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Pearson Edexcel International GCSE

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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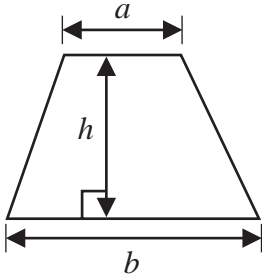
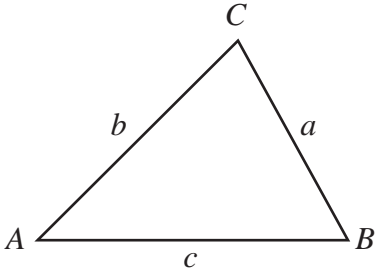
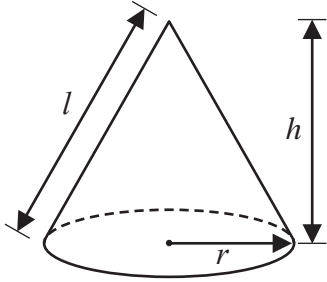
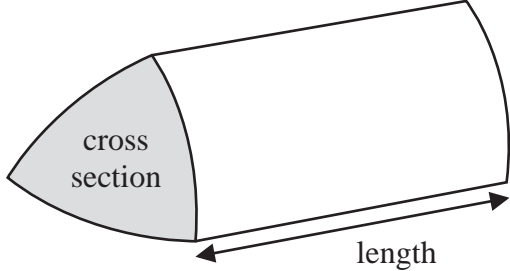
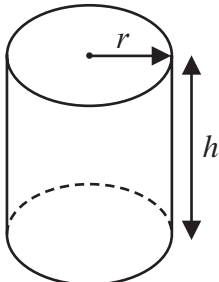
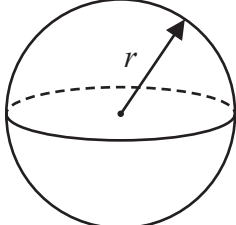
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Pearson

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 THREE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 A tin contains tea bags with a choice of four different flavours of tea. The four flavours of tea are Assam or Darjeeling or Nilgiri or Rize.

Sara takes at random a tea bag from the tin.

The table shows each of the probabilities that the flavour of the tea Sara takes is Assam or Darjeeling or Rize.

| | | | | |
|----------------|-------|------------|---------|------|
| Flavour of tea | Assam | Darjeeling | Nilgiri | Rize |
| Probability | 0.38 | 0.24 | 0.22 | 0.16 |

- (a) Work out the probability that the flavour of the tea Sara takes is Nilgiri.

$$1 - (0.38 + 0.24 + 0.16) \quad (1)$$

$$= 0.22 \quad (1)$$

$$0.22$$

(2)

- (b) Work out the probability that the flavour of the tea Sara takes is either Darjeeling or Rize.

$$0.24 + 0.16 = 0.4 \quad (1) \quad (1)$$

$$0.4$$

(2)

(Total for Question 1 is 4 marks)

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2 Mary saves for a holiday each year.

In 2020 she saved a total of \$720

In 2021, each month she saved \$78

The total amount Mary saved in 2021 was $P\%$ more than the total she saved in 2020

(a) Work out the value of P

$$78 \times 12 = 936 \quad (1)$$

$$936 - 720 = 216 \quad (1)$$

$$\frac{216}{720} \times 100\% = 30\% \quad (1)$$

36

(4)



Roberto is going to go on holiday.

He has two coupons that will save him money on his holiday.

Coupon A

18% off the cost of the accommodation

Coupon B

12.5% off the total cost of the accommodation **and** the flights

For Roberto's holiday

the cost of the accommodation is \$1600

the cost of the flights is \$800

Roberto can only use one of the coupons.

He wants to save as much money as he can.

- (b) Which of the two coupons, **A** or **B**, should he use?
Show your working clearly.

$$\text{Coupon A : } (0.82 \times 1600) + 800 = 2112 \text{ (1)}$$

$$\text{Coupon B : } 0.875 \times (1600 + 800) = 2100 \text{ (1)}$$

\therefore Coupon B should be used.

(1)

(3)

(Total for Question 2 is 7 marks)

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P 6 8 7 2 9 A 0 5 3 2

3 (a) Solve $4y + 5 > 12$

$$4y > 12 - 5 \quad (1)$$

$$4y > 7$$

$$y > \frac{7}{4} \quad (1)$$

$$y > \frac{7}{4}$$

(2)

(b) Solve $6x - 5 = \frac{4x - 7}{2}$

Show clear algebraic working.

$$2(6x - 5) = 4x - 7 \quad (1)$$

$$12x - 10 = 4x - 7$$

$$12x - 4x = -7 + 10 \quad (1)$$

$$8x = 3$$

$$x = \frac{3}{8} \quad (1)$$

$$\frac{3}{8}$$

$$x = \frac{3}{8} \quad (3)$$

(Total for Question 3 is 5 marks)

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- 4 The diagram shows a regular octagon $ABCDEFGH$ and a regular pentagon $ABIJK$

