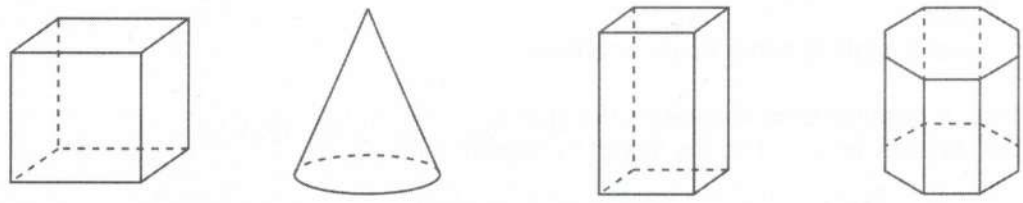
OCR-F Jun'23 3-Calc

1 (a) These four solids are labelled **A**, **B**, **C** and **D**.



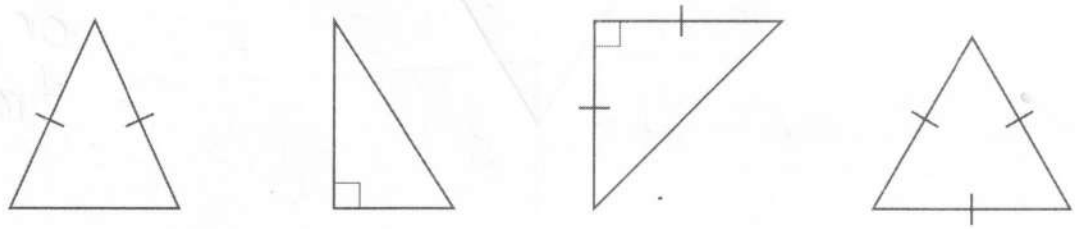
A B C D

Write down the letter of the solid that is **not** a prism.

B ✓

(a) ..... [1]

(b) These four triangles are labelled **E**, **F**, **G** and **H**.



E F G H

Write down the letter of the right-angled isosceles triangle.

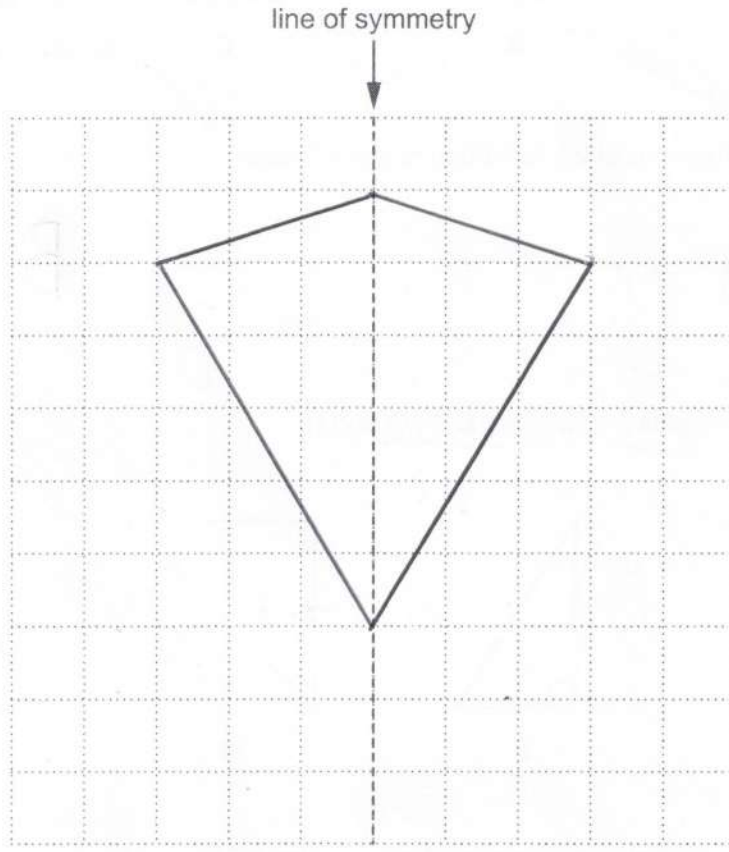
G ✓

(b) ..... [1]

(c) A quadrilateral has

- exactly one line of symmetry
  and
- each angle is either acute or obtuse.

Draw a possible quadrilateral on this grid.
The dashed line must be the line of symmetry.



etc ✓✓ or isosceles trapezium

[2]

2 The factors of 6 are 1, 2, 3 and 6.
The factors of 9 are 1, 3 and 9.

(a) Use one of the symbols $<$, $>$ or $=$ to make each statement true.

