

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname StemUp Model Solution

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier Paper 1 Non-Calculator

Thursday 16 May 2024

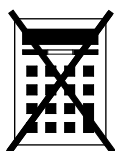
Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments
- the Formulae Sheet (enclosed).



You must **not** use a calculator.

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use

Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24	
TOTAL	



J U N 2 4 8 3 0 0 1 H 0 1

Answer **all** questions in the spaces provided.

- 1 Work out $12^2 \div \left(\frac{1}{3} \times \sqrt{36}\right)$ [3 marks]

$$12^2 = 144$$

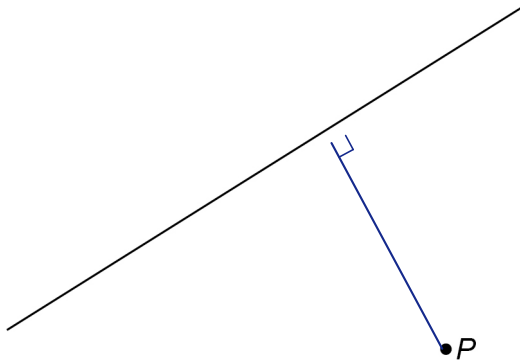
$$\frac{1}{3} \times \sqrt{36} = \frac{1}{3} \times 6 = 2$$

$$144 \div 2 = 72$$

Answer 72

- 2 Measure the **shortest** distance from point P to the line.
Give your answer in millimetres.

[1 mark]

Answer 32 mm

- 3 The vector $\begin{pmatrix} -3 \\ 7 \end{pmatrix}$ translates A to B.

Write down the vector that translates B to A.

[1 mark]

Answer $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$

- 4 The attendance for a rugby match is 8400 people to the nearest 100

- 4 (a) Write down the minimum possible attendance.

[1 mark]

Answer 8350

- 4 (b) Write down the maximum possible attendance.

[1 mark]

Answer 8449

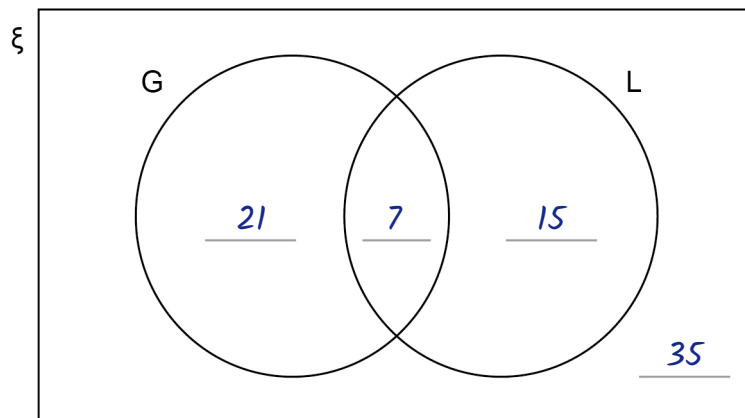
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- 5 A school year has 78 students.
 28 wear glasses.
 $\frac{1}{4}$ of the students who wear glasses are left-handed.
 30% of the students who do **not** wear glasses are left-handed.

- 5 (a) ξ = students in the school year
 G = wears glasses
 L = left-handed



Complete the Venn diagram.

[3 marks]

Glasses and left-handed: $28 \div 4 = 7$, glasses only: $28 - 7 = 21$

No glasses: $78 - 28 = 50$, 30% of 50 = $3 \times 5 = 15$

Neither: $50 - 15 = 35$

- 5 (b) A left-handed student is chosen at random.
 Work out the probability that the student wears glasses.

