AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

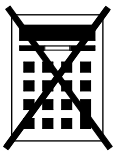
H

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	

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

Do not write outside the box

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

[3 marks]

$12^2 = 144$

$\sqrt{36} = 6$ ✓ (1)

$= 144 \div \left(\frac{1}{3} \times 6\right)$

$= 144 \div 2$ ✓ (1)

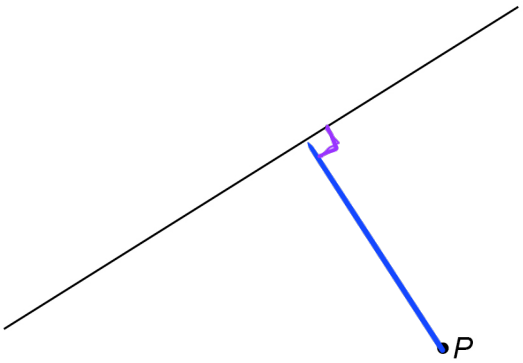
$= 72$

Answer 72 ✓ (1)

2 Measure the **shortest** distance from point *P* to the line.

Give your answer in millimetres.

[1 mark]



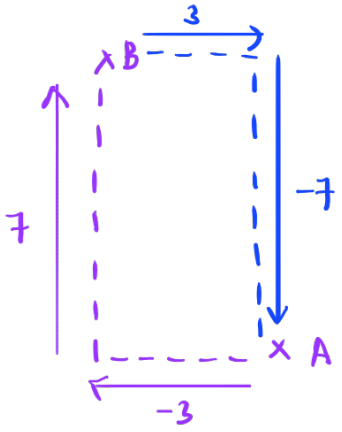
Answer 32 ✓ (1) mm

Do not write outside the box

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 $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$ ✓1

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

4 (a) Write down the minimum possible attendance.

if 8349 to the nearest 100, will be 8300.

[1 mark]

Answer 8350 ✓1

4 (b) Write down the maximum possible attendance.

[1 mark]

if 8450 to the nearest 100 will be 8500.

Answer 8449 ✓1

Turn over for the next question

7

Do not write outside the box

5 A school year has 78 students.

28 wear glasses.

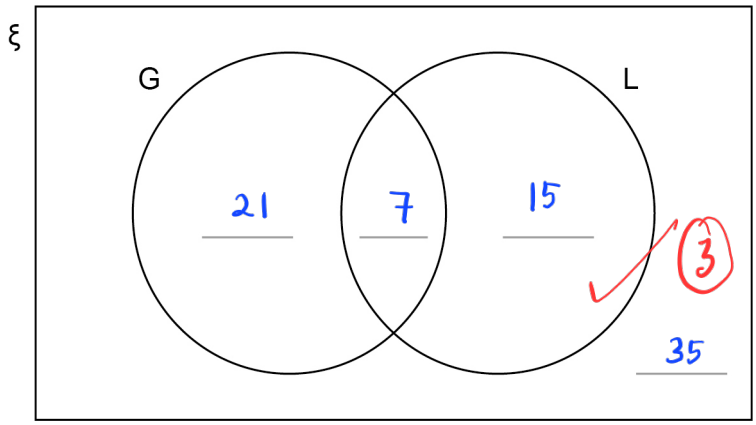
$\frac{1}{4}$ of the students who wear glasses are left-handed.

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]

wear glasses and left handed = $\frac{1}{4} \times 28 = 7$

not wearing glasses and left handed = $0.3 \times (78 - 28) = 15$

5 (b) A left-handed student is chosen at random.

Work out the probability that the student wears glasses.

[1 mark]