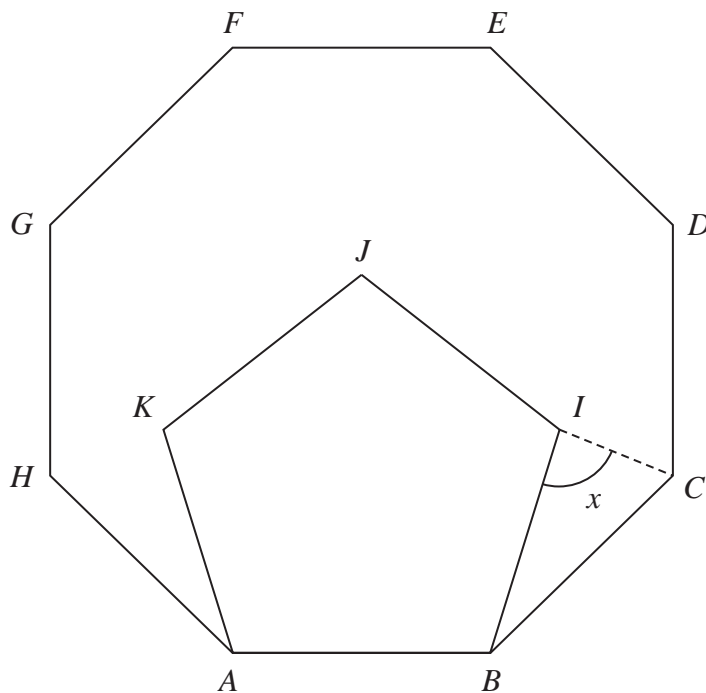


Diagram NOT
accurately drawn

Work out the size of the angle x

Interior angle :

$$\text{octagon} : 180^\circ - (360 \div 8) = 135^\circ \quad (1)$$

$$\text{pentagon} : 180^\circ - (360 \div 5) = 108^\circ$$

$$\begin{aligned} \angle BCI &= 135^\circ - 108^\circ \quad (1) \\ &= 27^\circ \end{aligned}$$

since BCI is isosceles,

$$\begin{aligned} x &= \frac{180^\circ - 27^\circ}{2} \quad (1) \\ &= 76.5^\circ \quad (1) \end{aligned}$$

76.5

(Total for Question 4 is 4 marks)

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- 5 Shane invests 7200 dollars for 3 years in a savings account.
He gets 2.5% per year compound interest.

How much money will Shane have in his savings account at the end of 3 years?
Give your answer to the nearest dollar.

$$7200 \times (1.025)^3 = 7754$$

(2) (1)

..... 7754 dollars

(Total for Question 5 is 3 marks)

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6 (a) Write down the value of x^0

1 (1)

(1)

Given that $2^{-3} \times 2^9 = 2^n$

(b) find the value of n

$$2^{-3+9} = 2^n$$

$$n = 6$$

$n = 6$ (1)

(1)

Given that $\frac{7^{206} \times 7^m}{7^{214}} = 7^{-3}$

(c) find the value of m

$$206 + m - 214 = -3 \quad (1)$$

$$m - 8 = -3$$

$$m = 5 \quad (1)$$

$m = 5$
(2)

(Total for Question 6 is 4 marks)

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- 7 (a) Write down an equation of the straight line with gradient -3 and which passes through the point with coordinates $(0, 5)$

$$y = mx + c$$

$$5 = -3(0) + c$$

$$c = 5$$

$$\therefore y = -3x + 5 \quad (2)$$

$$y = -3x + 5$$

(2)

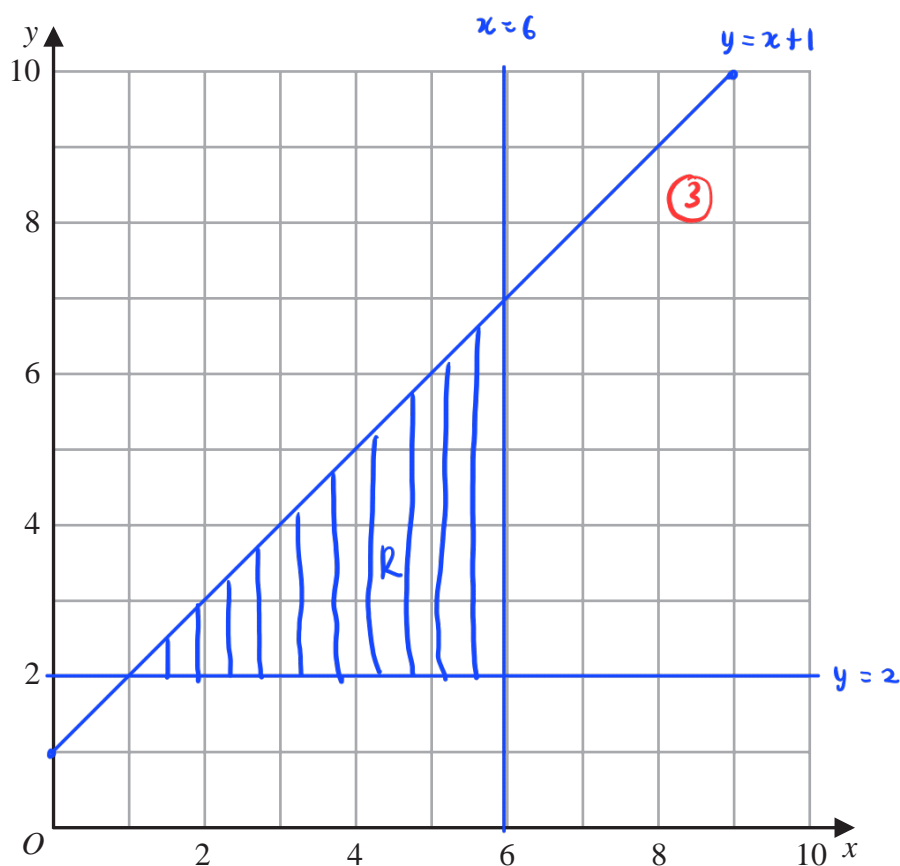
- (b) Show, by shading on the grid, the region defined by **all three** of the inequalities