(i) The number of factors of 6 ..... the number of factors of 9. **[1]** ✓

(ii) The lowest factor of 6 ..... the lowest factor of 9. **[1]** ✓

(b) Write down the highest common factor (HCF) of 6 and 9.

(b) 3 ✓ ..... **[1]**

3 **(a)** Complete this prime factorisation of 100.
You may not need to use all of the answer lines.

$100 = 2 \times 2 \times$ 5 x 5 ✓ (or 5^2)

.....

.....

[1]

(b) A teacher says that the cube root of their favourite number is 5.

Write down the teacher's favourite number.

$5^3 = 125$

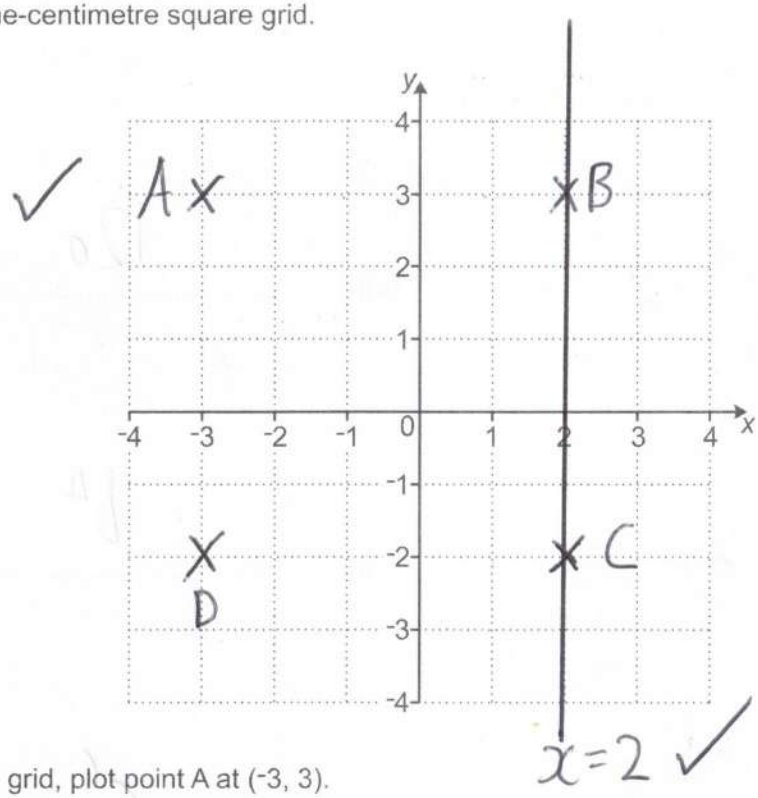
(b) 125 **[1]**

(c) Write $\frac{29}{10^2}$ as a percentage.

$\frac{29}{100}$

(c) 29 % **[1]**

5 This is a one-centimetre square grid.



(a) On the grid, plot point A at (-3, 3). **[1]**

(b) The line AB joins point A to point B.
Point B is at (2, 3).

Find the length of the line AB.

(b) 5 ..... cm **[1]**

(c) On the grid, draw the line $x = 2$. **[1]**

(d) ABCD is a square that fits on the grid.
Point C is on the line $x = 2$.

Find the coordinates of point D.

(d) D is at (-3 , -2) **[2]**

6 **(a)** Simplify.

(i) $3a \times 4$

(a)(i) 12a ✓ ..... [1]

(ii) $b \times b \times b \times b$

(ii) b^4 ✓ ..... [1]

(iii) $c^2 \times c^4$

(iii) c^6 ✓ ..... [1]

(b) Factorise.

$9 - 6y$

(b) $3(3-2y)$ ✓ ..... [1]

7 A student takes two tests.

In Test 1, the student scores 45 out of 60.
Test 2 is also out of 60.

Work out how many marks the student needs in Test 2 to have a mean of 70% in the two tests.

70% of 120

$= \frac{70}{100} \times 120 = 84$ ✓

84 − 45 ✓

$= 39$ ✓

..... [3]

3 **(a)** Complete this prime factorisation of 100.
You may not need to use all of the answer lines.

$100 = 2 \times 2 \times$ 5 x 5 ✓ (or 5^2)

.....

..... **[1]**

(b) A teacher says that the cube root of their favourite number is 5.

Write down the teacher's favourite number.