[1 mark]

Left-handed students: $7 + 15 = 22$

Answer $\frac{7}{22}$



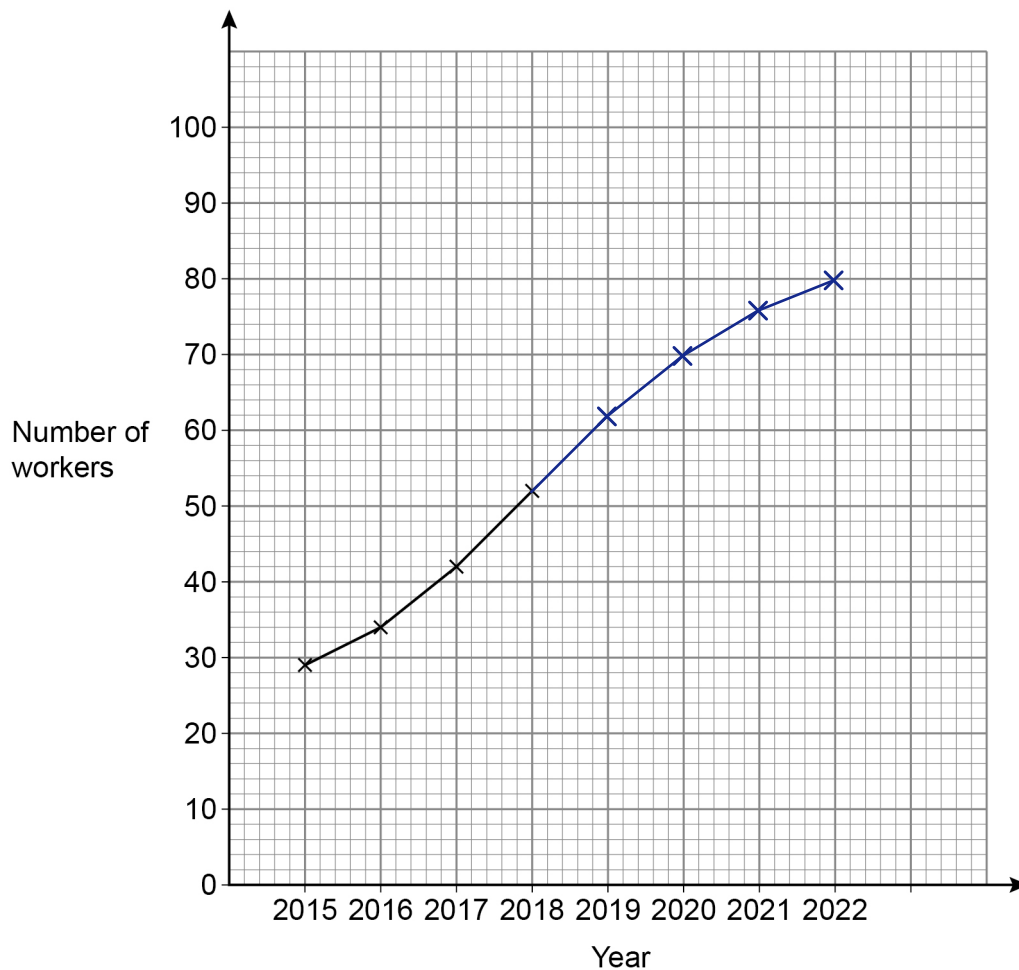
6

The table shows the number of workers at a company in different years.

Year	2015	2016	2017	2018	2019	2020	2021	2022
Number of workers	29	34	42	52	62	70	76	80

A time-series graph is drawn to represent the data.

The first four points have been plotted.



6 (a) Complete the graph.

[2 marks]

6 (b) Estimate the number of workers at the company in 2023

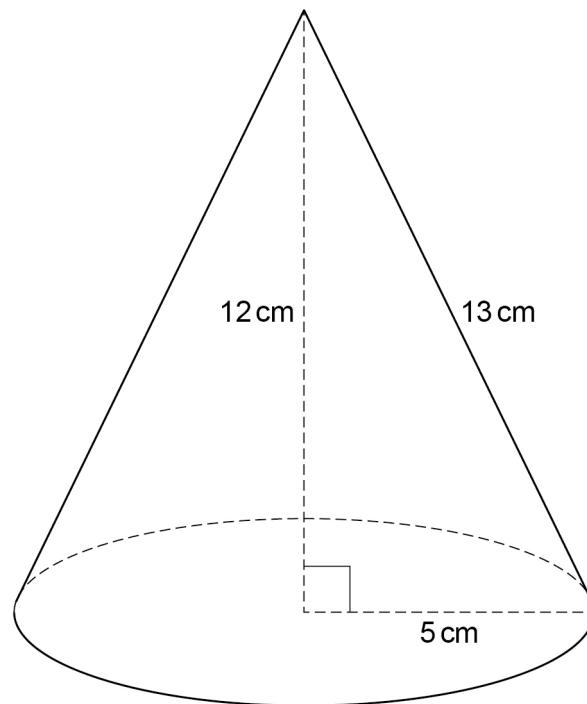
[1 mark]

Answer 84

Turn over ►



7 Here is a cone.



7 (a)

Curved surface area of a cone = $\pi r l$
where r is the radius and l is the slant height

Beth tries to work out the curved surface area in terms of π

Curved surface area of the cone = $\pi \times 5 \times 12$
= $60\pi \text{ cm}^2$

What mistake has she made?

