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

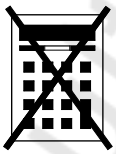
Higher Tier Paper 1 Non-Calculator

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	

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

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

[3 marks]

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

$144 \div 2$

$\frac{144}{2}$

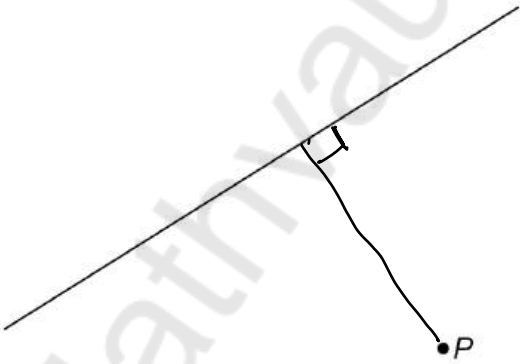
$2 \overline{)144} = 072$

Answer 72

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

Give your answer in millimetres.

[1 mark]



Answer 32 mm

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

-3 Left by 3
7 Up by 7

Write down the vector that translates B to A.

[1 mark]

3 Right by 3
-7 Down by 7

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

8300 ⋮ 8400 ⋮ 8500

$8350 \leq x < 8450$

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.

$\frac{1}{4} \times 28 = 7$

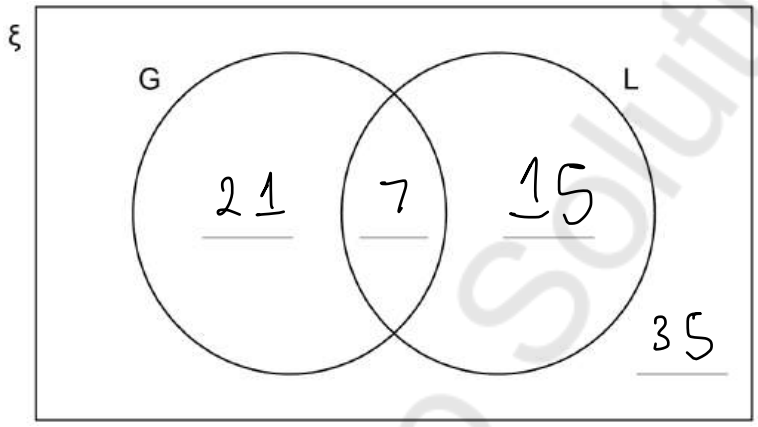
$78 - 28 = 50$

50 do not wear glasses

5 (a) ξ = students in the school year = 78

G = wears glasses = 28

L = left-handed



$\frac{30}{100} \times 50$

$\frac{1500}{100} = 15$

15 do not wear glasses and are left handed.

1+ 21 7 15 43

Complete the Venn diagram.

[3 marks]

$21 + 7 + 15 = 43$

$78 - 43 = 35$

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

Work out the probability that the student wears glasses.

[1 mark]