$$x \leq 6$$

$$y \geq 2$$

$$y \leq x + 1$$

Label the region **R**



(3)

(Total for Question 7 is 5 marks)



8 A scientist is investigating the weight of 50 tigers.

Here is some information about these tigers.

| | Type of tiger | |
|----------------------------|---------------|--------|
| | Siberian | Bengal |
| Number of tigers | 22 | 28 |
| Mean weight of tigers (kg) | 260 | 185 |

The mean weight of all 50 tigers is 218 kg

Work out the mean weight of the Bengal tigers.

$$\text{Siberian: } 260 \times 22 = 5720 \quad (1)$$

$$\text{All tigers: } 218 \times 50 = 10900$$

$$\begin{aligned} \text{mean of Bengal: } & \frac{10900 - 5720}{28} = \frac{5180}{28} \\ & = 185 \quad (1) \end{aligned}$$

..... 185 kg

(Total for Question 8 is 3 marks)



- 9 In the diagram, ABC is a right-angled triangle and DEF is a semicircular arc.

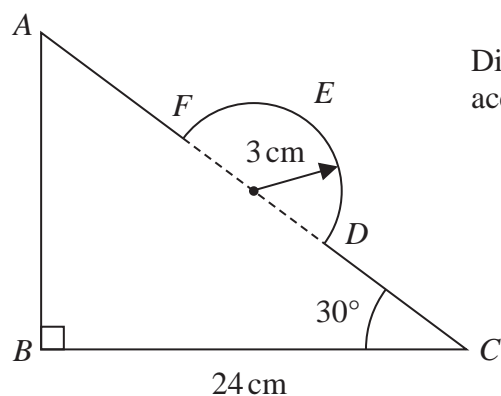


Diagram **NOT**
accurately drawn

In triangle ABC

$$BC = 24 \text{ cm} \quad \text{angle } ABC = 90^\circ \quad \text{angle } BCA = 30^\circ$$

The points D and F lie on AC so that DF is the diameter of the semicircular arc DEF
The radius of the semicircular arc is 3 cm.

Work out the length of $AFEDC$

Give your answer correct to 2 significant figures.

$$\cos 30^\circ = \frac{24}{AC} \quad (1)$$

$$AC = \frac{24}{\cos 30^\circ} = 27.712 \dots \quad (1)$$

$$FED = \frac{1}{2} \times 2 \times \pi \times 3 \quad (1)$$

$$= 3\pi = 9.424 \dots$$

$$AFEDC = 27.712 - 3 - 3 + 9.424 \quad (1)$$

$$= 31 \quad (1)$$

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31

..... cm

(Total for Question 9 is 5 marks)



P 6 8 7 2 9 A 0 1 3 3 2

- 10 The table gives information about the population and the total amount of money, in dollars, spent on healthcare for two countries in 2016

| Country | Total population | Total spent on healthcare (\$) |
|------------|-------------------|--------------------------------|
| Austria | 8.7×10^6 | 4.2×10^{10} |
| Luxembourg | 6.3×10^5 | 3.7×10^9 |

Work out how much more was spent **per person** on healthcare in Luxembourg than in Austria.

Give your answer correct to the nearest whole number.

$$\text{Austria: } \frac{4.2 \times 10^{10}}{8.7 \times 10^6} = 4827.58\dots$$

$$\text{Luxembourg: } \frac{3.7 \times 10^9}{6.3 \times 10^5} = 5873.01\dots$$

$$5873.01\dots - 4827.58\dots = 1045.42\dots$$

$$\approx 1045$$

1045

..... dollars

(Total for Question 10 is 3 marks)

