

Answer **all** the questions.

1 Work out.

(a) $\sqrt[3]{64} \times 2^{-1}$

$$4 \times \frac{1}{2}$$

✓

(a) 2 ✓ [2]

(b) $4.3 \times 10^5 + 3.8 \times 10^4$

Give your answer in standard form.

$$\begin{array}{r}
 4.3 \times 10^5 \\
 + 0.38 \times 10^5 \\
 \hline
 4.68
 \end{array}$$

✓✓

(b) 4.68×10^5 ✓ [3]

2 By writing each number correct to 1 significant figure, find an estimate for this calculation.

$$\frac{606.3 \times 0.312}{19.93}$$

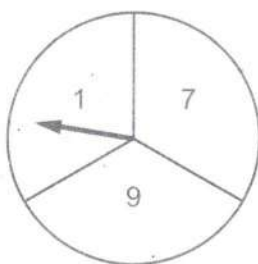
$$\checkmark \frac{600 \times 0.3}{20} = \frac{18}{2} \checkmark$$

$$9.$$

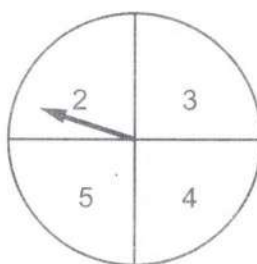
✓

..... [3]

- 3 Geoff has two fair spinners.



Spinner A



Spinner B

He spins both spinners and **multiplies** the numbers on each spinner.

- (a) Complete the table.

		Spinner A		
Spinner B	×	1	7	9
	2	2	14	18
	3	3	21	27
	4	4	28	36
	5	5	35	45

[1]

- (b) Geoff wants to work out the probability that the outcome of the multiplication is an even number or a prime number. Here is his working.

The probability the outcome is an even number is $\frac{6}{12}$.

The probability the outcome is a prime number is $\frac{3}{12}$.

The probability the outcome is an even number or a prime number is $\frac{6}{12} + \frac{3}{12} = \frac{9}{12}$.

Geoff is wrong.

Explain his error and give the correct answer.

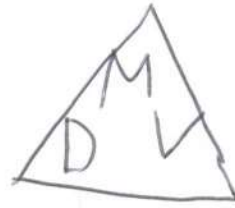
2 is counted twice

$$\frac{8}{12}$$

[2]

- 4 A solid metal block has mass 500 g and volume 125 cm³.

Work out the density of the block.
Give the units of your answer.



$$D = \frac{500}{125}$$

✓

$$4 \text{ g/cm}^3$$

✓

✓

[3]

- 5 The depth of water in a garden pond is 57.8 cm.
The depth decreases by 0.3 cm per day.

(a) Assume the depth continues to decrease at the same rate.

After how many days will the depth reach 54.2 cm?

$$\begin{array}{r} 57.8 - \\ 54.2 \\ \hline 3.6 \end{array}$$

✓

$$\frac{3.6}{0.3} = \frac{36}{3}$$

✓

12

✓

(a) days [3]

- (b) If the depth of water decreases at a slower rate, what effect will this have on your answer to part (a)?

It would increase

✓ etc

[1]

- 6 Sally has 30 feet of ribbon.

She cuts strips each of length $2\frac{2}{5}$ feet from the ribbon.

Sally says

I can cut 13 of these strips from this ribbon.

Is she correct?

Show how you decide.

$$\frac{13}{1} \times \frac{12}{5} = \frac{156}{5} = 31\frac{1}{5} \text{ feet needed}$$

✓✓

so NO $31\frac{1}{5} > 30$ ✓

[4]

- 7 Emily spent £2400 on holiday in 2017.
This was 20% more than she spent on holiday in 2016.

Calculate the amount she spent on holiday in 2016.