$\frac{7}{22}$

Answer $\frac{7}{22}$

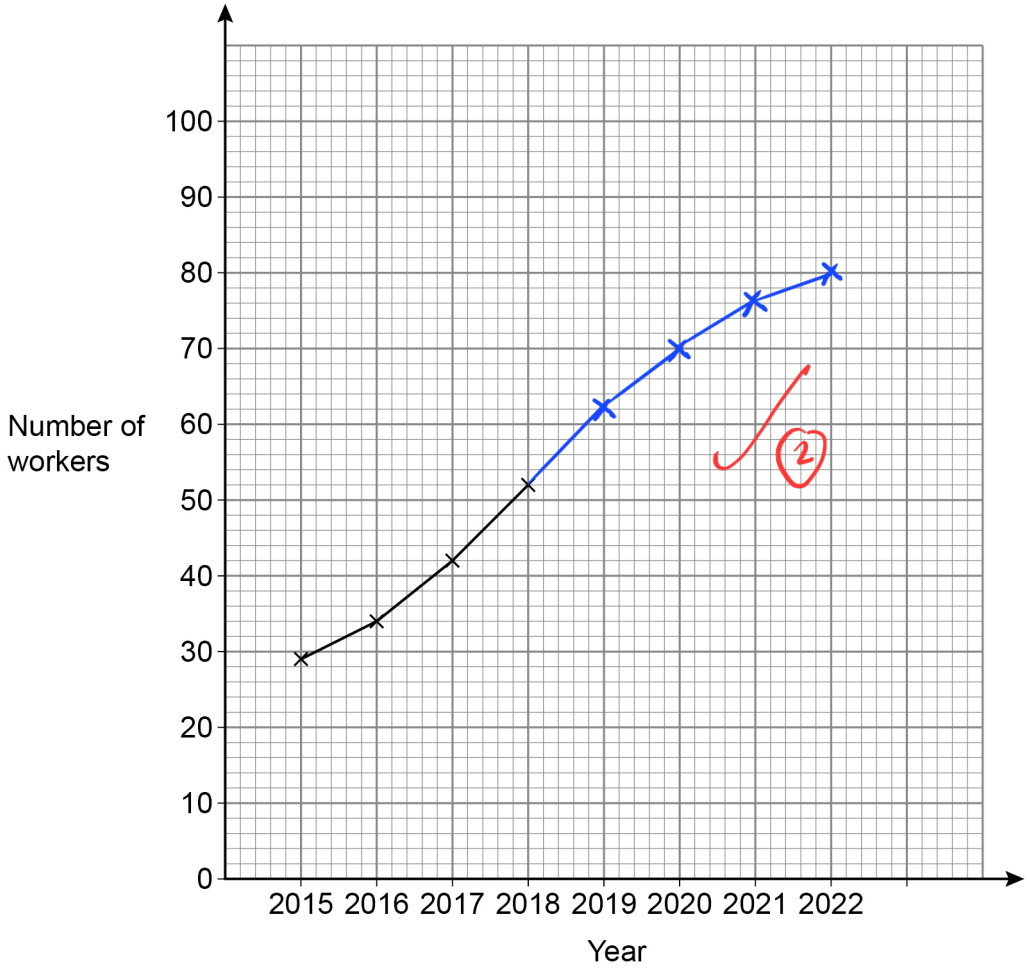
Do not write outside the box

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

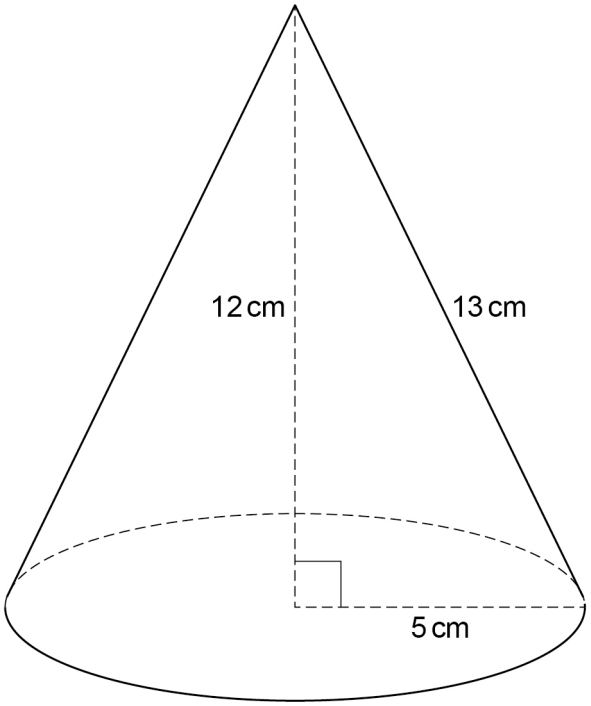
[1 mark]

Answer 82

7

Do not write outside the box

7 Here is a cone.



7 (a)

Curved surface area of a cone $= \pi rl$

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]

The value of l should be 13 instead of 12 ✓ (1)

Do not write outside the box

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

Work out his estimate.