$5^3 = 125$

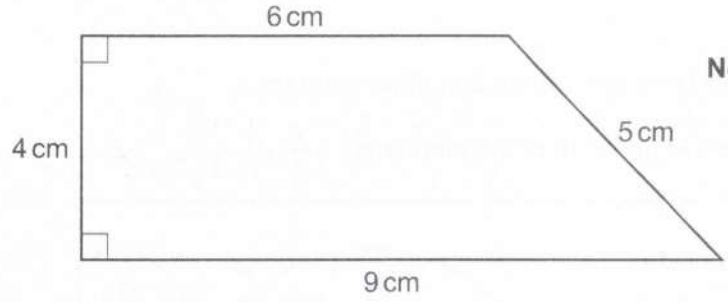
(b) ..... **[1]**

(c) Write $\frac{29}{10^2}$ as a percentage.

$\frac{29}{100}$

(c) 29 ..... % **[1]**

8 **(a)** Work out the area of this trapezium.



Not to scale

$\frac{1}{2}(9+6)\times 4$ ✓

30 ✓

(a) ..... cm^2 **[2]**

(b) The circumference of a circle, in terms of π, is 100π cm.

Work out the radius of the circle.

$Circ = 2\pi r = 100\pi$ ✓

$2r = 100$

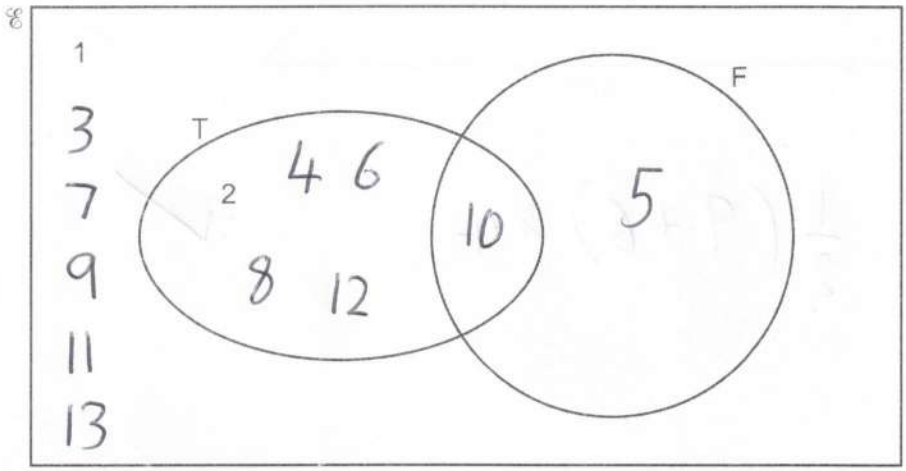
50 ✓

(b) ..... cm **[2]**

9 $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$
$T = \{2, 4, 6, 8, 10, 12\}$
$F = \{5, 10\}$

(a) The elements 1 and 2 have been entered on this Venn diagram.

Complete the Venn diagram to show **all** of the elements.



√√ All
√ 1 region

[2]

(b) Finley picks one of the 13 elements in the universal set, $\mathscr{E}$, at random.

Write down the probability that the element is a member of both set T and set F.

$\frac{1}{13}$ ✓

(b) ..... **[1]**

(c) Sam picks one of the 13 elements in the universal set, $\mathscr{E}$, at random.

Sam says

The probability the element is in set T is $\frac{6}{13}$.

The probability the element is in set F is $\frac{2}{13}$.

Therefore, the probability the element is in set T or set F is $\frac{6}{13} + \frac{2}{13} = \frac{8}{13}$.

Sam is wrong.

Explain Sam's error and give the correct answer.

Sam's error : 10 is counted twice ✓

..... correct answer : $\frac{7}{13}$ ✓ **[2]**

10 **(a)** Write 18 : 42 as a ratio in its simplest form.

9 : 21 ✓etc
partial

(a) 3 : 7 **[2]**

(b) In a bag of sweets $\frac{1}{5}$ of the sweets are green.

The rest of the sweets are red. $\frac{4}{5}$

The ratio of the number of green sweets to the number of red sweets can be written in the form 1 : *n*.

Find the value of *n*.

G : R
$\frac{1}{5} : \frac{4}{5}$ ✓

1 : 4

(b) *n* = 4 ✓ **[2]**

(c) A factory has a large order for copper pipe.
The factory has many machines that make the copper pipe.

Each machine makes the same length of copper pipe in a day.
3 machines can make the copper pipe for this order in 25 days.