[1 mark]

She used the vertical height (12 cm) instead of the slant height (13 cm). It should be $\pi \times 5 \times 13 = 65\pi \text{ cm}^2$



- 7 (b) Adam uses $\pi = 3$ to estimate the area of the **base** of the cone.

Work out his estimate.

[2 marks]

$$\text{Area} = \pi r^2$$

$$= 3 \times 5^2 = 3 \times 25$$

$$= 75$$

Answer 75 cm²

- 7 (c) Beth uses $\pi = 3.14$ to estimate the area of the **base** of the cone.

Is Beth's estimate more than or less than Adam's estimate?

Tick a box.

More than



Less than



Give a reason for your answer.

[1 mark]

3.14 is bigger than 3 (Adam rounded π down), so Beth

gets $3.14 \times 25 = 78.5$, which is more than 75

Turn over for the next question

Turn over ►



8 Solve $7x - 22 = 4x + 29$ **[3 marks]**

$$7x - 22 = 4x + 29$$

$$7x - 4x = 29 + 22$$

$$3x = 51$$

$$x = 51 \div 3 = 17$$

$$x = 17$$

9 In a house

the floor area of the living room is 26 m^2 the floor area of the kitchen is 16.4 m^2

Express the area of the living room as a fraction of the area of the kitchen.

Give your answer in its simplest form.

[3 marks]

$$\frac{\text{living room}}{\text{kitchen}} = \frac{26}{16.4} = \frac{260}{164} \quad (\times 10)$$

$$= \frac{130}{82} \quad (\div 2)$$

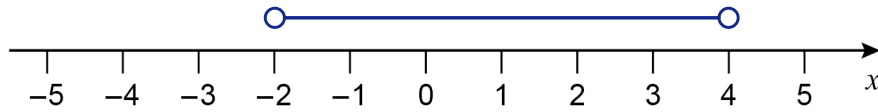
$$= \frac{65}{41} \quad (\div 2)$$

$$\text{Answer } \frac{65}{41}$$



- 10 (a) Represent $-2 < x < 4$ on the number line.

[1 mark]



- 10 (b) Solve $5y + 14 \geq 11$

[2 marks]