Total left handed $= 7 + 15 = 22$

Answer $\frac{7}{22}$

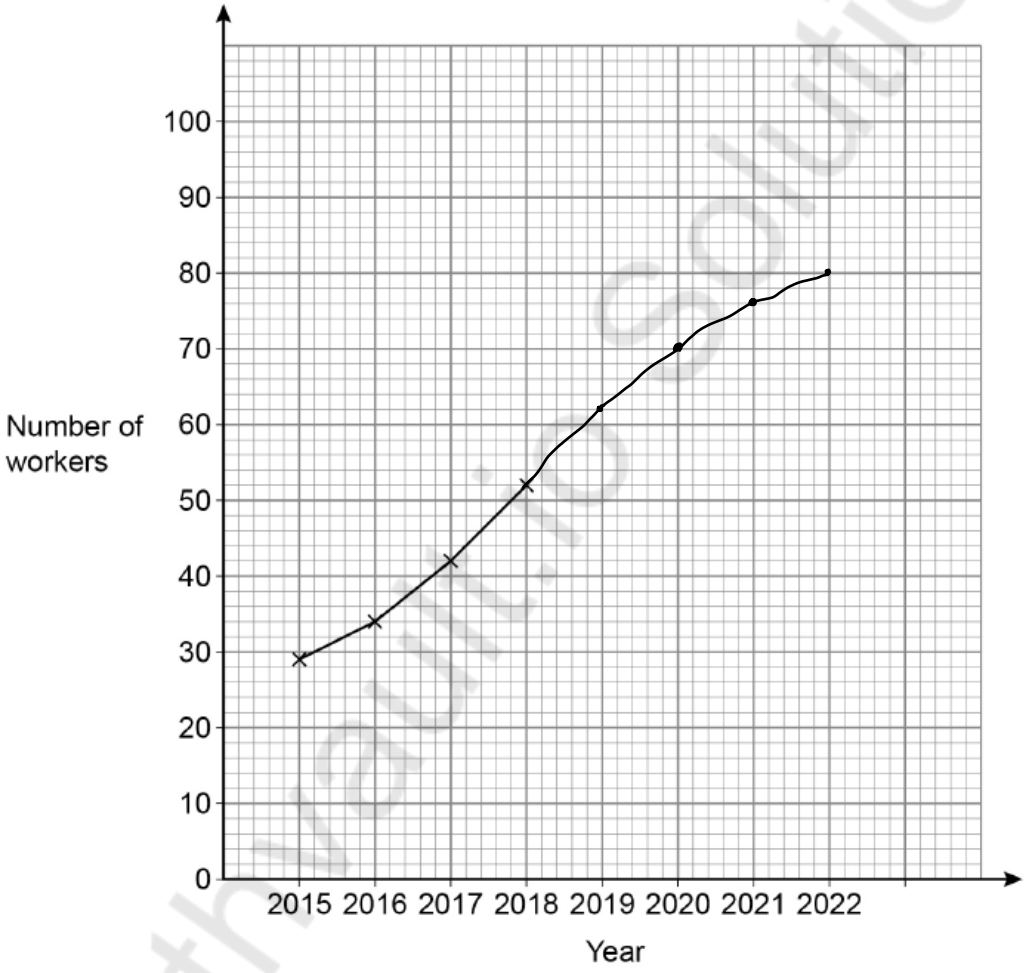
Do not write outside the box

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 85

7

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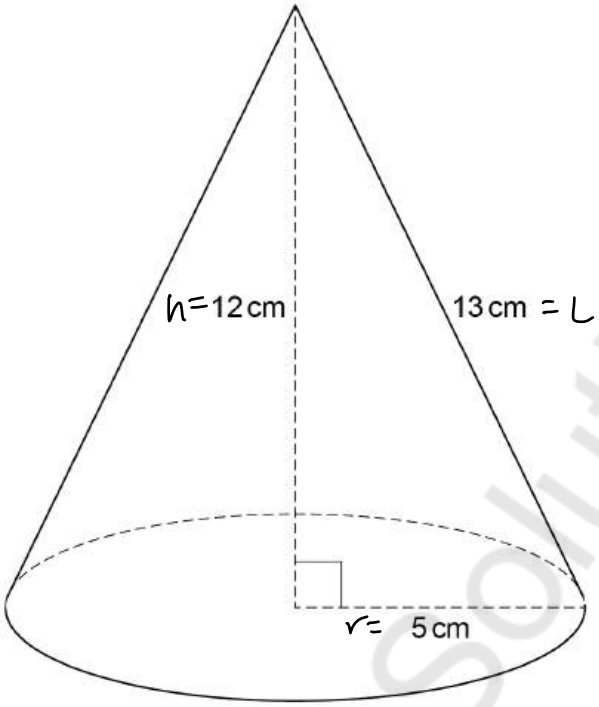
7 Here is a cone.



7 (a)

Curved surface area of a cone = πrl

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]

Beth has used the perpendicular height of the cone but she should use the slant height.

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]

$A = \pi r^2$

$A = 3 \times 5^2$

$A = 3 \times 25$

$A = 75 \text{ cm}^2$

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 was rounded down to 3 in Adam's estimate so Beths answer will be greater.

