

Answer **all** the questions.

- 1 (a) Calculate.

$$\frac{3}{5} + \frac{5}{8}$$

Give your answer as a mixed number in its simplest form.

$$\checkmark \quad \frac{24}{40} + \frac{25}{40} = \frac{49}{40} \quad \checkmark$$

$$1 \frac{9}{40} \quad \checkmark$$

(a) [3]

- (b) Work out.

$$5 \times 10^4 - 1.6 \times 10^3$$

Give your answer in standard form.

$$\begin{array}{r} 50000 \\ - 1600 \\ \hline 48400 \end{array} \quad \checkmark$$

$$(b) \quad 4.84 \times 10^4 \quad \checkmark$$

(b) [3]

- 2 Gemma's solution to the inequality
- $3x + 1 > -5$
- is shown on the number line.

Is Gemma's solution correct?
Explain your reasoning.

$$3x > -6 \quad \checkmark$$

$$x > -2 \quad \checkmark$$

no, arrow is wrong direction ✓

..... [3]

3 Work out.

(a) $\begin{pmatrix} -3 \\ 2 \end{pmatrix} + \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

(a) $\begin{pmatrix} 2 \\ 9 \end{pmatrix}$ ✓ [1]

(b) $\begin{pmatrix} 3 \\ 4 \end{pmatrix} - 2 \begin{pmatrix} 1 \\ -3 \end{pmatrix}$

(b) $\begin{pmatrix} 1 \\ 10 \end{pmatrix}$ ✓ [2]

4 Here is the nutritional information for a 110g serving of cereal.

Carbohydrates	99.4g
Proteins	9.5g
Fats	1.1g

Emily says that more than 90% of this serving is carbohydrates.

Is she correct?
Explain your reasoning.

10% of 110g = 11g ✓
90% = 99g ✓

Yes 99.4g > 90% ✓

[3]

- 5 The table shows the relative frequencies of the results for a football team after a number of games:

Result of game	won	lost	drew
Relative frequency	0.2	0.45	0.35

- (a) Complete the table.

$$1 - 0.2 - 0.45$$

[2]

- (b) The team lost 10 more games than they won.

How many games did the team play altogether?

$$10 = 0.25 \text{ difference}$$

$$\textcircled{\times 4}$$

$$40$$

(b) [3]

- 6 Jack sent 15% more text messages in March than in February.
Jack sent 460 text messages in March.

How many more texts did Jack send in March than in February?

$$460 \text{ tm} = 115\%$$

$$4 = 1\%$$

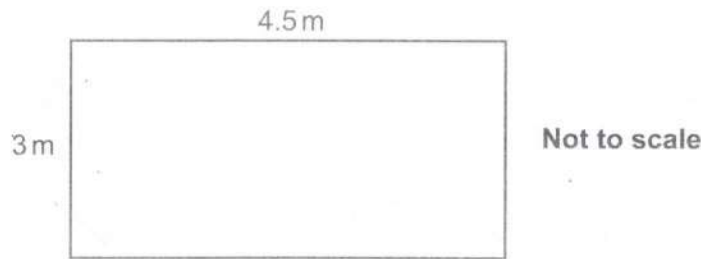
$$400 = 100\%$$

$$460 - 400$$

$$60$$

[4]

- 7 Here is the floor plan of a rectangular room.



Tim buys carpet tiles for this room.

Each tile is a square measuring 50 cm by 50 cm.

The tiles are only sold in packs of ten.

Each pack costs £20.

Tim pays for fitting at a rate of £7.50 per square metre, with any fraction of a square metre rounded up.

Work out the **total** cost of the tiles and fitting.

$$\text{Whole} = 4.5 \times 3 = 13.5 \text{m}^2 \quad \checkmark$$

$$\text{Pack} = 10 \times 0.5 \times 0.5 = 2.5 \text{m}^2 \quad \checkmark$$

$$6 \times 2.5 = 15 \quad / \quad 5 \times 2.5 = 12.5$$

Need 6 packs ✓

$$6 \times \pounds 20 = \pounds 120 \quad \checkmark$$

$$\text{Fitting} = 7.50 \times 14 \quad \checkmark$$

$$= 7.5 \times 2 \times 7$$

$$\begin{array}{r} 15 \\ \times 7 \\ \hline 105 \end{array}$$

$$120 + 105 = 225 \quad \checkmark$$

£ [6]

- 8 Hannah wants to display all the possible outcomes when rolling two fair 6-sided dice.

