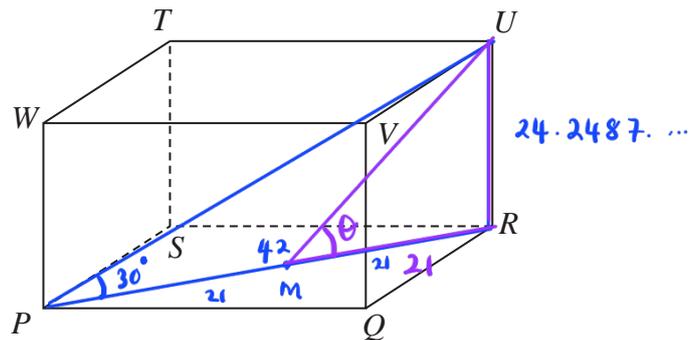


Diagram NOT
accurately drawn

$PR = 42$ cm

The size of the angle between PU and the plane $PQRS$ is 30°

M is the midpoint of PR

- (b) Work out the size of angle UMR
Give your answer correct to 3 significant figures.

$$\tan 30^\circ = \frac{UR}{42}$$

$$UR = 42 \tan 30^\circ \quad (1)$$

$$= 24.2487\dots$$

$$\tan \theta = \frac{24.2487\dots}{21} \quad (1)$$

$$\tan \theta = 1.1547\dots$$

$$\theta = \tan^{-1} 1.1547\dots$$

$$= 49.1 \text{ (3 s.f.)} \quad (1)$$

49.1

(3)

(Total for Question 22 is 5 marks)



23 Here are the first three terms of an arithmetic sequence.

$$8p \quad 7p - 3 \quad 4p + 2$$

The sum of the first n terms of the sequence is -1914

Work out the value of n

Show your working clearly.

$$7p - 3 - 8p = 4p + 2 - 7p + 3$$

$$7p - 8p - 4p + 7p = 2 + 3 + 3$$

$$2p = 8$$

$$p = 4 \quad (1)$$

$$a = 8(4) = 32$$

$$d = 7(4) - 3 - 32$$

$$= 28 - 3 - 32 \quad (1)$$

$$= -7$$

$$S_n = -1914 = \frac{n}{2} [2(32) + (n-1)(-7)] \quad (1)$$

$$-1914 = \frac{n}{2} [64 - 7n + 7]$$

$$-3828 = n(71 - 7n)$$

$$7n^2 - 71n - 3828 = 0 \quad (1)$$

$$(7n + 132)(n - 29) = 0$$

$$n = 29 \text{ only since } n > 0$$

$$n = 29 \quad (1)$$

(Total for Question 23 is 5 marks)

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- 24 The surface area of sphere **A** is nine times the surface area of sphere **B**
The difference between the volume of sphere **A** and the volume of sphere **B** is $117\pi \text{ cm}^3$

Find the radius of the smaller sphere.
Show your working clearly.

$$\text{area} \quad : \quad A : B = 9 \times 4\pi r^2 : 4\pi r^2 \quad (1)$$

$$\begin{aligned} \text{scale factor of radius} \quad : \quad A : B &= \sqrt{9} : 1 \\ &= 3 : 1 \quad (1) \end{aligned}$$

$$\text{difference in volume} \quad : \quad \frac{4}{3}\pi(3r)^3 - \frac{4}{3}\pi r^3 = 117\pi \quad (1)$$

$$\frac{4}{3}\pi(27r^3 - r^3) = 117\pi$$

$$26r^3 = \frac{117\pi}{\frac{4}{3}\pi}$$

$$26r^3 = 87.75$$

$$r^3 = \frac{87.75}{26} = 3.375$$

$$r = \sqrt[3]{3.375} \quad (1)$$

$$= 1.5 \quad (1)$$

1.5 cm

(Total for Question 24 is 5 marks)



- 25 The straight line with equation $y - 2x = 7$ is the perpendicular bisector of the line AB where A is the point with coordinates $(j, 7)$ and B is the point with coordinates $(6, k)$

Find the coordinates of the midpoint of the line AB

Show clear algebraic working.

$$y = 2x + 7$$

$$m = 2$$

$$m_{AB} = -\frac{1}{2} \quad (1)$$

$$-\frac{1}{2} = \frac{k-7}{6-j} \quad (1)$$

$$-6+j = 2k-14$$

$$2k-j = 8 \quad (1)$$

$$\text{midpoint of } AB : \left(\frac{j+6}{2}, \frac{7+k}{2} \right) \quad (1)$$

$$\frac{7+k}{2} = 2\left(\frac{j+6}{2}\right) + 7$$

$$7+k = 2j+12+14 \quad (1)$$

$$k = 2j+19 \quad (2)$$

substitute (2) into (1) :

$$2(2j+19) - j = 8$$

$$4j+38-j = 8$$

$$3j = -30$$

$$j = -10 \quad (1)$$

$$k = 2(-10) + 19 \\ = -1$$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



$$\begin{aligned}\text{midpoint of AB} &: \left(\frac{-10+6}{2}, \frac{7-1}{2} \right) \\ &= (-2, 3) \quad (1)\end{aligned}$$

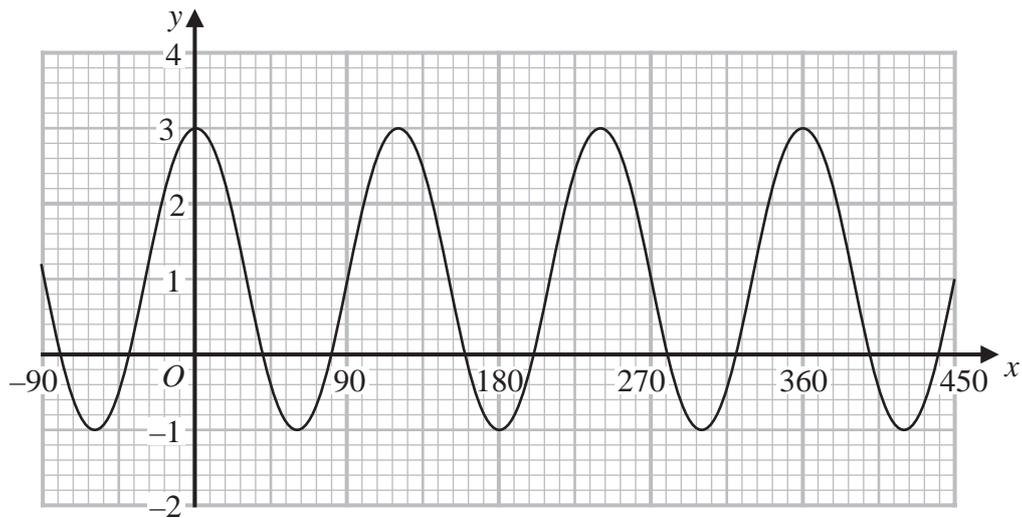
(.....,)

(Total for Question 25 is 6 marks)

Turn over for Question 26



26 Here is a sketch of the curve with equation $y = a \cos bx^\circ + c$ where $-90 \leq x \leq 450$



Find the value of a , the value of b and the value of c

$a =$ 2 ①
 $b =$ 3 ①
 $c =$ 1 ①

(Total for Question 26 is 3 marks)

TOTAL FOR PAPER IS 100 MARKS