$$5y + 14 \geq 11$$

$$5y \geq 11 - 14$$

$$5y \geq -3$$

$$y \geq -\frac{3}{5}$$

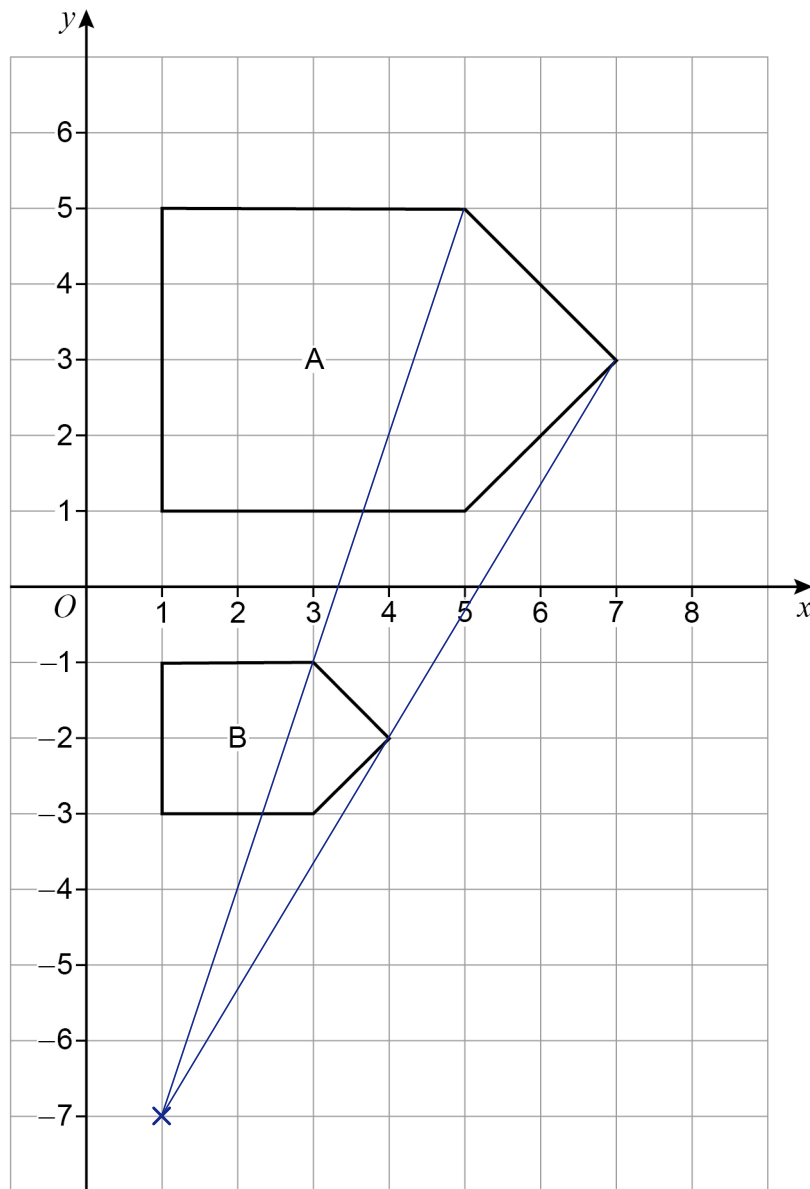
Answer $y \geq -\frac{3}{5}$

Turn over for the next question

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11



Describe fully the **single** transformation that maps shape A to shape B.

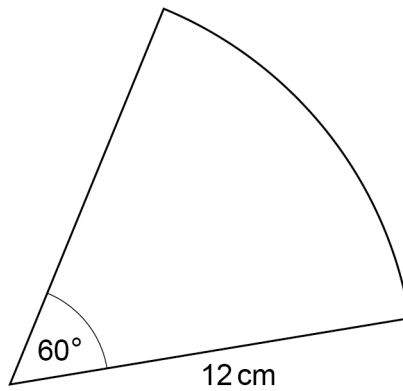
[3 marks]

Enlargement, scale factor $\frac{1}{2}$

centre (1, -7)



12

A sector has radius 12 cm and angle 60° Not drawn
accurately

Work out the length of the arc.