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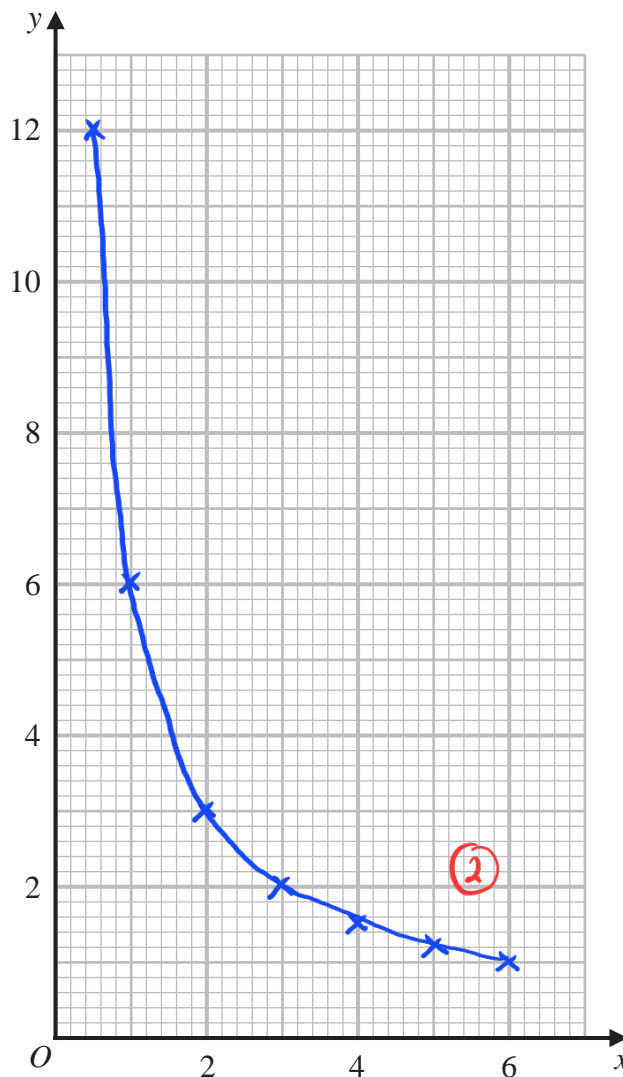
11 (a) Complete the table of values for $y = \frac{6}{x}$

| | | | | | | | |
|-----|-----|---|---|---|-----|-----|---|
| x | 0.5 | 1 | 2 | 3 | 4 | 5 | 6 |
| y | 12 | 6 | 3 | 2 | 1.5 | 1.2 | 1 |

(2)

(2)

(b) On the grid, draw the graph of $y = \frac{6}{x}$ for $0.5 \leq x \leq 6$



(2)

(Total for Question 11 is 4 marks)



12 The diagram shows two vertical phone masts, AB and CD , on horizontal ground.

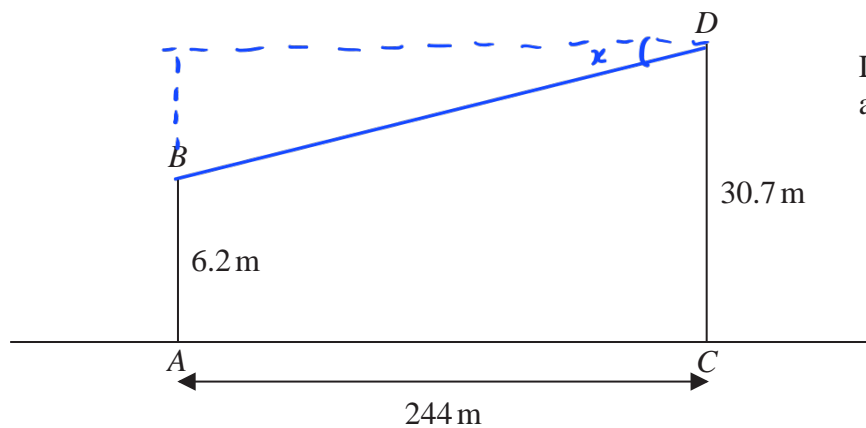


Diagram NOT
accurately drawn

$$AB = 6.2 \text{ m} \quad AC = 244 \text{ m} \quad CD = 30.7 \text{ m}$$

Work out the size of the angle of depression of B from D
Give your answer correct to one decimal place.

$$\tan x = \frac{30.7 - 6.2}{244} \quad (1)$$

$$x = \tan^{-1} \frac{24.5}{244} \quad (1)$$

$$= 5.7 \quad (1)$$

5.7 °

(Total for Question 12 is 3 marks)



$$13 \quad a = \sqrt{8} + 4$$

$$b = \sqrt{8} - 4$$

$(a - b)(a + b)$ can be written in the form $y\sqrt{4y}$

Find the value of y

Show your working clearly.

$$\begin{aligned} a - b &= \sqrt{8} + 4 - (\sqrt{8} - 4) \\ &= 8 \quad (1) \end{aligned}$$

$$\begin{aligned} a + b &= \sqrt{8} + 4 + (\sqrt{8} - 4) \\ &= 2\sqrt{8} \end{aligned}$$

$$\begin{aligned} (a - b)(a + b) &= 8(2\sqrt{8}) \quad (1) \\ &= 8(\sqrt{4 \times 8}) \end{aligned}$$

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

$$y = \dots\dots\dots 8$$

(Total for Question 13 is 3 marks)