(a) Give a reason why a tree diagram is not the best method to use.

$6 \times 6 = 36$ branches is too many

✓ etc
[1]

(b) (i) Draw a sample space to display all the possible outcomes.

[2]

	1	2	3	4	5	6
1	11	12	13	14	15	16
2	21	22	23	24	25	26
3	31	32	33	34	35	36
4	41	42	43	44	45	46
5	51	52	53	54	55	56
6	61	62	63	64	65	66

✓

✓

(ii) Show that the probability of the scores on the two dice adding to 11 is $\frac{1}{18}$.

$$\frac{2}{36} = \frac{1}{18}$$

✓✓

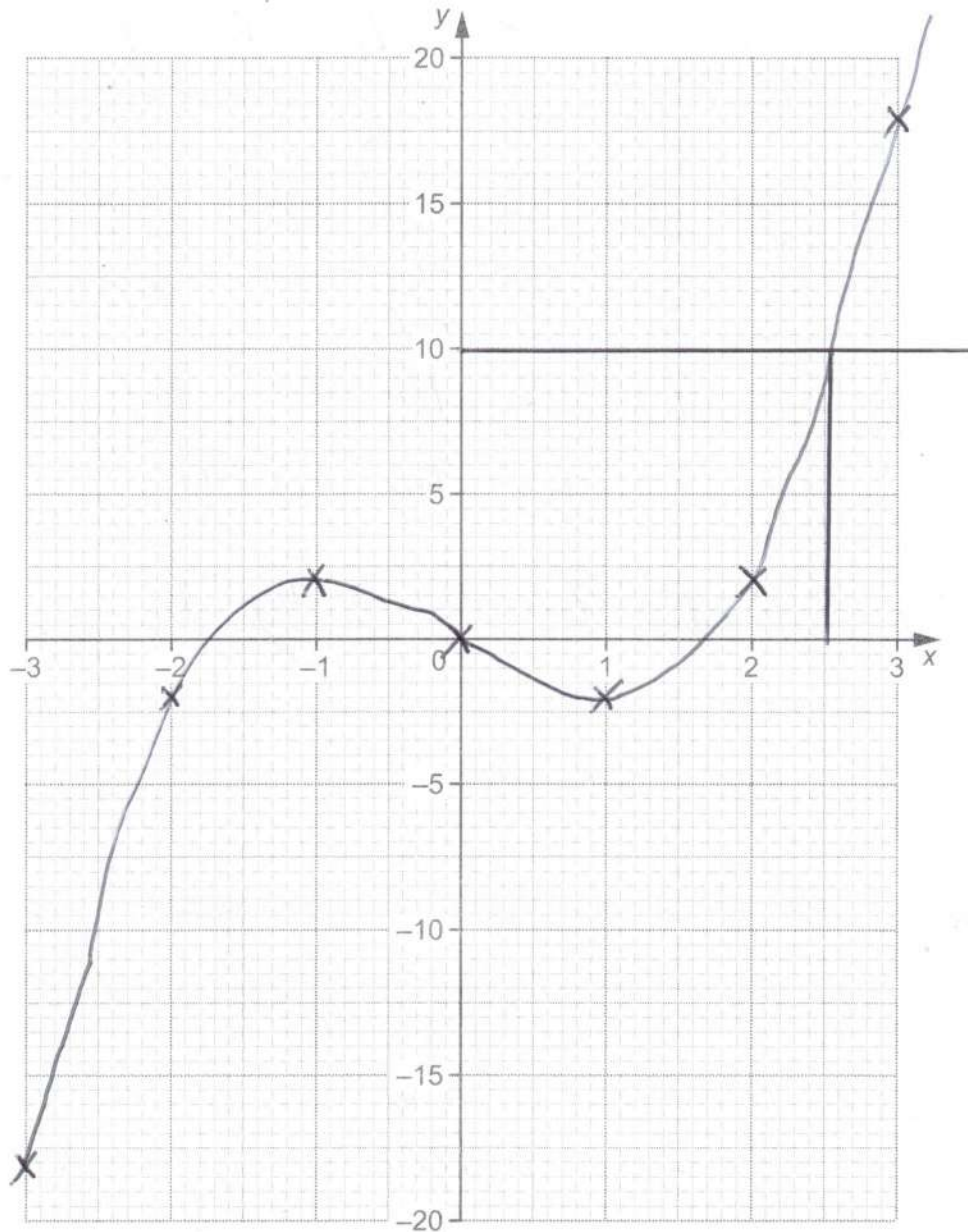
[2]

- 9 (a) Complete the table for $y = x^3 - 3x$.

x	-3	-2	-1	0	1	2	3
y	-18	-2	2	0	-2	2	18

[1]

- (b) Draw the graph of $y = x^3 - 3x$ for $-3 \leq x \leq 3$.