[2 marks]

Area of the base of the cone = $\pi \times r^2$

$= 3 \times 5^2$

$= 3 \times 25$ ✓1

$= 75\ cm^2$ ✓1

Answer 75 cm^2

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 larger than 3. ✓1

Turn over for the next question

4

Do not write outside the box

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

[3 marks]

$7x - 4x = 29 + 22$ ✓1

$3x = 51$

$x = \frac{51}{3}$ ✓1

$= 17$ ✓1

$x =$ 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]

Area of living room $= \frac{26.0}{16.4}$ area of kitchen ✓1

$= \frac{260 \div 4}{164 \div 4}$ area of kitchen ✓1

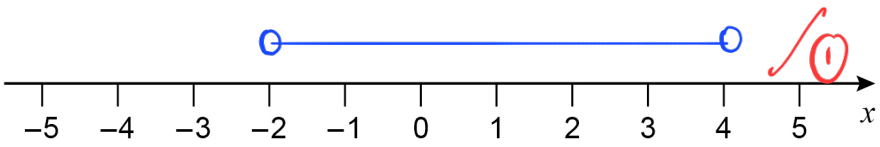
$= \frac{65}{41}$ area of kitchen ✓1

Answer $\frac{65}{41}$

Do not write outside the box

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

[1 mark]



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

[2 marks]