$$\begin{aligned} 120\% &= 2400 \\ 1\% &= 20 \\ 100\% &= 2000 \end{aligned}$$

✓
✓

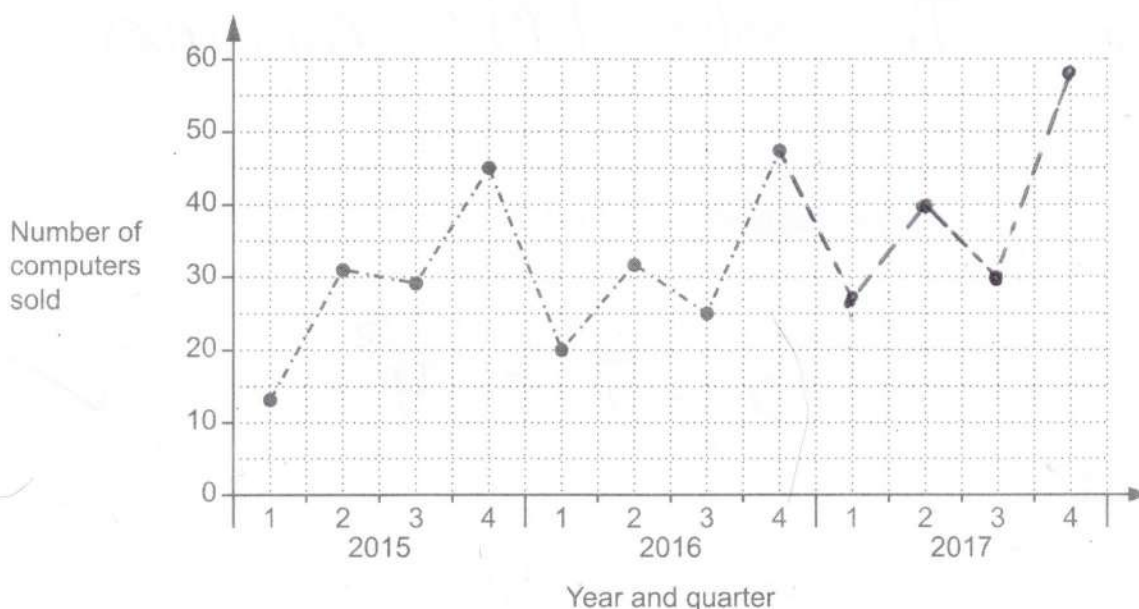
2000 ✓

£ [3]

- 8 The table shows the number of computers sold in Tom's shop each quarter from 2015 to 2017.

	2015				2016				2017			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Number of computers sold	13	31	29	45	20	32	25	47	27	40	30	58

- (a) Complete this graph using the information for 2017.



[2]

- (b) Tom adds the three results for quarter 1 and he adds the three results for quarter 4. Tom says

The ratio of the **total** number of computers sold in quarter 1 compared to quarter 4 is 2 : 5.

Is he correct?

Show your reasoning.

$$Q1 = 13 + 20 + 27 = 60$$

$$Q4 = 45 + 47 + 58 = 150$$

$$60 : 150$$

$$= 6 : 15$$

$$= 2 : 5$$

so YES ✓

[2]

- (c) Make two comments about Tom's sales over the period 2015 to 2017.

Comment 1 Q1 weakest, Q4 strongest ✓

Comment 2 Sales year on year are increasing ✓

[2]

- (d) Tom predicts that he will sell more than 60 computers in the 4th quarter of 2018.

What assumption has he made?

The sales trend continues

[1]

- 9 Rearrange this formula to make y the subject.