[3]

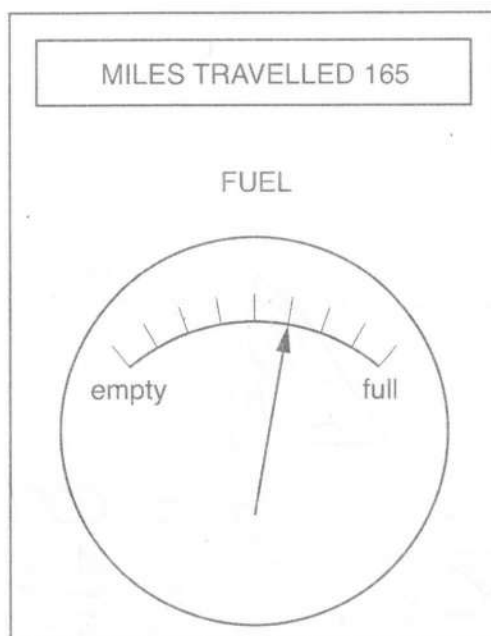
- (c) Use your graph to solve $x^3 - 3x = 10$.

(c) $x = 2.5$ [1]

[ms 2.5 → 2.7]

Turn over

- 10 Ifsaw noticed this information on her car's dashboard at the end of her journey. She started her journey with a full tank of fuel and her miles travelled set to zero.



- (a) Work out how far Ifsaw's car can travel on a full tank of fuel.

$$\frac{3}{8} \text{ Used} \quad \checkmark$$

$$\frac{3}{8} = 165$$

$$\frac{1}{8} = 3 \overline{) 165} \quad \checkmark$$

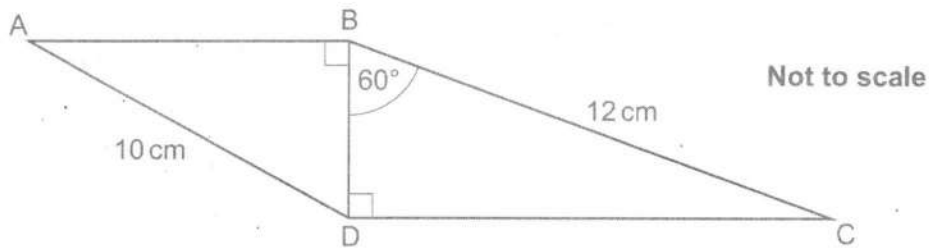
$$\begin{array}{r} 55 \\ \times 8 \\ \hline 440 \end{array} \quad \checkmark$$

(a) miles [3]

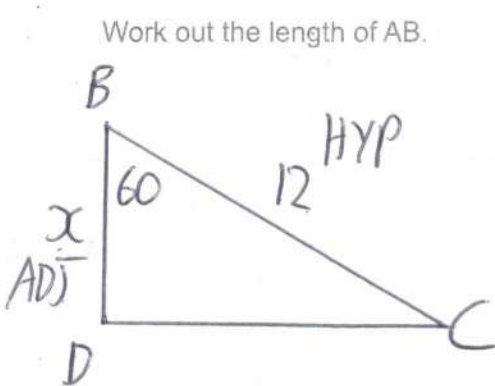
- (b) What assumption have you made when answering part (a)?

Petrol consumption remains constant. ✓
 [1]

- 11 The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD. AD = 10 cm, BC = 12 cm and angle DBC = 60° .

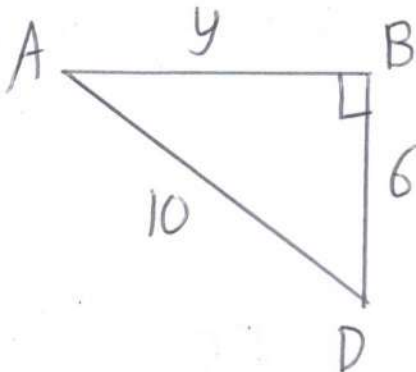


Work out the length of AB.



$$x = \cos 60 \times 12 \quad \checkmark \checkmark$$

$$= \frac{1}{2} \times 12 = 6 \quad \checkmark$$



$$y = \sqrt{10^2 - 6^2} \quad \checkmark \checkmark$$

$$= \sqrt{64}$$

8



..... cm [6]

- 12 Carol says that $64^{-\frac{1}{2}} = \frac{1}{32}$.