Turn over for the next question

4

Do not write outside the box

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

[3 marks]

$-4x \quad -4x$

$3x - 22 = 29$

$+22 \quad +22$

$3x = 51$

$\div 3 \quad \div 3$

$x = 17$

$3 \overline{)51}$ → 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]

$L = 26\,m^2$ $\quad K = 16.4\,M^2$ $\div 16.4$

$L = \frac{K}{16.4} \times 26$

$L = \frac{26K \times 10}{16.4 \times 10}$ $\times 26$

$L = \frac{260K \div 2}{164 \div 2}$

$L = \frac{130K \div 2}{82 \div 2}$

$L = \frac{65}{41}K$

$\frac{K}{16.4} = 1$ $\times 26$

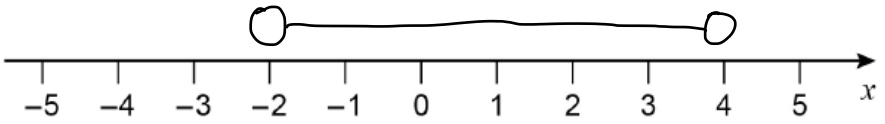
$\frac{K}{16.4} \times 26 = 26$

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]

$-14 \quad -14$

$5y \geqslant -3$

$\div 5 \qquad \div 5$

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

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

Turn over for the next question

9

Turn over ►

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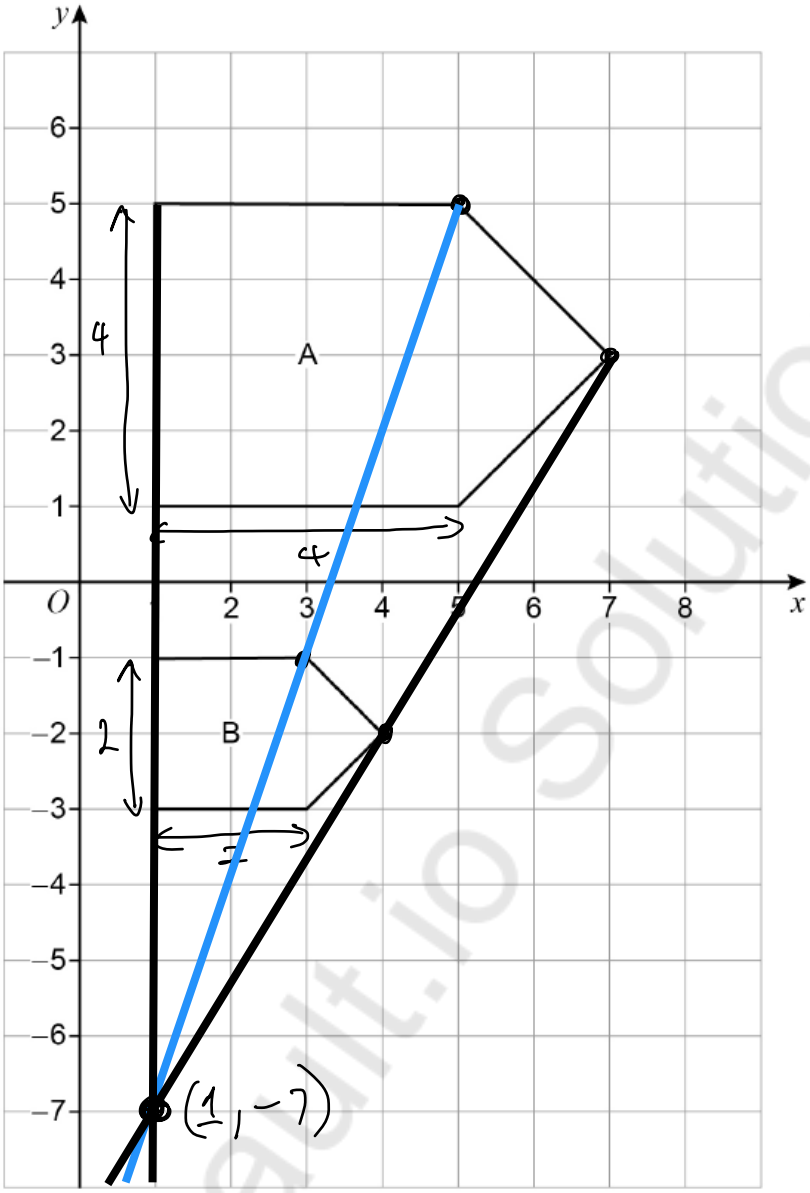
11



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

[3 marks]

Enlargement with a scale factor of $\frac{1}{2}$ and a centre of enlargement $(1, -7)$

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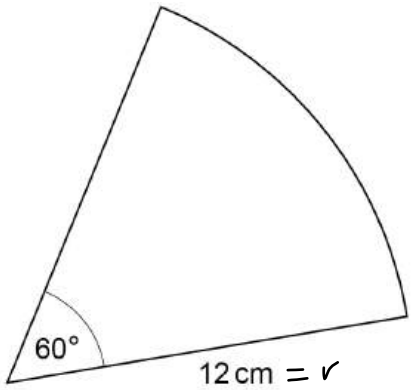
12 A sector has radius 12 cm and angle 60°



Not drawn accurately

Work out the length of the arc.