$5y \geqslant 11 - 14$ ✓1

$5y \geqslant -3$

$y \geqslant \frac{-3}{5}$ ✓1

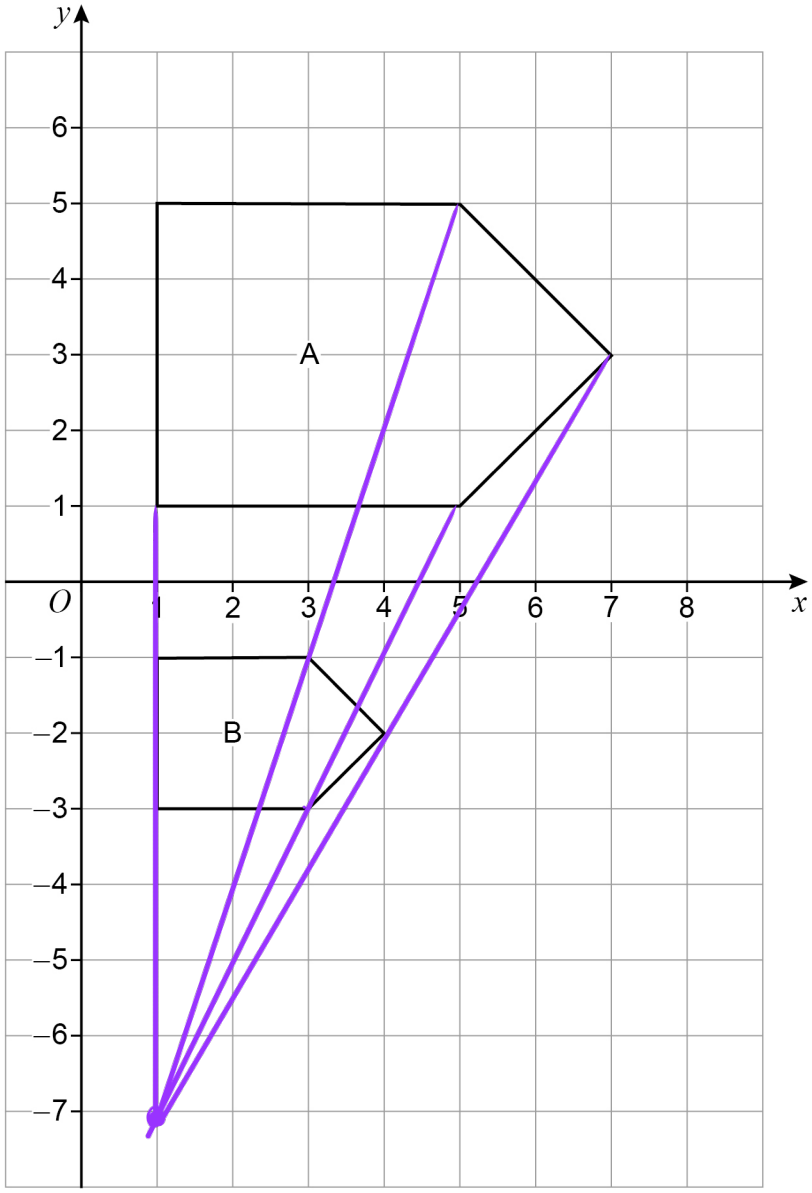
Answer $y \geqslant -\frac{3}{5}$

Turn over for the next question

9

Do not write outside the box

11



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

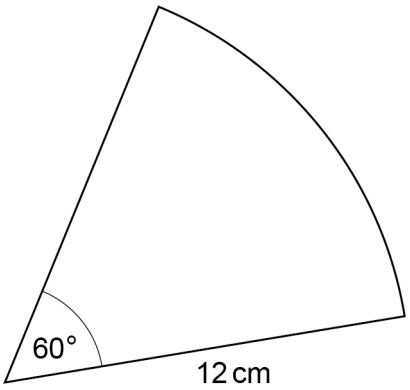
[3 marks]

Enlargement of scale factor $\frac{1}{2}$ at point $(1,-7)$.

✓① ✓① ✓①

Do not write outside the box

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]

circumference = $2\pi \times$ radius ✓1

lenght of arc = $\frac{60^\circ}{360^\circ} \times 2\pi \times$ radius ✓1

= $\frac{1}{6} \times 2\pi \times 12$

= 4π ✓1

Answer 4π cm

Turn over for the next question

6

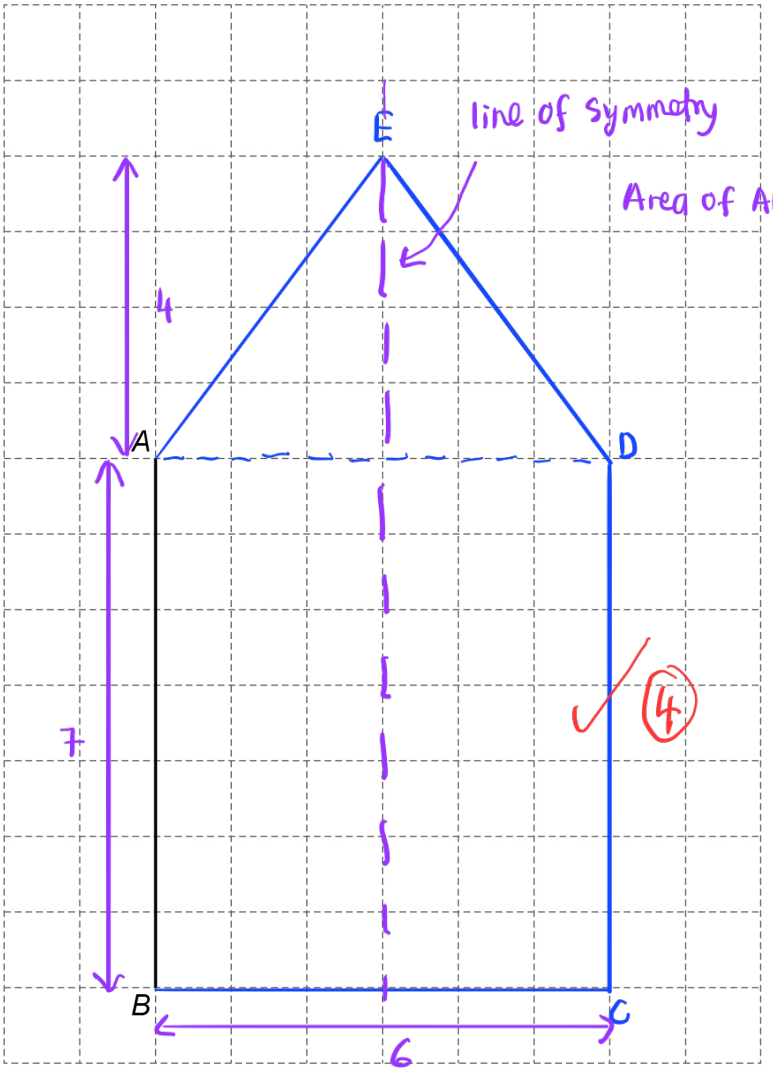
Do not write outside the box

13 *ABCDE* is a pentagon with $AB = 7$ cm

- $BC = 6$ 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]



Area of ADE $= \frac{1}{2} \times 6 \times 4$
$= 12\ \text{cm}^2$

4

Area of ABCD $= 7 \times 6 = 42\ \text{cm}^2$

Area of ADE $= 54 - 42 = 12\ \text{cm}^2$

Do not write outside the box

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]