Explain her error and give the correct value of $64^{-\frac{1}{2}}$ in the form $\frac{p}{q}$.

She did $64 \div 2$, not square root ✓

$$64^{-\frac{1}{2}} = \frac{1}{\sqrt{64}} = \frac{1}{8} \quad \checkmark \checkmark \quad [3]$$

- 13 (a) Write $\frac{5}{12}$ as a recurring decimal.

$$\begin{array}{r} 0.416 \\ 12 \overline{) 5.0000} \dots \end{array}$$

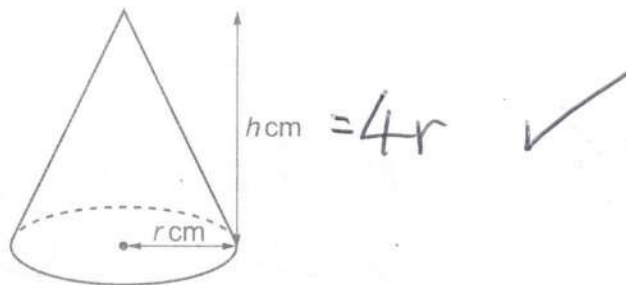
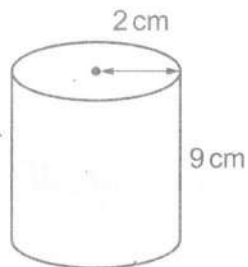
(a) $0.41\bar{6}$ ✓ [2]

- (b) Convert $0.\bar{76}$ to a fraction.

$$\begin{array}{r} x = 0.\bar{76} \\ - 100x = 76.\bar{76} \\ \hline 99x = 76 \end{array} \quad \checkmark$$

(b) $\frac{76}{99}$ ✓ [2]

- 14 The diagram shows a cylinder and a cone.



The cylinder has radius 2 cm and height 9 cm.
The cone has radius r cm and height h cm.

The ratio $r : h$ is $1 : 4$.

The volume of the cone is **equal to** the volume of the cylinder.

Work out the value of r .

[The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

$$\pi \times 2^2 \times 9 = \frac{1}{3} \times \pi \times r^2 \times 4r \quad \checkmark \checkmark$$

$$36 = \frac{4}{3} r^3 \quad \checkmark$$

$$27 = r^3$$

$$r = \sqrt[3]{27}$$

$$3 \quad \checkmark$$

[5]

15 n is a positive integer.

Prove that $13n + 3 + (3n - 5)(2n + 3)$ is a multiple of 6.

[4]

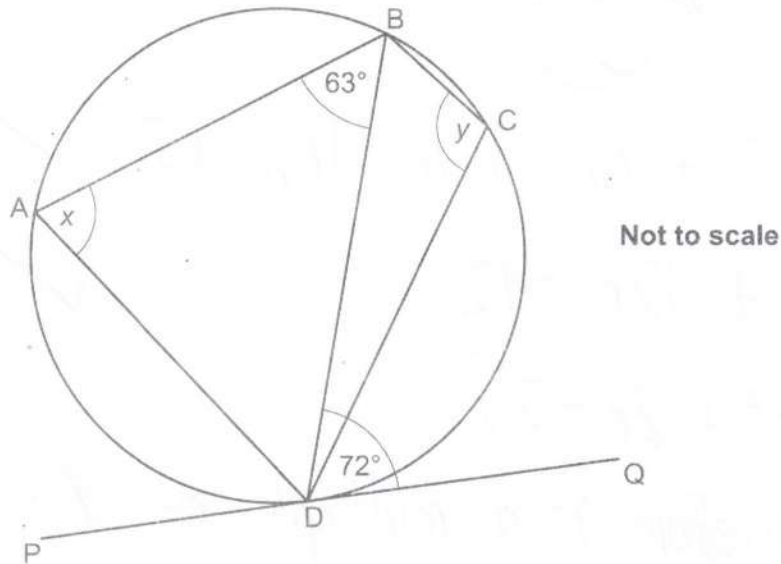
$$= 13n + 3 + 6n^2 + 9n - 10n - 15 \quad \checkmark \checkmark$$

$$= 6n^2 + 12n - 12 \quad \checkmark$$

$$= 6(n^2 + 2n - 2)$$

therefore is a multiple of 6 $\checkmark$

- 16 A, B, C and D are points on the circumference of a circle.