Give your answer in terms of π

[3 marks]

$\frac{60}{360} = \frac{1}{6}$

$C = 2\pi r$ Sector $\Rightarrow \frac{1}{6} \times 24\pi$

$2 \times \pi \times 12$

24π cm

Answer 4π cm

Turn over for the next question

6

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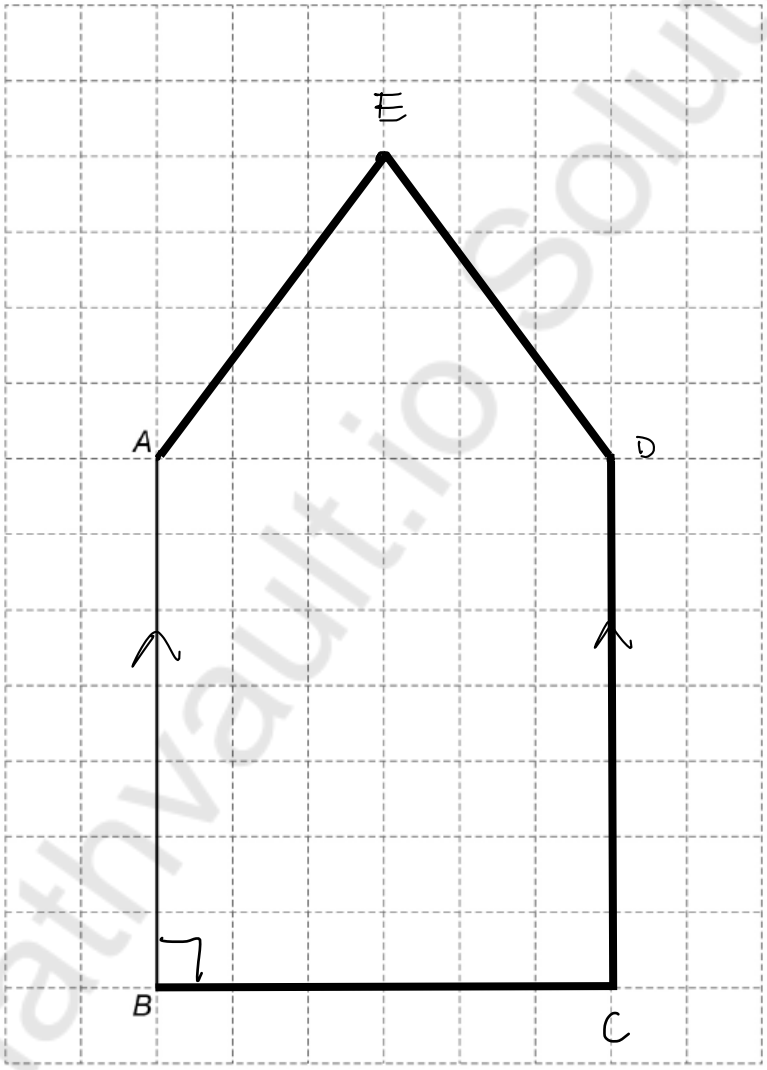
13 *ABCDE* is a pentagon with $AB = 7$ cm

- $BC = 6$ 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]



ABCD has area

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

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

↙ Area of triangle

$12 = \frac{6 \times h}{2}$

$24 = 6 \times h$

$4\text{cm} = h$

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]

$$\begin{array}{r} {}^{1+}4.5 \\ \times \quad 3 \\ \hline 13.5 \end{array}$$

$4C + 3m = 4.7$ — (1)

$5C + m = 4.5$ — (2)

$\times 3 \quad \times 3 \quad \times 3$

$15C + 3m = 13.5$

$4C + 3m = 4.7$

$11C = 8.8$

$\div 11 \quad \div 11$

$C = £0.80$

$5\left(\frac{4}{5}\right) + m = 4.5$

$4 + m = 4.5$

$-4 \quad -4$

$m = £0.50$

chocolate bar £0.80

packet of mints £0.50

$\frac{8.8 \times 10}{11 \times 10} = \frac{88}{110} \begin{array}{l} \div 11 \\ \div 11 \end{array} = \frac{8}{10} = 0.8$

$$\begin{array}{r} {}^{12}{}^{0}\not{3}.{}^{1}5 \\ - \quad 4.7 \\ \hline 8.8 \end{array}$$