Give your answer in terms of π **[3 marks]**

$$\text{Arc} = \frac{60}{360} \times 2 \times \pi \times 12$$

$$= \frac{1}{6} \times 24\pi$$

$$= 4\pi$$

Answer 4π cm

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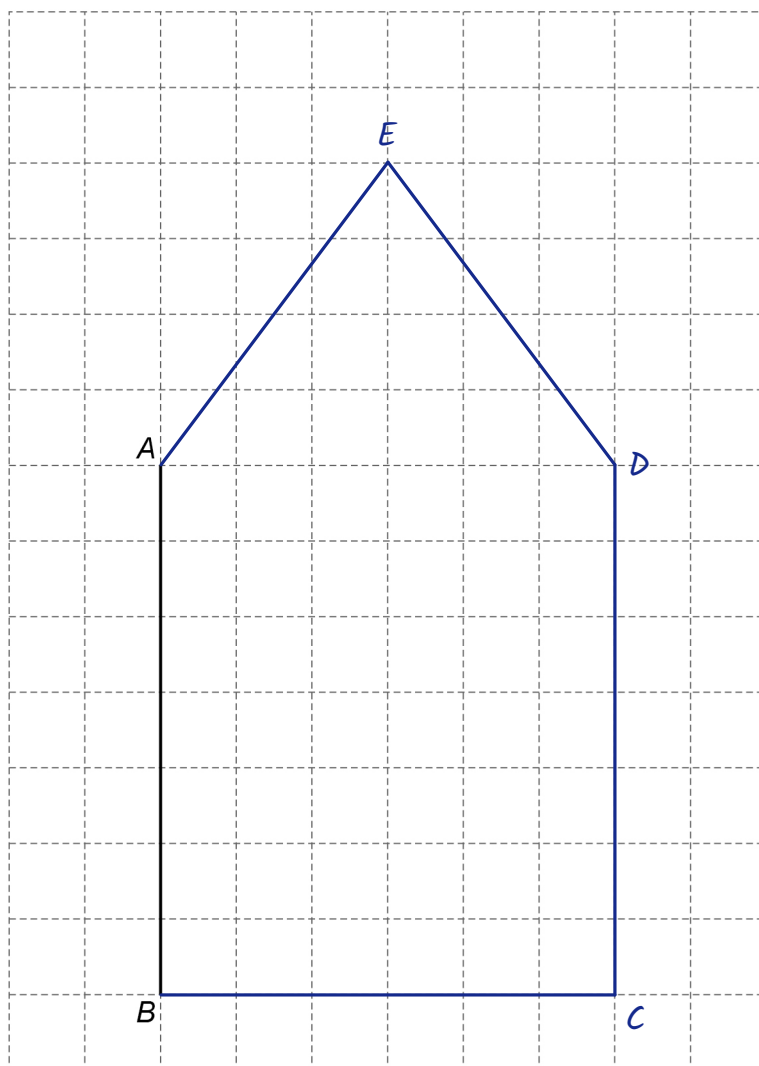
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13

 $ABCDE$ is a pentagon with $AB = 7\text{ cm}$

- $BC = 6\text{ cm}$
- AB and BC are perpendicular.
- AB and DC are equal **and** parallel.
- Area of the pentagon $= 54\text{ cm}^2$
- The pentagon has exactly **one** line of symmetry.

Complete a **labelled** drawing of the pentagon.**[4 marks]**

Rectangle $ABCD$: $7 \times 6 = 42\text{ cm}^2$, triangle ADE : $54 - 42 = 12\text{ cm}^2$
 $\frac{1}{2} \times 6 \times h = 12$ so $h = 4\text{ cm}$, E is above the middle of AD



14

4 chocolate bars and 3 packets of mints cost £4.70

5 chocolate bars and 1 packet of mints cost £4.50

Work out the cost of a chocolate bar and the cost of a packet of mints.

[4 marks]*c = chocolate bar, m = packet of mints (in pence)*

$$4c + 3m = 470$$

$$5c + m = 450 \quad \times 3: \quad 15c + 3m = 1350$$

$$(15c + 3m) - (4c + 3m) = 1350 - 470$$

$$11c = 880$$

$$c = 80$$

$$5 \times 80 + m = 450$$

$$m = 450 - 400 = 50$$

chocolate bar 80ppacket of mints 50p**Turn over for the next question****Turn over ►**

- 15 (a) Between which two **consecutive** integers does the square root of 210 lie?

[1 mark]

$$14^2 = 196, \quad 15^2 = 225$$

$$196 < 210 < 225$$

Answer 14 and 15

- 15 (b) Here are two calculations, A and B.

A

$$1.92^7 + 6.9^3$$

B

$$5 \times \sqrt[3]{1\,000\,350}$$

Use approximations to show that answer to A < answer to B

[3 marks]

$$A \approx 2^7 + 7^3 = 128 + 343 = 471$$

$$B \approx 5 \times \sqrt[3]{1\,000\,000} = 5 \times 100 = 500$$

$$1.92 < 2 \text{ and } 6.9 < 7, \text{ so } A < 471$$

$$1\,000\,350 > 1\,000\,000, \text{ so } B > 500$$

$$471 < 500, \text{ so answer to A} < \text{answer to B}$$



16

The table shows information about the ages of members of two clubs.

	Median age (years)	Interquartile range of ages (years)
Swimming club	21.2	7.3
Cycling club	29.7	4.6

Compare the average age and consistency of ages for the members of the two clubs.

[2 marks]

Average The cycling club members are older on average
(median 29.7 years is higher than 21.2 years).

Consistency The cycling club ages are more consistent
(smaller interquartile range: $4.6 < 7.3$).