Find the number of machines needed to make this order in 15 days.

3 × 25 = 75 ✓

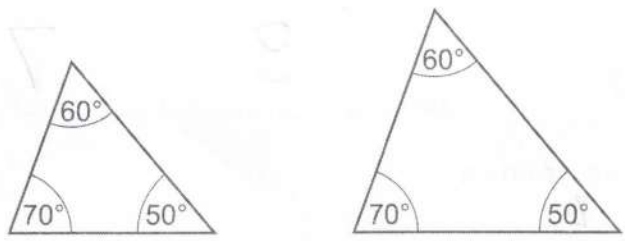
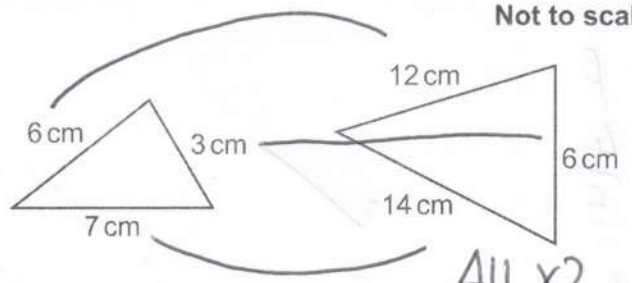
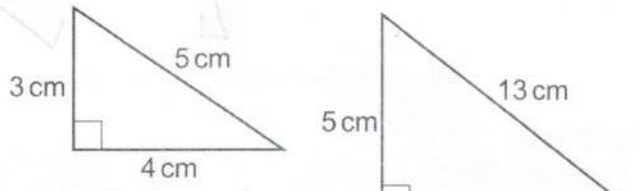
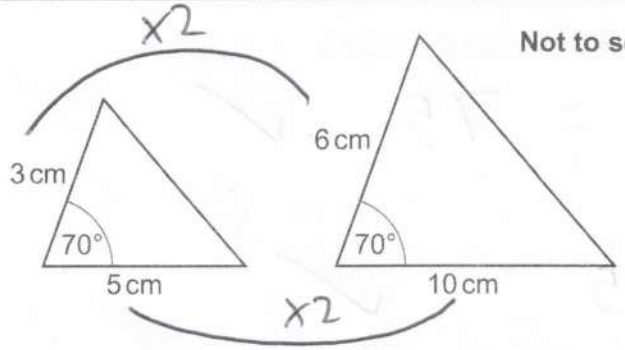
75 ÷ 5 ✓

= 5 ✓

(c) ..... **[3]**

11 The table shows four pairs of triangles.

For each pair, decide whether the two triangles are mathematically similar.
Write each answer, yes or no, in the second column of the table.

Triangles	Mathematically similar? (yes/no)
Not to scale 	Yes
Not to scale  All x2	Yes
Not to scale  diff scale factors	No
x2 Not to scale 	Yes

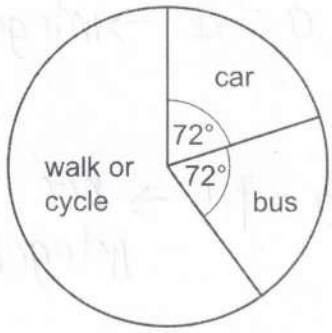
[2]

✓3 ✓✓All

12 A school has 540 students.

This pie chart shows the way that all 540 students travel to the school.

Each student either walked or cycled or travelled by bus or travelled by car.



(a) Work out how many of the 540 students travel to the school by car.

$\frac{72}{360} \times 540$ ✓✓

108 ✓

(a) ..... **[3]**

(b) The number of students who walk is three times the number who cycle.

Work out the sector angle for the students who walk to school.
You do **not** need to draw this on the pie chart.

W : C
3 : 1
$\frac{3}{4} : \frac{1}{4}$ ✓

$360 - 144 = 216$ ✓

$\frac{3}{4} \times 216$

162 ✓

(b) ..... ° **[3]**

13 (a) $2a = \sqrt{b}$ where b is a positive integer from 8 to 17.

Given that a is a positive integer, find its value.
You must show your working.

$\sqrt{16} = 4 = 2a$ so $a = 2$ → integer ✓

$\sqrt{9} = 3 = 2a$ so $a = 1.5$ → non integer

(a) $a =$ 2 ✓ **[2]**

(b) How would your answer to **part (a)** change if a was only described as an integer?