$$x = y^2 + 7$$

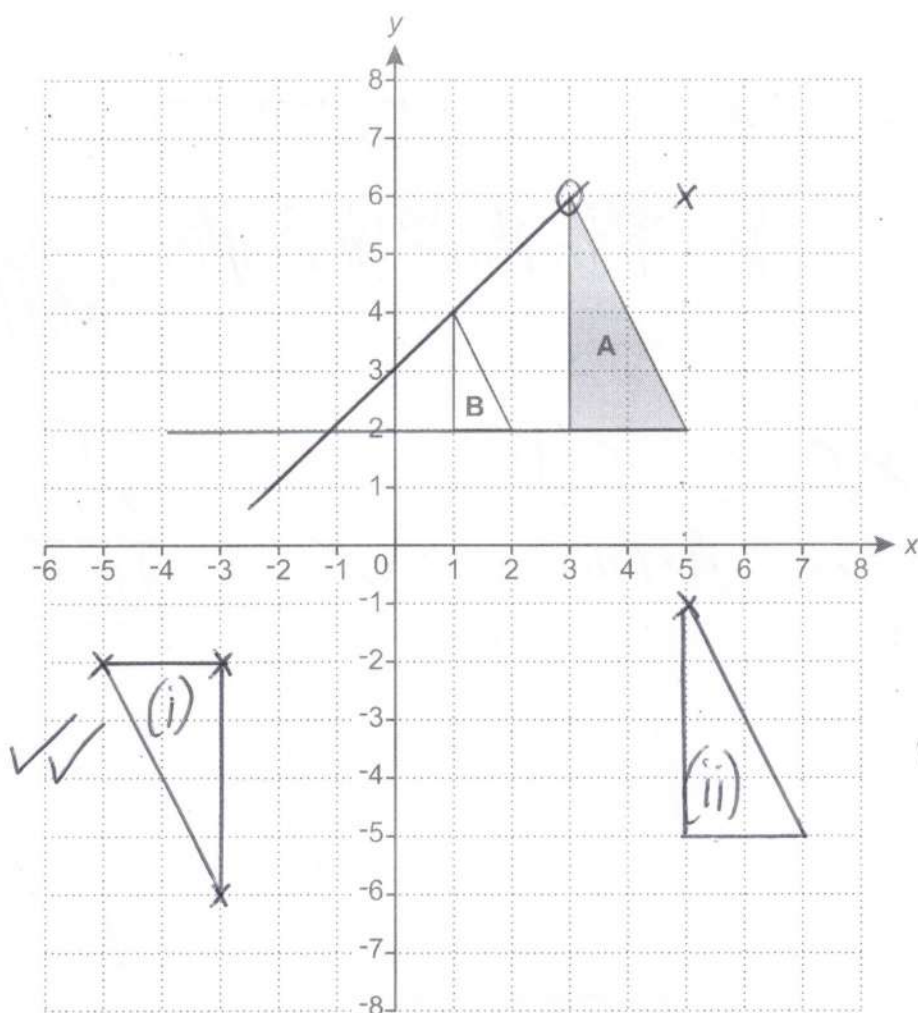
$$x - 7 = y^2$$

✓

$$y = \left(\begin{smallmatrix} + \\ - \end{smallmatrix} \right) \sqrt{x-7}$$

[2]

10 Triangle **A** and triangle **B** are drawn on the coordinate grid.



- (a) (i) Draw the image of triangle **A** after a rotation of 180° about $(0, 0)$.

[2]

- (ii) Draw the image of triangle **A** after a translation by the vector $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$.

[2]

- (b) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

Enlargement, centre $(-1, 2)$

scale factor $= \frac{1}{2}$

[3]

- 11 The price of a washing machine is reduced by 20% for a sale. Afterwards, the sale price is increased by 30%.

Joachim says

The washing machine is now 10% more expensive than before the sale.

Explain Joachim's error and work out the correct percentage change in the price of the washing machine from before the sale to after the sale.

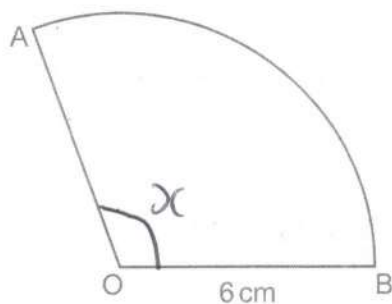
Joachim's error is use percentage multipliers, do not add/subtract ✓

$$\begin{array}{l} \checkmark \checkmark \checkmark \\ \text{OE} \end{array} \times 0.8 \times 1.3 = 1.04 \quad \checkmark$$

$$\begin{array}{r} 13 \\ \times 28 \\ \hline 104 \end{array}$$

Correct percentage change is 4 ✓ % [6]

- 12 AOB is a sector of a circle, centre O and radius 6 cm.
The length of arc AB is 5π cm.



Not to scale

Find the area of the sector.
Give your answer in terms of π .

$$\text{arc length} = 2 \times \pi \times 6 \times \frac{x}{360} = 5\pi \quad \checkmark$$

$$\frac{12x}{360} = 5 \quad \checkmark$$

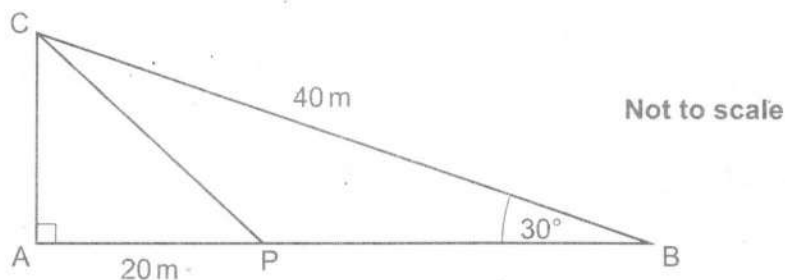
$$x = 5 \times 30 = 150 \quad \checkmark$$