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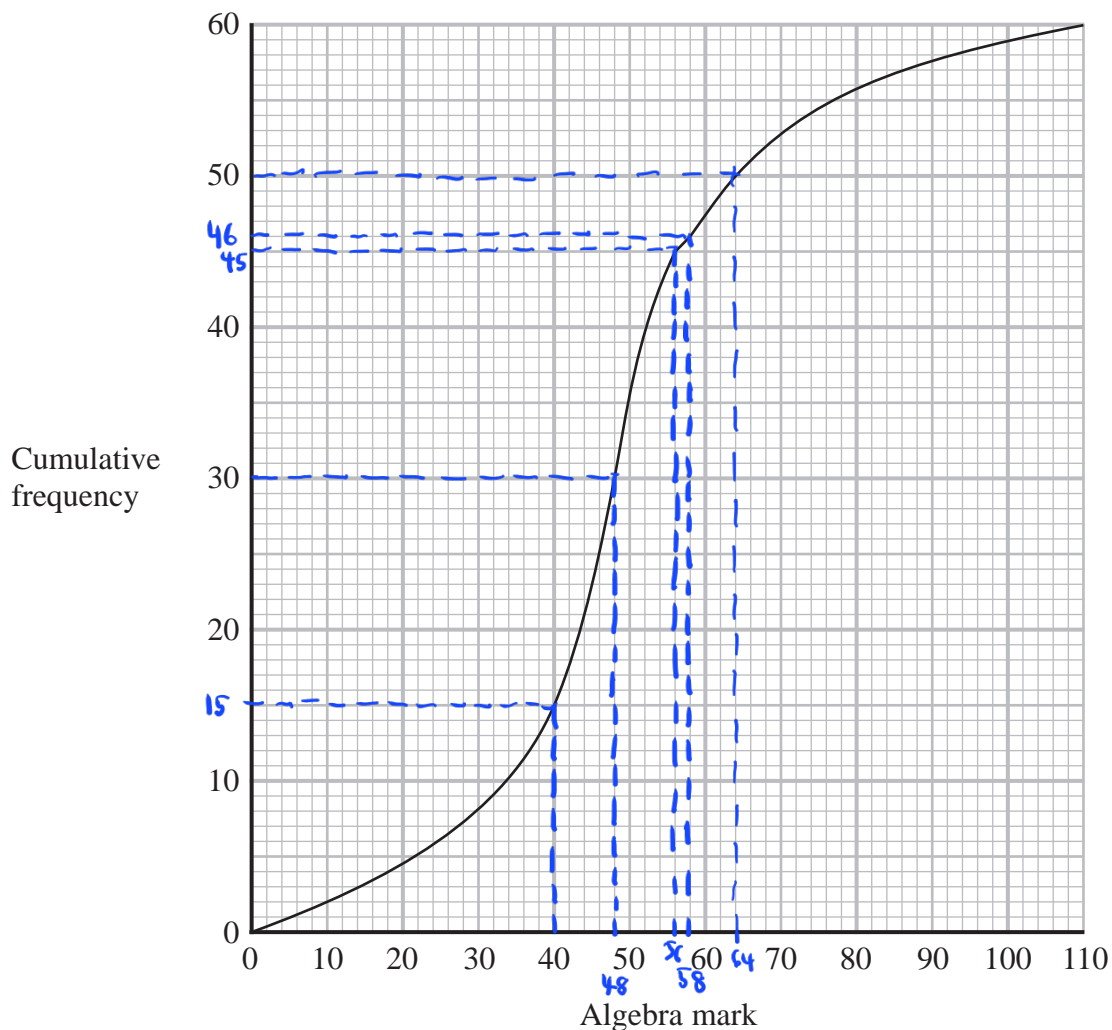
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- 14 A group of 60 students each sat an algebra test and a geometry test.
Each test was marked out of 110

The cumulative frequency graph gives information about the marks gained by the 60 students in the algebra test.



- (a) Use the graph to find an estimate for the median mark in the algebra test.

48 (1)

- (b) Use the graph to find an estimate for the number of students who gained 58 marks or less in the algebra test.

46 (1)

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- (c) Use the graph to find an estimate for the interquartile range of the marks gained in the algebra test. $Q_3 = 56$

$$Q_1 = 40 \quad (1)$$

$$Q_3 - Q_1 = 56 - 40$$

$$= 16 \quad (1)$$

$$\frac{16}{\dots}$$

(2)

The interquartile range of the marks gained in the geometry test is 9

Luis says

“The students’ marks are more spread out in the algebra test than in the geometry test.”

- (d) Is Luis correct?

Give a reason for your answer.

Yes. Interquartile range for algebra test is greater than geometry test.

(1)

(1)

To be awarded a grade A in the algebra test, a student had to gain a mark greater than 64

Two students are to be selected at random from the 60 students in the group.