Turn over for the next question

Turn over ►



17

Rearrange $y = \frac{3x+7}{x}$ to make x the subject.

[4 marks]

$$y = \frac{3x+7}{x}$$

$$xy = 3x + 7$$

$$xy - 3x = 7$$

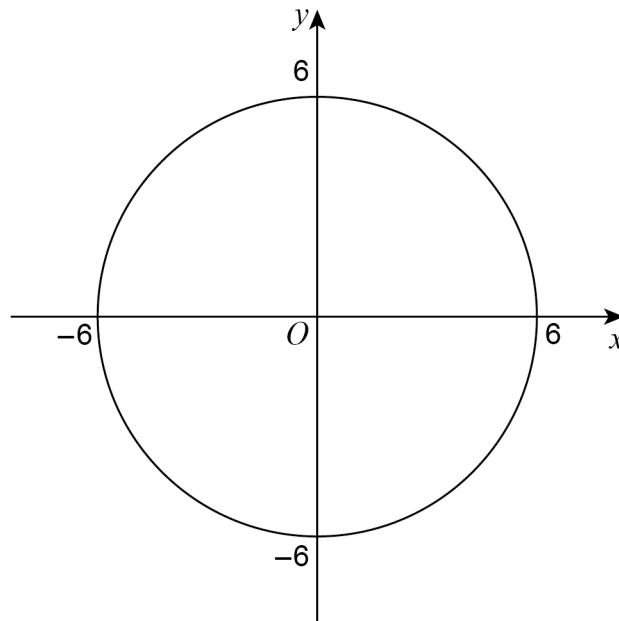
$$x(y - 3) = 7$$

$$x = \frac{7}{y-3}$$

Answer $x = \frac{7}{y-3}$



- 18 A circle has centre O and passes through $(0, 6)$



Write down the equation of the circle.

[1 mark]

Answer $x^2 + y^2 = 36$

Turn over for the next question

Turn over ►



19

 A , B and C are numbers.Here is some information about B and C .

B	$\frac{7}{4}$ of A
C	A increased by 150%

Work out C as a fraction of B .**[4 marks]**

$$B = \frac{7}{4} A$$

$$C = A + 1.5A = 2.5A = \frac{5}{2} A$$

$$\frac{C}{B} = \frac{5}{2} \div \frac{7}{4} = \frac{5}{2} \times \frac{4}{7}$$

$$= \frac{20}{14} = \frac{10}{7}$$

Answer $\frac{10}{7}$



20

$$5x^3 + ax^2 + bx + c \equiv kx^3 + (2 - k)x^2 + (a^2 - 1)x + \frac{b}{2}$$

Work out the values of a , b and c .

[3 marks]

$$x^3: 5 = k$$

$$x^2: a = 2 - k = 2 - 5 = -3$$

$$x: b = a^2 - 1 = (-3)^2 - 1 = 9 - 1 = 8$$

$$\text{constant: } c = b \div 2 = 8 \div 2 = 4$$

$$a = -3 \quad b = 8 \quad c = 4$$

Turn over for the next question

Turn over ►



21

Prove algebraically that $1.0\dot{1}8 = \frac{56}{55}$

[3 marks]