$$\text{area} = \pi \times 6^2 \times \frac{150}{360} \quad \checkmark$$

$$15\pi \quad \checkmark$$

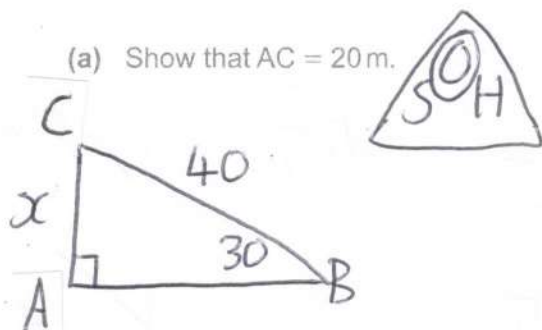
..... cm^2 [5]

- 13 In the diagram, ABC is a right-angled triangle.
P is a point on AB.
BC = 40 m, AP = 20 m and angle ABC = 30° .



- (a) Show that AC = 20 m.

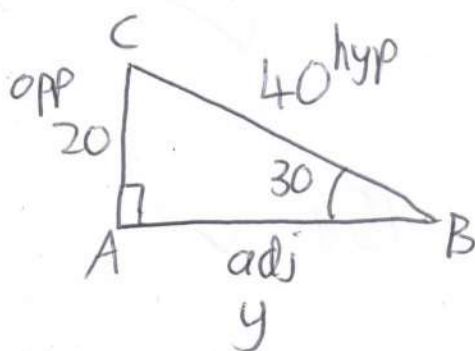
[3]



$$\begin{aligned} x &= \sin 30 \times 40 \quad \checkmark \\ &= \frac{1}{2} \times 40 \quad \checkmark \checkmark \\ &= 20 \end{aligned}$$

- (b) Find the length of PB.

Give your answer in the form $a(\sqrt{3} - b)$, where a and b are integers.