- (e) Use the graph to find an estimate for the probability that both of these students were awarded a grade A in the algebra test.

$$60 - 50 = 10 \quad (1)$$

$$\frac{10}{60} \times \frac{9}{59} = \frac{3}{118} \quad (1)$$

$$\frac{3}{118}$$

(3)

(Total for Question 14 is 8 marks)

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15 Make t the subject of $n^2 = \frac{4d+t^3}{t^3}$

$$n^2 t^3 = 4d + t^3 \quad (1)$$

$$n^2 t^3 - t^3 = 4d$$

$$t^3 (n^2 - 1) = 4d \quad (1)$$

$$t^3 = \frac{4d}{n^2 - 1} \quad (1)$$

$$t = \sqrt[3]{\frac{4d}{n^2 - 1}} \quad (1)$$

$$t = \sqrt[3]{\frac{4d}{n^2 - 1}}$$

(Total for Question 15 is 4 marks)

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16 The diagram shows quadrilateral $ABCD$

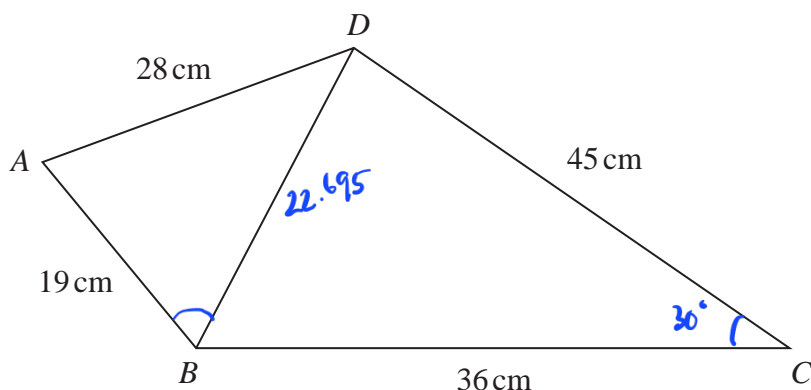


Diagram **NOT** accurately drawn

The angle BCD is acute.

Given that the area of triangle $BCD = 405 \text{ cm}^2$

work out the size of angle ABD

Give your answer correct to one decimal place.

$$\frac{1}{2} \times 36 \times 45 \times \sin C = 405 \quad (1)$$

$$\sin C = \frac{405 \times 2}{36 \times 45}$$

$$C = \sin^{-1} \frac{405 \times 2}{36 \times 45}$$

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

$$BD = \sqrt{45^2 + 36^2 - 2 \times 45 \times 36 \times \cos 30^\circ} \quad (1)$$

$$= \sqrt{3321 - 3240 \cos 30^\circ}$$

$$= \sqrt{515.077 \dots}$$

$$= 22.695$$

$$28^2 = 19^2 + 22.695^2 - 2(19)(22.695) \cos ABD$$

83.9

$$\cos ABD = - \frac{(28^2 - 19^2 - 22.695^2)}{2(19)(22.695)} \quad (1)$$

$$ABD = 83.9^\circ \quad (1)$$

(Total for Question 16 is 5 marks)

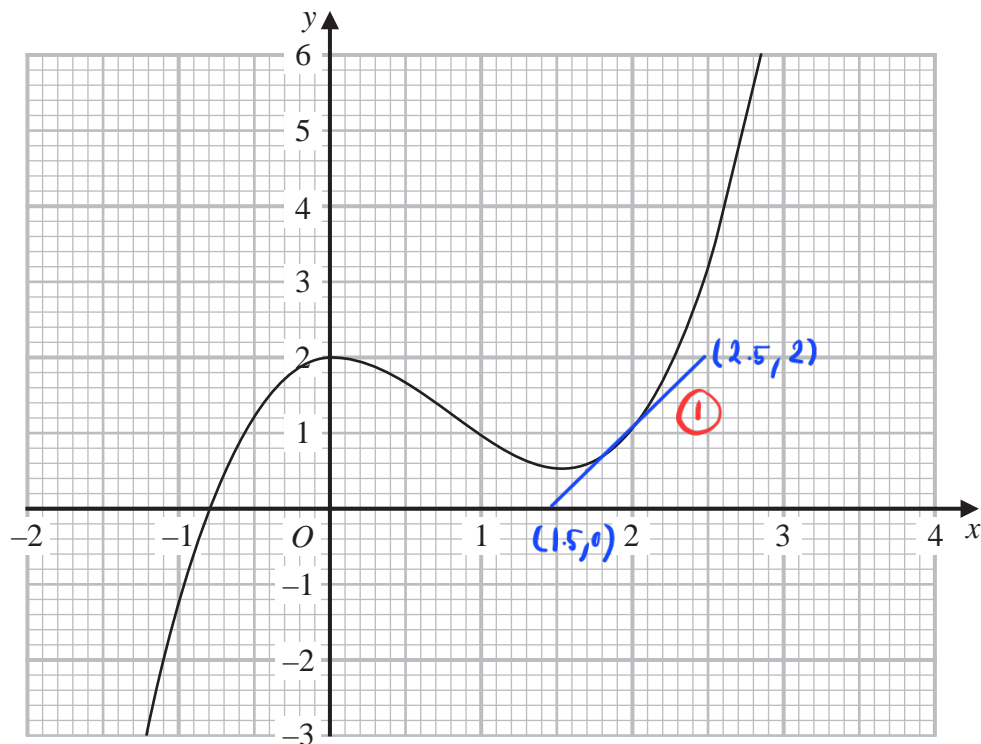
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17 Part of the curve with equation $y = f(x)$ is shown on the grid.