$$\text{Let } x = 1.01818...$$

$$10x = 10.1818...$$

$$1000x = 1018.1818...$$

$$1000x - 10x = 1018.1818... - 10.1818...$$

$$990x = 1008$$

$$x = \frac{1008}{990} = \frac{504}{495} = \frac{56}{55}$$

$$\text{so } 1.0181818... = \frac{56}{55}$$

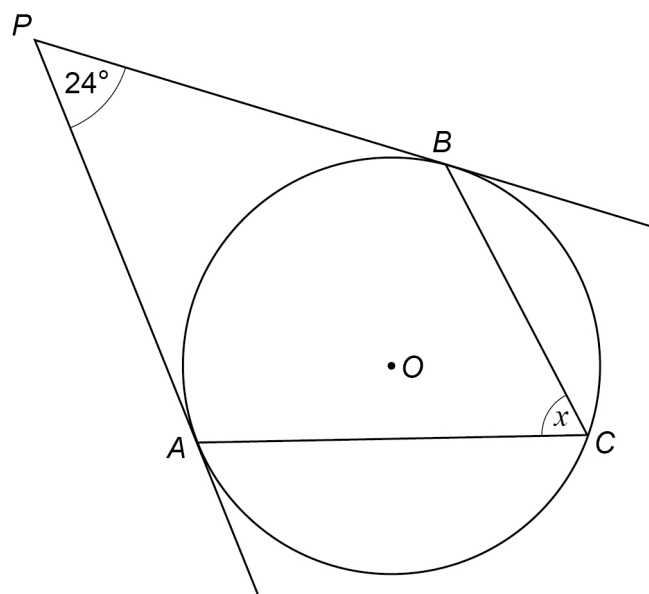


22

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

AP and BP are tangents to the circle.

Not drawn
accurately



Work out the size of angle x .

[3 marks]

$PA = PB$ (tangents from a point are equal)

Angle $PBA = (180 - 24) \div 2 = 78^\circ$ (isosceles triangle)

$x = \text{angle } PBA = 78^\circ$ (alternate segment theorem)

Answer 78 °



- 23 (a) The first three terms of a geometric progression are $\frac{\sqrt{5}}{2}$ $\frac{5}{4}$ $\frac{5\sqrt{5}}{8}$

Work out the next term.

[1 mark]

$$r = \frac{5}{4} \div \frac{\sqrt{5}}{2} = \frac{\sqrt{5}}{2} \quad \text{next} = \frac{5\sqrt{5}}{8} \times \frac{\sqrt{5}}{2} = \frac{25}{16}$$

Answer $\frac{25}{16}$

- 23 (b) The n th term of a sequence is $(2 + \sqrt{3})^n$

Show that the third term is $26 + 15\sqrt{3}$

[3 marks]

$$(2 + \sqrt{3})^2 = (2 + \sqrt{3})(2 + \sqrt{3})$$

$$= 4 + 2\sqrt{3} + 2\sqrt{3} + 3 = 7 + 4\sqrt{3}$$

$$(2 + \sqrt{3})^3 = (7 + 4\sqrt{3})(2 + \sqrt{3})$$

$$= 14 + 7\sqrt{3} + 8\sqrt{3} + 4 \times 3$$

$$= 14 + 7\sqrt{3} + 8\sqrt{3} + 12$$

$$= 26 + 15\sqrt{3}$$



- 24 (a) $9k + 7$ and $2k^2 + 3$ are consecutive integers.
 $9k + 7$ is the smaller integer.

Work out the value of the **next** consecutive integer.

[5 marks]

$$9k + 7 + 1 = 2k^2 + 3$$

$$2k^2 - 9k - 5 = 0$$

$$(2k + 1)(k - 5) = 0$$

$$k = 5 \text{ or } k = -\frac{1}{2}$$

$$k = -\frac{1}{2} \text{ gives } 9k + 7 = 2.5 \text{ (not an integer), so } k = 5$$

$$9k + 7 = 9 \times 5 + 7 = 52$$

$$2k^2 + 3 = 2 \times 25 + 3 = 53$$

$$\text{next integer} = 54$$

Answer 54

- 24 (b) x is a square number.

Show that the **next** square number is $x + 2\sqrt{x} + 1$

[2 marks]

$$\text{Let } x = n^2, \text{ so } \sqrt{x} = n$$

$$\text{next square} = (n + 1)^2 = n^2 + 2n + 1$$

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



25

Show that the value of $6 \sin 30^\circ + 2 \cos 30^\circ \times 4 \tan 30^\circ$ is an integer.**[4 marks]**

$$\sin 30^\circ = \frac{1}{2}, \quad \cos 30^\circ = \frac{\sqrt{3}}{2}, \quad \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$6 \sin 30^\circ = 6 \times \frac{1}{2} = 3$$

$$2 \cos 30^\circ \times 4 \tan 30^\circ = 2 \times \frac{\sqrt{3}}{2} \times 4 \times \frac{1}{\sqrt{3}} = \frac{8\sqrt{3}}{2\sqrt{3}} = 4$$

$$6 \sin 30^\circ + 2 \cos 30^\circ \times 4 \tan 30^\circ = 3 + 4 = 7$$

7 is an integer

END OF QUESTIONS

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