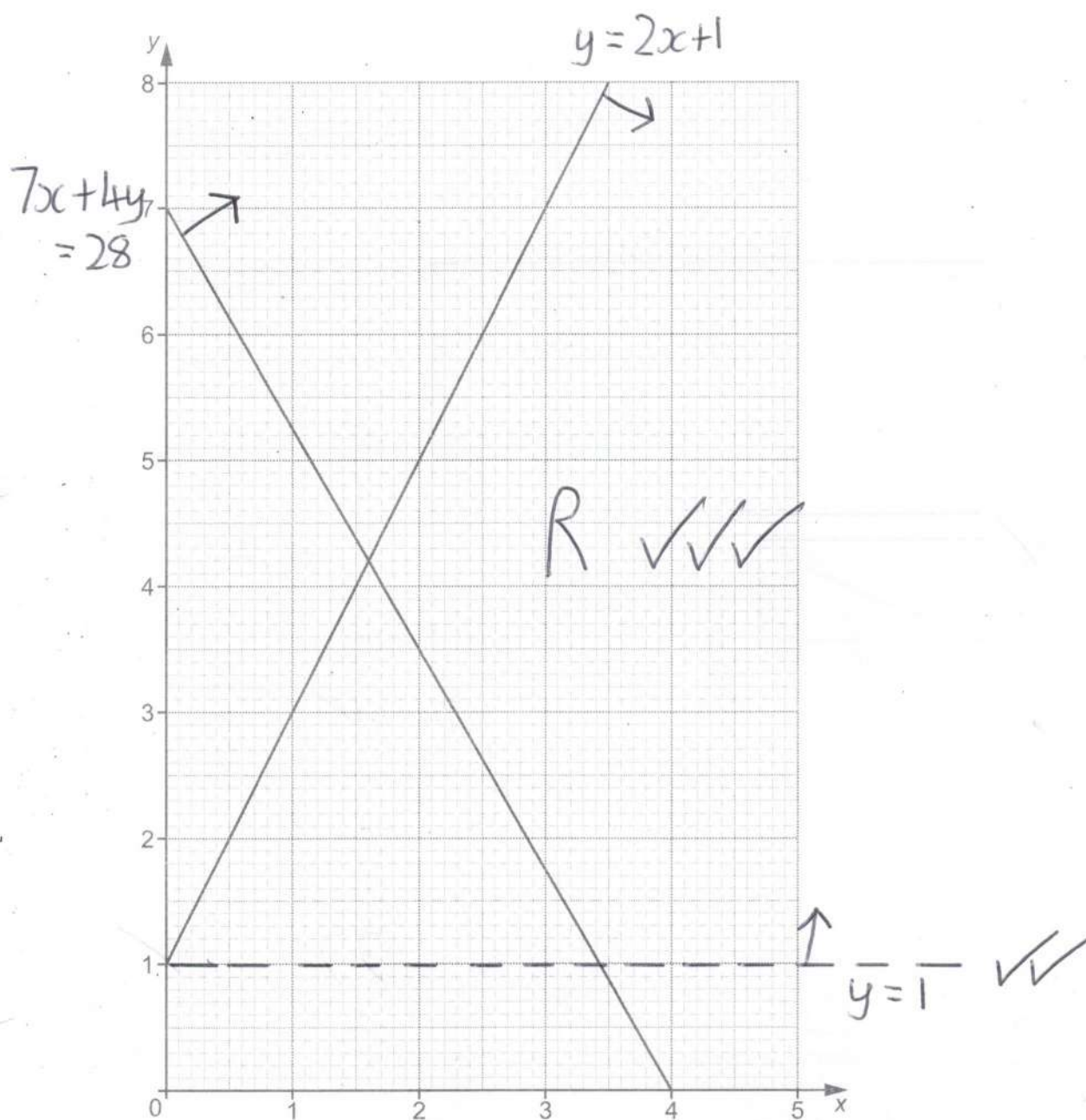


$$\begin{aligned} y &= \cos 30 \times 40 \quad \checkmark \checkmark \\ &= \frac{\sqrt{3}}{2} \times 40 = 20\sqrt{3} \quad \checkmark \end{aligned}$$

$$PB = 20\sqrt{3} - 20 \quad \checkmark$$

(b) $20(\sqrt{3} - 1)$ [5] $\checkmark$

- 14 The diagram shows the lines $y = 2x + 1$ and $7x + 4y = 28$.



The region R satisfies these inequalities.