Let chocolate bars = C and packet of mints = M

$4C + 3M = 4.70$ — (1)

$5C + M = 4.50$ — (2) ✓1

$M = 4.50 - 5C$ — (3)

Substitute (3) into (1):

$4C + 3(4.50 - 5C) = 4.70$ ✓1

$4C + 13.50 - 15C = 4.70$

$11C = 8.80$ ✓1

$C = 0.80$

$M = 4.50 - 5(0.80) = 0.50$

chocolate bar £0.80 ✓1

packet of mints £0.50

Turn over for the next question

8

Do not write outside the box

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

[1 mark]

$14^2 = 196$

$15^2 = 225$

square root of 210 is between 14 to 15.

Answer 14 and 15 ✓1

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

A	B
$1.92^7 + 6.9^3$	$5 \times \sqrt[3]{1\,000\,350}$

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

[3 marks]

Approximation of A : $2^7 + 7^3$ ✓1

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$

$7 \times 7 = 49 \times 7 = 343$

$= 128 + 343$

$= 471$

Approximation of B : $5 \times \sqrt[3]{1\,000\,000}$ ✓1

$5 \times (1 \times 10^6)^{1/3}$

$5 \times (1 \times 10^2) = 500$

$\therefore \quad 500 > 471$ ✓1

Do not write outside the box

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 Average age of cycling club members are higher than swimming club since the median age is higher. ✓1

Consistency Age of members in cycling club is more consistent compared to swimming club since the IQR is lower. ✓1

Turn over for the next question

6

Do not write outside the box

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

[4 marks]

$yx = 3x + 7$ ✓(1)

$yx - 3x = 7$ ✓(1)

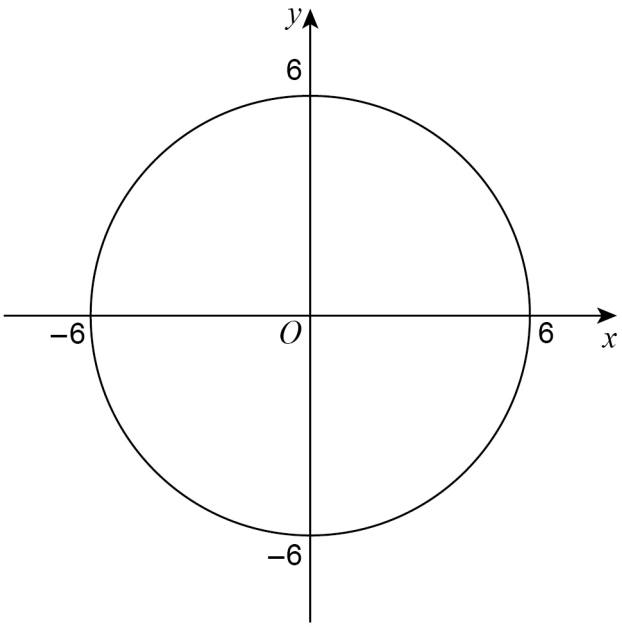
$x(y-3) = 7$ ✓(1)

$x = \dfrac{7}{y-3}$ ✓(1)

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

Do not write outside the box

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



Write down the equation of the circle.

[1 mark]

Answer $x^2 + y^2 = 6^2$ ✓ (1)

Turn over for the next question

5

Do not write outside the box

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]

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

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

$C = A + 1.5A$ ✓1

$= 2.5A = \frac{5}{2} A = \frac{10}{4} A$ ✓1

$C = \frac{10}{4} \left(\frac{4}{7}\right) B$ ✓1

$= \frac{10}{7} B$

Answer $\frac{10}{7}$ ✓1

Do not write outside the box

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]

$x^3 : 5 = k$

$x^2 : a = 2 - k$

$a = 2 - 5 = -3$ ✓1

$x : b = a^2 - 1$

$b = (-3)^2 - 1 = 8$ ✓1

$c = \frac{b}{2} = \frac{8}{2} = 4$ ✓1

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

Turn over for the next question

7

Do not write outside the box

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

[3 marks]

let $x = 1.0\dot{1}\dot{8}$

$10x = 10.\dot{1}\dot{8}$

$1000x = 101\dot{8}$ ✓(1)