PQ is a tangent to the circle at D.
Angle $BDQ = 72^\circ$ and angle $ABD = 63^\circ$.

- (a) Work out angle x .
Give a reason for your answer.

Angle $x = 72^\circ$ because alternate segment theorem [2]

- (b) Work out angle y .
Give a reason for your answer.

Angle $y = 108^\circ$ because opposite angles in a cyclic quadrilateral sum to 180 [2]

17 $(x+a)(x+3)(2x+1) = bx^3 + cx^2 + dx - 12$

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

$$(x+a)(2x^2+7x+3)$$

$$3a = -12, a = -4$$

	$2x^2 + 7x + 3$		
x	$2x^3$	$+7x^2$	$+3x$
-4	$-8x^2$	$-28x$	-12

$$= 2x^3 - x^2 - 25x - 12$$

$$bx^3 + cx^2 + dx - 12$$

$a =$	-4	✓
$b =$	2	✓
$c =$	-1	✓
$d =$	-25	✓

[4]

- 18 (a) A straight line passes through the point (0, 6) and is perpendicular to $y = 4x - 5$.

Find the equation of this line, giving your answer in the form $y = mx + c$.

$$m = 4$$

$$m_{\perp} = -\frac{1}{4}$$

✓

$$\text{so } c = 6$$

✓

$$y = -\frac{1}{4}x + 6$$

(a) [3]

- (b) Work out the coordinates of the intersection of the graphs of $y = 4x - 5$ and $y = x^2 - 17$.