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]

$\sqrt{225} = 15$

$\sqrt{196} = 14$

Answer 14 and 15

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]

(A)

$2^7 + 7^3$

$128 + 343$

471

(B)

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

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

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

5×10^2

500

$471 < 500$

6+

49

× 7

343

128

471

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 On average the Cycling Club has older members

Consistency The Cycling Club has more Consistant ages because it has a lower interquartile range than swimming club.

Turn over for the next question

6

Do not write outside the box

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

[4 marks]

$x \times x \qquad x \times x$

$xy = 3x + 7$

$xy - 3x = 7$

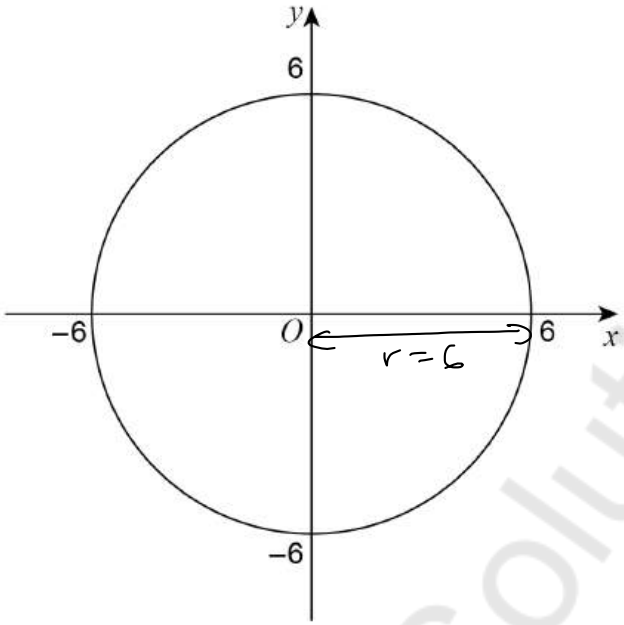
$x(y-3) = 7$

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

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

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 $x^2 + y^2 = 36$

Turn over for the next question

5

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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%

100% + 150% = 250%

250% = 2·5 (÷100)

Work out C as a fraction of B.

[4 marks]

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

$C = 2{\cdot}5A$

$C = \frac{5}{2}A$

$2C = 5A$

$\frac{2C}{5} = A$

$B = \frac{7}{4}\left[\frac{2C}{5}\right]$

$B = \frac{14C}{20}$

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

$10B = 7C$

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

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

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]

$5 = k$

$a = (2-5)$

$a = -3$

$b = a^2 - 1$

$b = (-3)^2 - 1$

$b = 9 - 1$

$b = 8$

$c = \frac{b}{2}$

$c = \frac{8}{2}$

$c = 4$

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

Turn over for the next question

7

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

[3 marks]

$0.0\dot{1}\dot{8} = 0.018\dot{1}\dot{8} = x$

$\times 10$ $\times 10$

$0.18\dot{1}\dot{8} = 10x$

$\times 100$ $\times 100$

$18.\dot{1}\dot{8} = 1000x$

$1000x - 10x = 18.\dot{1}\dot{8} - 0.0\dot{1}\dot{8}$

$990x = 18$

$x = \frac{18}{990} = \frac{18 \div 9}{990 \div 9} = \frac{2}{110} = \frac{2 \div 2}{110 \div 2} = \frac{1}{55}$

$1 + \frac{1}{55} = \frac{55}{55} + \frac{1}{55} = \frac{56}{55}$ Shown.

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

AP and *BP* are tangents to the circle.