$$y \leq 2x + 1$$

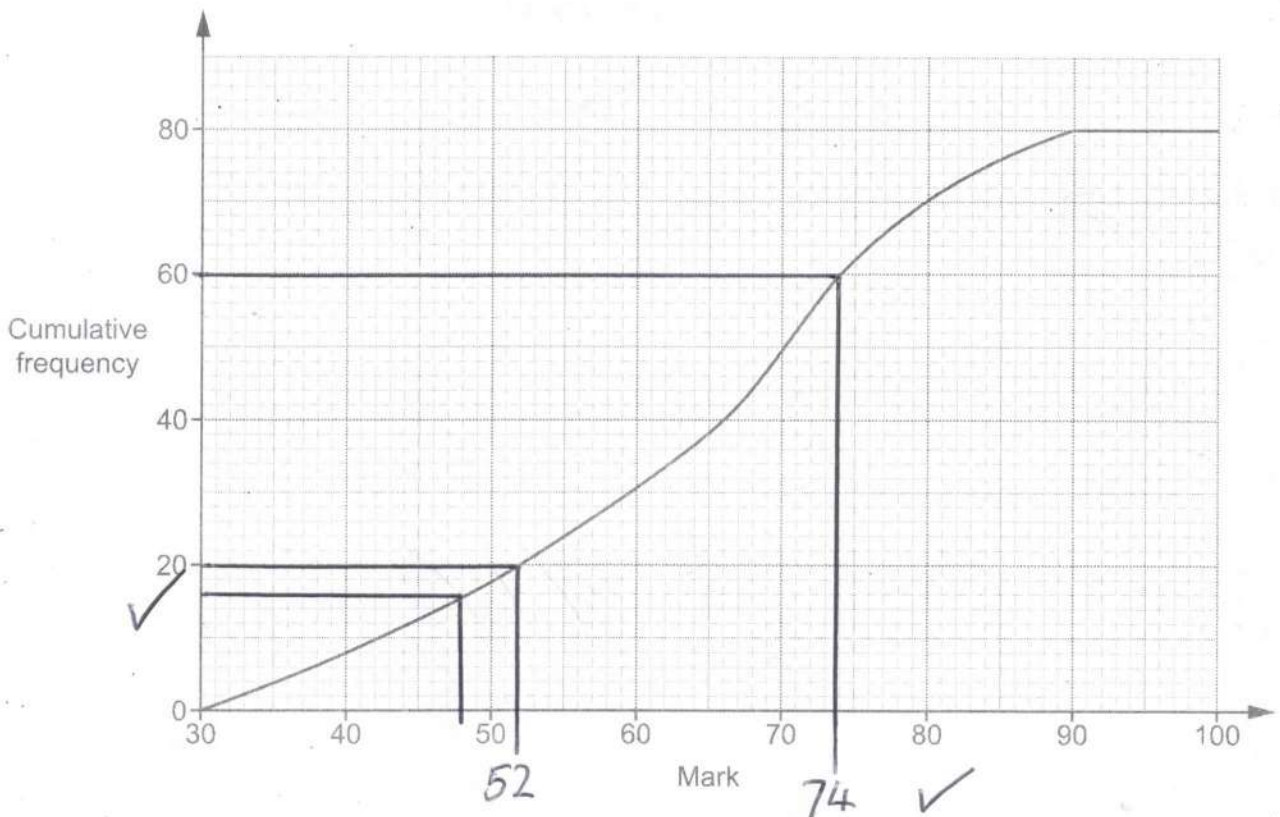
$$7x + 4y \geq 28$$

$$y > 1$$

By drawing a third straight line, find and label the region R that satisfies these inequalities.

[5]

- 15 The cumulative frequency graph shows information about the marks scored by a group of 80 students in a test.



- (a) Find the interquartile range.

(a) 22 [2] ✓

- (b) The ratio of the number of students passing the test compared to failing the test is 4 : 1. Find the minimum mark needed to pass the test.

$$\text{Fail} = \frac{1}{5} \text{ of } 80 = 16 \quad \checkmark$$

(b) 48 [3] ✓

Turn over

16 Here is a sequence.

5

 $5\sqrt{3}$

15

 $15\sqrt{3}$ $\times \sqrt{3}$

(a) Work out the next term.

 15×3

(a) 45 ✓ [1]

(b) Find the n th term.

n
1 $5 \times \sqrt{3}^0$

2 $5 \times \sqrt{3}^1$

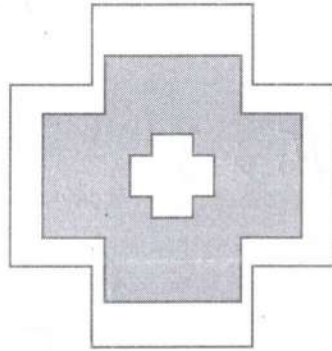
3 $5 \times \sqrt{3}^2$

etc

✓ ✓ ✓
 $5 \times \sqrt{3}^{(n-1)}$

(b) $5 \times \sqrt{3}^{(n-1)}$ [3]

- 17 The diagram consists of three mathematically similar shapes.
The heights of the shapes are in the ratio 1 : 4 : 5.



Not to scale

Find the ratio

total shaded area : total unshaded area.

Give your answer in its simplest form.

$$\begin{aligned} \text{Area} &= 1^2 : 4^2 : 5^2 \\ &= 1 : 16 : 25 \end{aligned}$$

✓

$$\begin{aligned} \text{Shaded} &= 16 - 1 = 15 \\ \text{Unshaded} &= 25 - 15 = 10 \end{aligned}$$

✓✓

$$15 : 10 \quad \checkmark$$

3

2

✓

total shaded area : total unshaded area : [4]

- 18 (a) (i) Write $x^2 + 4x - 16$ in the form $(x + a)^2 - b$.

$$(x+2)^2 - 4 - 16$$

✓

$$(x+2)^2 - 20$$

(a)(i) [3]

- (ii) Solve the equation. $x^2 + 4x - 16 = 0$.
Give your answers in surd form as simply as possible.