$$x^2 - 17 = 4x - 5$$

✓

$$x^2 - 4x - 12 = 0$$

✓

$$(x - 6)(x + 2) = 0$$

✓✓

$$x = 6$$

$$y = 4 \times 6 - 5$$

$$= 19$$

$$x = -2$$

✓

$$y = 4 \times -2 - 5$$

$$= -13$$

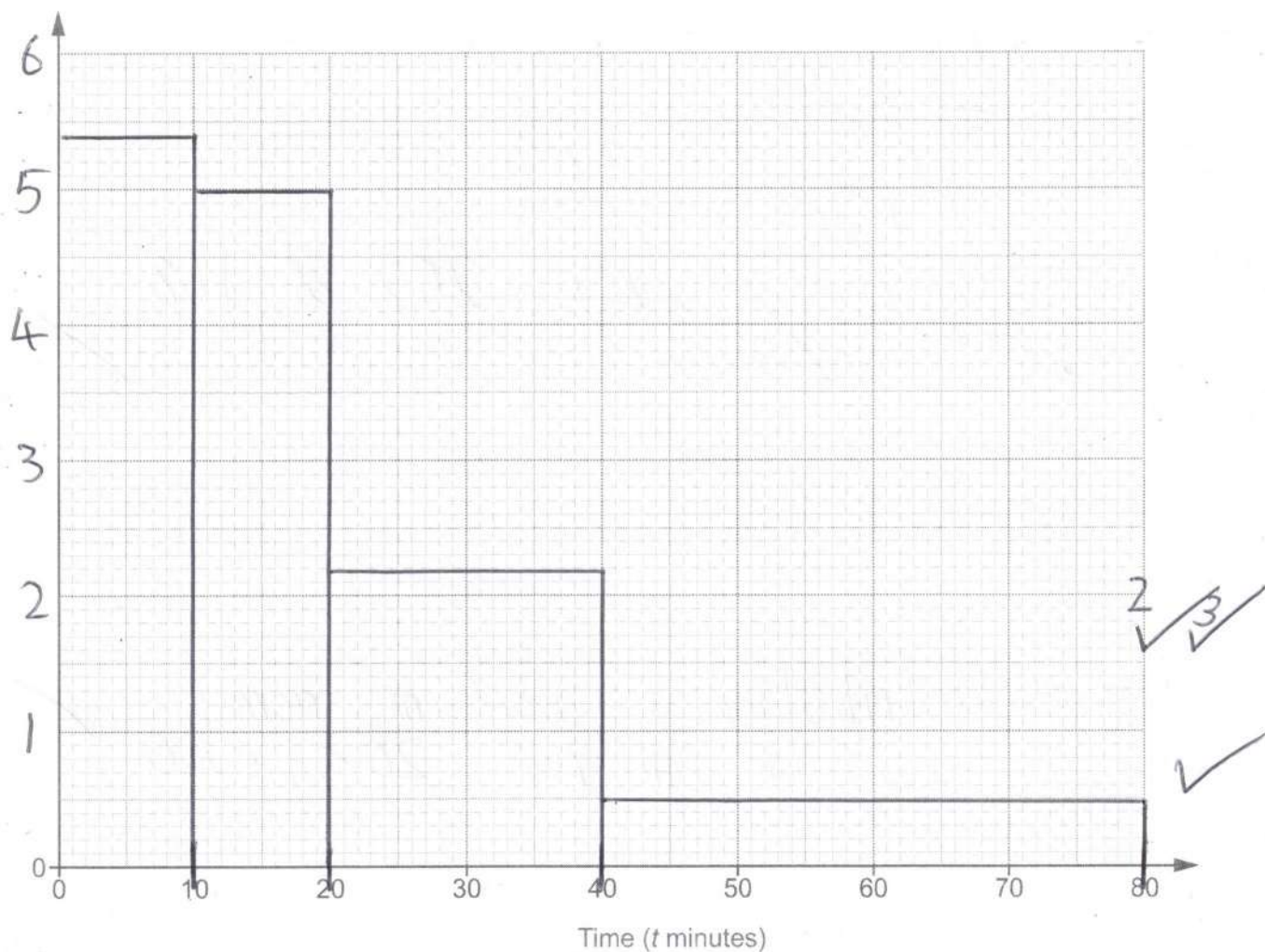
✓

(b) $\left(\begin{array}{cc} 6 & 19 \\ -2 & -13 \end{array} \right)$ [6]

- 19 Ceri records the time taken, t minutes, to travel to school for a sample of 168 students at her Academy.

	Time taken (t minutes)	Frequency
W	$0 < t \leq 10$	54
10	$10 < t \leq 20$	50
10	$20 < t \leq 40$	44
20	$40 < t \leq 80$	20
40		

(a) Draw a histogram to represent this information.



$$54 \div 10 = 5.4$$

$$50 \div 10 = 5$$

$$\frac{44}{20} = \frac{22}{10} = 2.2$$

$$m \quad [4]$$

$$\frac{20}{40} = 0.5$$

(b) Ceri says

The longest time that any of these students took to travel to school was 80 minutes.

Is she correct?

Give a reason for your answer.

Unsure as exact data is unknown ✓
[ms → No] [1]

(c) Ceri also claims that 25% of all of the students at this Academy took more than 30 minutes to travel to school.

(i) Show how Ceri might have worked out her claim.

[2]

$$\begin{aligned} & \frac{44}{2} + 20 \\ &= 22 + 20 \\ &= 42 \quad \checkmark \end{aligned} \quad \begin{aligned} & 42 \text{ is } 25\% \text{ of } 168 \\ & \checkmark \end{aligned}$$

(ii) State one assumption that Ceri has made in making her claim.

Distribution is uniform across the interval $20 < t \leq 40$ ✓
[1]

20 In the following equation, n is an integer greater than 1.

$$(\sqrt{2})^n = k\sqrt{2}$$

(a) (i) Find k when $n = 7$.

$$\begin{aligned}\sqrt{2}^7 &= \sqrt{2}^2 \times \sqrt{2}^2 \times \sqrt{2}^2 \times \sqrt{2} \quad \checkmark \text{OE} \\ &= 2 \times 2 \times 2 \times \sqrt{2}\end{aligned}$$

(a)(i) $k = 8$ [2] ✓

(ii) Find n when $k = 64$.

$$\begin{aligned}64 &= 2^6 \\ &= \sqrt{2}^{12} \quad \checkmark\end{aligned}$$

$$\sqrt{2}^{12} \times \sqrt{2}^1$$

(ii) $n = 13$ [2] ✓

(b) Show that $\frac{14}{3-\sqrt{2}}$ can be written in the form $a + b\sqrt{2}$. [5]

$$\frac{14}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}} \quad \checkmark$$

$$= \frac{42 + 14\sqrt{2}}{9-2} \quad \checkmark$$

$$= \frac{42 + 14\sqrt{2}}{7} \quad \checkmark$$

$$= 6 + 2\sqrt{2} \quad \checkmark$$

END OF QUESTION PAPER