Find an estimate for the gradient of the curve at the point where $x = 2$.
Show your working clearly.

$$m = \frac{(2-0)}{2.5-1.5} = 2$$

2

(Total for Question 17 is 3 marks)



- 18 The line with equation $2y = x + 1$ intersects the curve with equation $3y^2 + 7y + 16 = x^2 - x$ at the points A and B

Find the coordinates of A and the coordinates of B
Show clear algebraic working.

$$3y^2 + 7y + 16 = (2y-1)^2 - (2y-1) \quad (1)$$

$$3y^2 + 7y + 16 = 4y^2 - 4y + 1 - 2y + 1$$

$$3y^2 - 4y^2 + 7y + 6y + 16 - 2 = 0$$

$$-y^2 + 13y + 14 = 0$$

$$y^2 - 13y - 14 = 0 \quad (1)$$

$$(y-14)(y+1) = 0 \quad (1)$$

$$y = 14, \quad y = -1$$

$$x = 2(14) - 1, \quad x = 2(-1) - 1$$

$$= 27 \quad \quad \quad = -3 \quad (1)$$

$$(27, 14) \text{ and } (-3, -1)$$

(1)

$$(\dots\dots\dots 27 \dots\dots\dots, \dots\dots\dots 14 \dots\dots\dots) \text{ and } (\dots\dots\dots -3 \dots\dots\dots, \dots\dots\dots -1 \dots\dots\dots)$$

(Total for Question 18 is 5 marks)



19 $ABCD$ is a horizontal rectangular field.

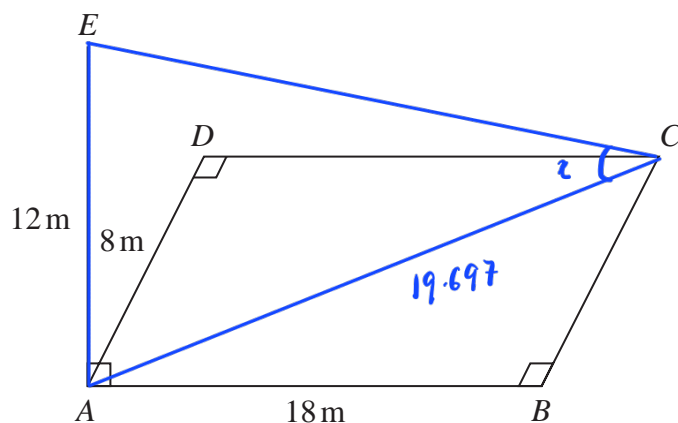


Diagram **NOT** accurately drawn

A vertical pole, AE , is placed at the corner A of the field.

$$AE = 12\text{ m} \quad AB = 18\text{ m} \quad AD = 8\text{ m}$$

Calculate the size of the angle between EC and the plane $ABCD$

Give your answer correct to one decimal place.

$$\begin{aligned} AC &= \sqrt{8^2 + 18^2} \\ &= \sqrt{388} \quad (1) \\ &= 19.697\dots \end{aligned}$$

$$\tan x = \frac{12}{19.697\dots} \quad (1)$$

$$\begin{aligned} x &= \tan^{-1} \frac{12}{19.697\dots} \\ &= 31.4 \quad (1) \end{aligned}$$

31.4

(Total for Question 19 is 3 marks)



- 20 y is inversely proportional to \sqrt{x}
 x is directly proportional to T^3

Given that $y = 8$ when $T = 25$

find the exact value of T when $y = 27$

$$y = \frac{k}{\sqrt{x}}, \quad x = \rho T^3$$

$$y = \frac{k}{\sqrt{\rho T^3}}$$

$$\text{let } \frac{k}{\sqrt{\rho}} = c,$$

$$y = \frac{c}{\sqrt{T^3}} \quad (1)$$

$$8 = \frac{c}{\sqrt{25^3}}$$

$$c = 8 \times \sqrt{25^3} \\ = 1000 \quad (1)$$

$$27 = \frac{1000}{\sqrt{T^3}} \quad (1)$$

$$T^3 = \frac{1000^2}{27^2}$$

$$T = \left(\frac{1000^2}{27^2}\right)^{\frac{1}{3}} = \frac{100}{9} \quad (1)$$

$$T = \frac{100}{9}$$

(Total for Question 20 is 4 marks)

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- 21 The diagram shows a solid made from a cylinder and a hemisphere.
The cylinder and the hemisphere are both made from the same metal.

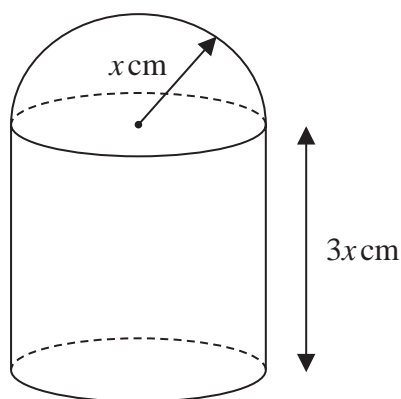


Diagram **NOT**
accurately drawn

The plane face of the hemisphere coincides with the upper plane face of the cylinder.