$$(x+2)^2 - 20 = 0$$

$$(x+2)^2 = 20$$

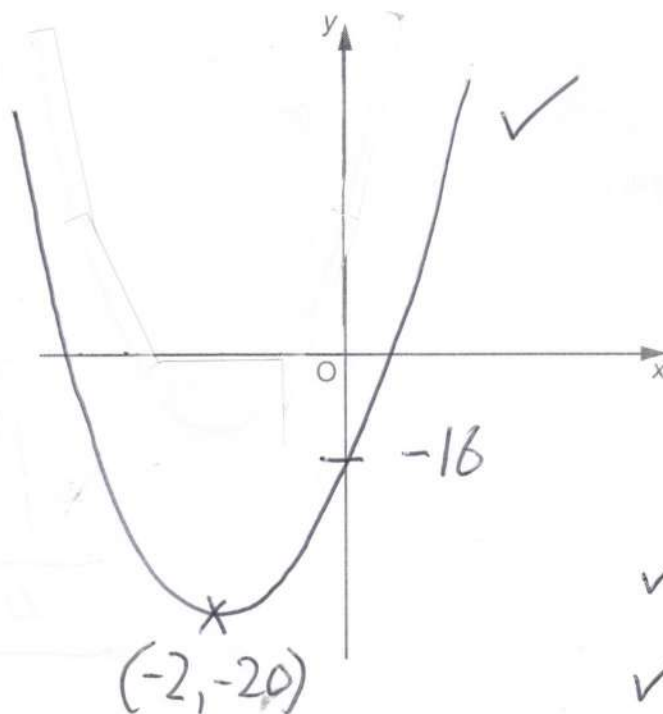
$$x+2 = \pm \sqrt{20}$$

$$x = -2 \pm 2\sqrt{5}$$

$$\left(\begin{aligned} \sqrt{20} &= \sqrt{4 \cdot 5} \\ &= 2\sqrt{5} \end{aligned} \right)$$

(ii) $x = \frac{-2+2\sqrt{5}}{1}$ or $x = \frac{-2-2\sqrt{5}}{1}$ [4]

- (b) Sketch the graph of $y = x^2 + 4x - 16$, showing clearly the coordinates of any turning points.

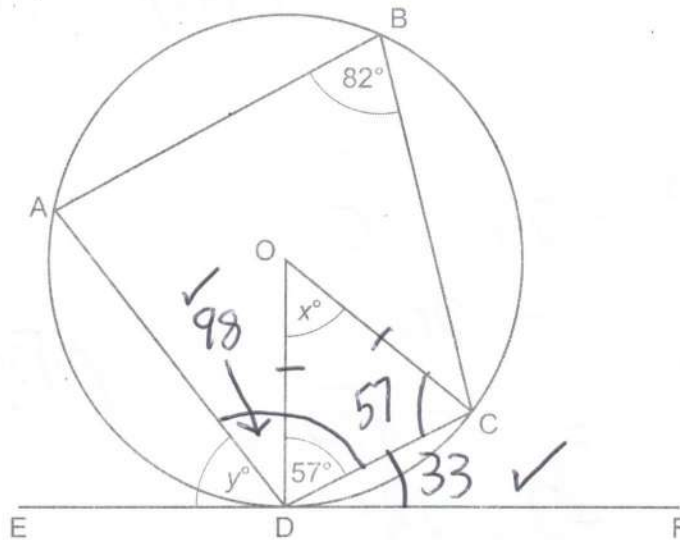


$$V(-2, -20)$$

[3]

- 19 The diagram shows a circle, centre O.

Points A, B, C and D lie on the circumference of the circle.
EDF is a tangent to the circle.
Angle $ABC = 82^\circ$ and angle $ODC = 57^\circ$.



- (a) Work out the value of x .

$$\begin{array}{r} 180 \\ - 114 \\ \hline 66 \end{array}$$

- (a) $x = 66$ [2]

- (b) Work out the value of y .

$$\begin{array}{r} 98 \\ + 33 \\ \hline 131 \end{array}$$

- (b) $y = 49$ [3]

20 (a) Prove that $(2x+1)(3x+2) + x(3x+5) + 2$ is a perfect square.

$$= \underline{6x^2} + \underline{4x} + \underline{3x} + 2 + \underline{3x^2} + \underline{5x} + 2$$

$$= 9x^2 + 12x + 4$$

$$= (3x+2)(3x+2)$$

$$= (3x+2)^2 \text{ which is a perfect square}$$

✓✓✓

✓

✓✓

(b) Gemma says

The equation $(2x+1)(3x+2) + x(3x+5) + 2 = -12$ has no solutions.

Explain Gemma's reasoning.

Cannot $\sqrt{-ve}$ / $b^2 - 4ac < 0$ etc ✓

[1]

END OF QUESTION PAPER