$1000x - 10x = 101\dot{8} - 10.\dot{1}\dot{8}$

$990x = 1008$

$x = \frac{1008 \div 9}{990 \div 9} = \frac{112 \div 2}{110 \div 2} = \frac{56}{55}$ (proved)

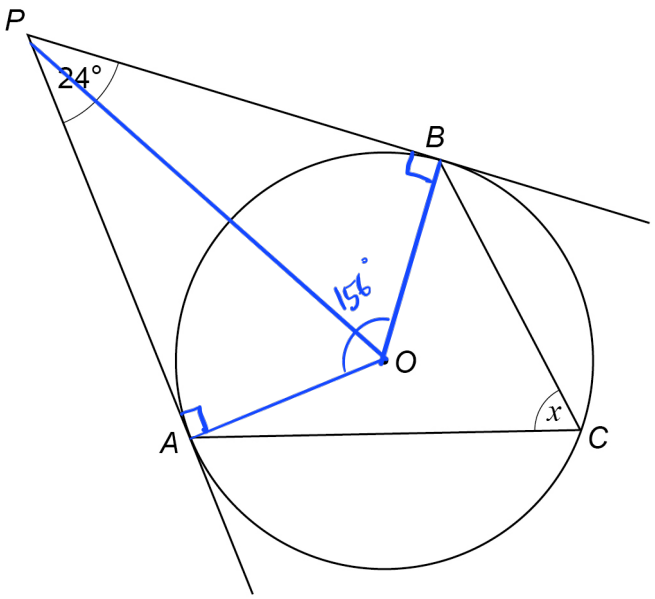
✓(1) ✓(1)

Do not write outside the box

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]

angle PBO = angle PAO = 90° (1)

angle AOB = 360 − 90 − 90 − 24 = 156° (1)

$x° = \frac{156°}{2} = 78°$ (1)

(angle at the centre is twice angle at circumference)

Answer 78° °

6

Do not write outside the box

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]

$\times\sqrt{5}$ $\times\sqrt{5}$ $\times 2$ $\times 2$

4th term $= \frac{5\sqrt{5}(\sqrt{5})}{8\times 2} = \frac{5(5)}{16}$

$= \frac{25}{16}$

Answer $\frac{25}{16}$ ✓1

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

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

[3 marks]

$T_3 = (2+\sqrt{3})^3$

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

$= (4+4\sqrt{3}+3)(2+\sqrt{3})$ ✓1

$= (7+4\sqrt{3})(2+\sqrt{3})$ ✓1

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

$= 14+12+15\sqrt{3}$ ✓1

$= 26+15\sqrt{3}$ (shown)

Do not write outside the box

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]

$2k^2 + 3 - (9k + 7) = 1$ ✓ (1)

$2k^2 - 9k - 5 = 0$ ✓ (1)

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

$k = 5$ or $k = -\frac{1}{2}$ ✓ (1) ✓ (1)

Since $(9k + 7)$ and $(2k^2 + 3)$ are integers,

we can eliminate $k = -\frac{1}{2}$

$2(5^2) + 3 = 53$

The next integer is 54. ✓ (1)

Answer 54

24 (b) x is a square number.

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

[2 marks]

$x = n^2$ ✓ (1)

Subs $x = n^2$ into $x + 2\sqrt{x} + 1$

$= n^2 + 2\sqrt{n^2} + 1$ ✓ (1)

$= n^2 + 2n + 1$

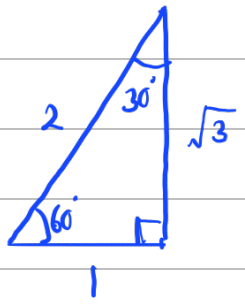
$= (n + 1)^2$

11

25 Show that the value of $6 \sin 30° + 2 \cos 30° \times 4 \tan 30°$ is an integer.

[4 marks]

Do not write outside the box



$\sin 30° = \frac{1}{2}$

$\cos 30° = \frac{\sqrt{3}}{2}$ ✓1

$\tan 30° = \frac{1}{\sqrt{3}}$

$6\left(\frac{1}{2}\right) + \left(2\left(\frac{\sqrt{3}}{2}\right) \times 4\left(\frac{1}{\sqrt{3}}\right)\right)$ ✓1

$= 3 + \left(\sqrt{3} \times \frac{4}{\sqrt{3}}\right)$

$= 3 + 4$ ✓1

$= 7$ ✓1

END OF QUESTIONS

4

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**