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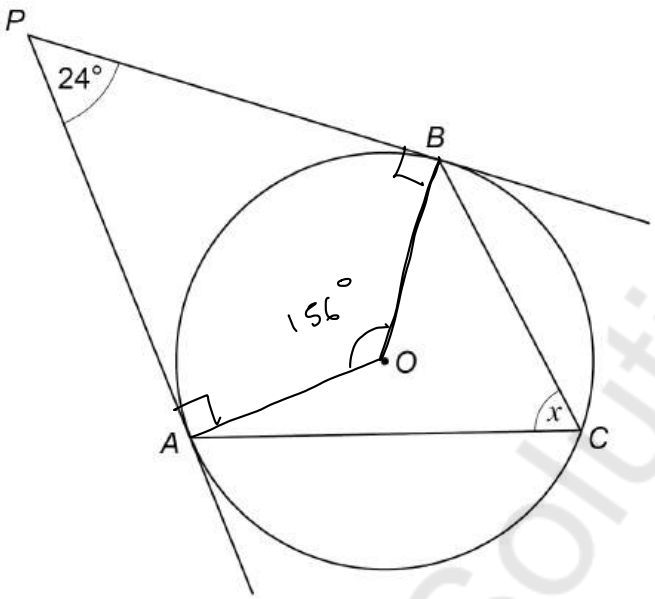

078
2 | 1'5'6

5
360
- 24
2'36
- 90
1'2'46
- 90
156

Work out the size of angle x.

[3 marks]

$P\hat{A}O = 90° = P\hat{B}O$ (Tangent and radius meet at 90°)

$A\hat{O}B = 360 - 24 - 90 - 90$ [Angles in quadrilateral sum to 360°)

$A\hat{O}B = 156°$

$x = 156 \div 2$ [Angle at centre is twice angle at circumference)

$x = 78°$

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]

$r = \frac{5}{4} \div \frac{\sqrt{5}}{2} = \frac{5}{4} \times \frac{2}{\sqrt{5}} = \frac{5 \times \sqrt{5}}{2\sqrt{5} \times \sqrt{5}} = \frac{5\sqrt{5}}{2 \times 5} = \frac{\sqrt{5}}{2}$

$r = \frac{\sqrt{5}}{2}, \quad T_4 = \frac{5\sqrt{5}}{8} \times \frac{\sqrt{5}}{2} = \frac{5 \times \sqrt{5} \times \sqrt{5}}{8 \times 2} = \frac{5 \times 5}{16} = \frac{25}{16}$

Answer $\frac{25}{16}$

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]

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

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

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

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

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

$7 + 4\sqrt{3}$

	7	$+4\sqrt{3}$
2	14	$+8\sqrt{3}$
$+\sqrt{3}$	$+7\sqrt{3}$	$+12$

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

$26 + 15\sqrt{3}$ 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]

$2k^2 + 3 - (9k + 7) = 1$

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

$2k^2 - 9k + 3 - 7 - 1 = 0$

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

$2k^2 - 10k + k - 5 = 0$

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

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

$2k + 1 = 0$ $\quad k - 5 = 0$

$2k = -1$ $\quad k = 5$

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

$2x - 5 = -10$

$-10, 1$

$-5, 2$

$9(5) + 7$

$45 + 7 = 52$

$2(5)^2 + 3$

$50 + 3 = 53$

54

Answer 54

24 (b) x is a square number.

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

[2 marks]

$\sqrt{x} = n$

$n + 1$

$(n + 1)^2$ is next square number

$(\sqrt{x} + 1)^2$

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

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

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

Shown.

11

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

[4 marks]

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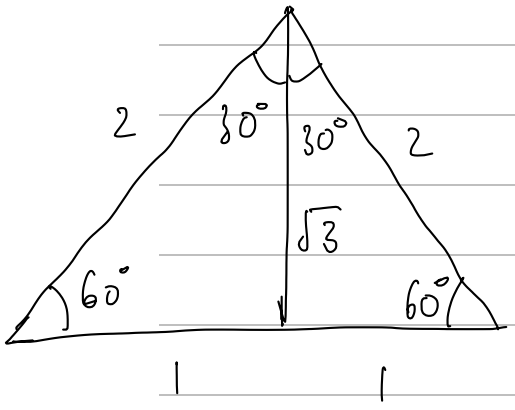

$\left(6 \times \frac{1}{2}\right) + \left(2 \times \frac{\sqrt{3}}{2}\right) \times \left(4 \times \frac{1}{\sqrt{3}}\right)$

$3 + \sqrt{3} \times \frac{4}{\sqrt{3}}$

$3 + 4$

7

$\sqrt{2^2 - 1^2} = h$

$\sqrt{3} = h$

$\sin 30 = \frac{1}{2}$

$\cos 30 = \frac{\sqrt{3}}{2}$

$\tan 30 =$

END OF QUESTIONS

4

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ANSWER IN THE SPACES PROVIDED

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