The radius of the cylinder and the radius of the hemisphere are both x cm.
The height of the cylinder is $3x$ cm.

The total surface area of the solid is $81\pi\text{cm}^2$

The mass of the solid is 840 grams.

The following table gives the density of each of four metals.

| Metal | Density (g/cm^3) |
|-----------|-----------------------------|
| Aluminium | 2.7 |
| Nickel | 8.9 |
| Gold | 19.3 |
| Silver | 10.5 |

The metal used to make the solid is one of the metals in the table.

Determine the metal used to make the solid.

Show your working clearly.

$$\pi x^2 + 2\pi x \times 3x + \frac{1}{2} \times 4\pi x^2 = 81\pi \quad (1)$$

$$\pi x^2 + 6\pi x^2 + 2\pi x^2 = 81\pi$$

$$9\pi x^2 = 81\pi$$

$$9x^2 = 81$$

$$x^2 = 9 \quad (1)$$

$$x = 3$$

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$$\text{Volume} : \pi \times 3^2 \times 3(3) + \frac{1}{2} \times \frac{4^2}{3} \times \pi (3)^3 \quad \textcircled{1}$$

$$= 81\pi + 18\pi = 99\pi \quad \textcircled{1}$$

$$\frac{840}{99\pi} = 2.7\dots \quad (\text{aluminium})$$

$\textcircled{1}$

$\textcircled{1}$ aluminium

(Total for Question 21 is 6 marks)

Turn over for Question 22



22 ABC is a triangle in which angle $ABC = 90^\circ$

p and q are integers such that

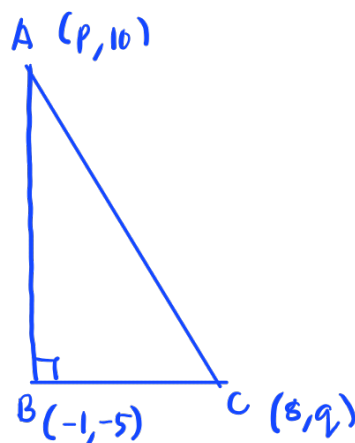
the coordinates of A are $(p, 10)$

the coordinates of B are $(-1, -5)$

the coordinates of C are $(8, q)$

Given that the gradient of AC is $-\frac{6}{7}$

work out the value of p and the value of q



$$\text{gradient } AB : \frac{10 - (-5)}{p - (-1)} = \frac{15}{p+1} \quad (1)$$

$$\text{gradient } BC : \frac{q - (-5)}{8 - (-1)} = \frac{q+5}{9}$$

$$\frac{15}{p+1} \times \frac{q+5}{9} = -1 \quad (1)$$

$$5q + 25 = -3p - 3 \quad (1)$$

$$5q + 3p = -28 \quad (1)$$

$$p = \frac{-28 - 5q}{3}$$

$$\text{gradient } AC : \frac{10 - q}{p - 8} = -\frac{6}{7}$$

$$70 - 7q = -6p + 48$$

$$6p - 7q = -22 \quad (2)$$

$$6 \left(\frac{-28 - 5q}{3} \right) - 7q = -22 \quad (1)$$

$$\therefore -56 - 10q - 7q = -22$$

$$-17q = -22 + 56$$

$$-17q = 34$$

$$q = -2$$

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$$p = \frac{-28 - 5(-2)}{3}$$

$$= \frac{-28 + 10}{3}$$

$$= \frac{-18}{3}$$

$$= -6$$

$$p = \dots -6 \quad \textcircled{1} \dots$$

$$q = \dots -2 \dots$$

(Total for Question 22 is 5 marks)

Turn over for Question 23



P 6 8 7 2 9 A 0 2 9 3 2

23 The functions f and g are such that

$$f(x) = x + 25 \quad g(x) = x^2 - 12x$$

The function h is such that $h(x) = fg(x)$

The domain of h is $\{x : x \leq 6\}$

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

$$\begin{aligned} h(x) &= (x^2 - 12x) + 25 \\ &= x^2 - 12x + 25 \quad (1) \\ &= (x-6)^2 - 36 + 25 \\ &= (x-6)^2 - 11 \quad (1) \quad \{x : x \leq 6\} \end{aligned}$$

$$\text{let } h(x) = y$$

$$y = (x-6)^2 - 11$$

$$y + 11 = (x-6)^2 \quad (1)$$

$$\pm \sqrt{y+11} = x-6$$

$$x = 6 \pm \sqrt{y+11}$$

$$h^{-1}(x) = 6 \pm \sqrt{x+11}$$

since domain of h is $x \leq 6$, then $h^{-1}(x) \leq 6$

$$\text{Hence, } h^{-1}(x) = 6 - \sqrt{x+11} \quad (1)$$

$$h^{-1}(x) = \dots 6 - \sqrt{x+11}$$

(Total for Question 23 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

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