√ only mentions positive root so answer is unchanged ✓ **[1]**

14 (a) Sundip plans to share some money so that

- Mia gets $\frac{1}{2}$
- Sara gets $\frac{2}{5}$
- Nina gets $\frac{1}{7}$.

Will Sundip's plan work?
Give a reason and show working to support your decision.

No ..... because $\frac{1}{2} + \frac{2}{5} + \frac{1}{7} = \frac{73}{70} > 1$ ✓✓

..... [2]

(b) Sundip gives Mia and Sara the fractions of the money that she planned.
Mia gets £320.

Work out how much money Sara gets.

M S
$\frac{1}{2}$ $\frac{2}{5}$
320

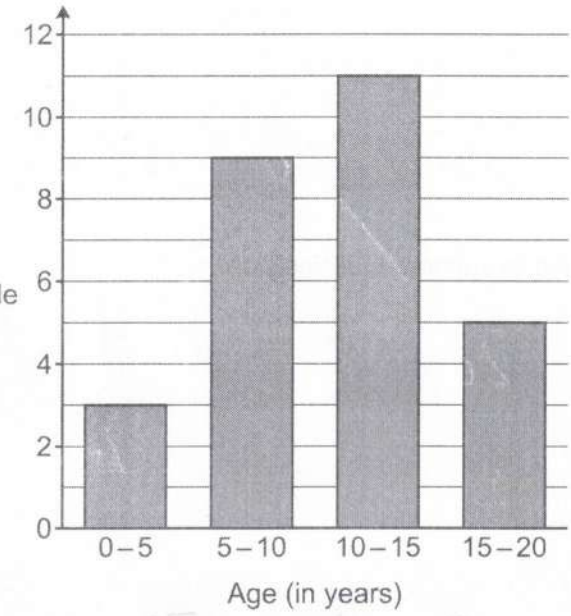
"All" = 640 ✓

$S = \frac{2}{5} \times 640$

256 ✓

(b) £ ..... [2]

15 Alex draws a bar chart to show the age of the young people attending a youth club.



Make **one** criticism of Alex's bar chart.

Age groups overlap ✓

.....

.....

..... **[1]**

16 **(a)** Write these numbers in order, starting with the smallest.

2.4×10^2 1.3×10^3 4.9×10^{-1} 9.5×10^1

(a) 4.9×10^{-1} , 9.5×10^1 , 2.4×10^2 , 1.3×10^3 ✓ **[1]**

smallest

(b) Work out.

$5 \times 10^2 + 4 \times 10^3$ = 4500 ✓

Give your answer in standard form.

(b) 4.5×10^3 ✓ **[2]**

17 The number of people watching a football match is 30 000, correct to the nearest thousand. $\pm\frac{1}{2}$

(a) Complete the error interval for n, the number of people watching the football match.

(a) 29 500 $\leqslant n <$ 30 500 **[1]**

(b) The number of people watching a rugby match is 30 500, correct to the nearest hundred.

Show that fewer people could be watching the rugby match than the football match. **[2]**

30 500 < 30 549 / 30 450

Rugby could = 30 450
Football could = 30 499

✓✓ OE

18 Rearrange this formula to make k the subject.

$t = 2k - h$

$t + h = 2k$

$K = \frac{t+h}{2}$

..... **[2]**

19 A bag contains 150 counters.
The counters are either red or yellow.

(a) Riley picks a counter from the bag, records its colour, and replaces it.
They do this nine times.

Here are Riley's results.

Red	𝍸
Yellow	𝍸 I

Use Riley's results to work out how many red counters are likely to be in the bag.

$\frac{5}{9} \times 150$ ✓✓

(a) 83 or 84 ✓ ..... red counters **[3]**

(b) Ling uses the same bag of counters and picks the counters in the same way.

Here are Ling's results.

Red	𝍸 𝍸 II
Yellow	𝍸 III

Use Ling's results to estimate the probability of choosing a red counter from the bag.
Give your answer as a fraction in its simplest form.

$\frac{12}{20}$ ✓

(b) $\frac{3}{5}$ ✓ ..... **[2]**

(c) Explain why Ling's results are likely to give a better estimate of the probability of choosing a red counter from the bag than Riley's results.

Ling has picked more counters ✓OE ..... **[1]**

20 New cars reduce in value once they have been bought.

Zayn buys a new car for £17 000.
They see this table in a magazine.

Year	Loss in value compared to the start of the year
Year 1	15%
Year 2	10%

Zayn says

According to this table, the value of my car will be £12 750 at the end of Year 2.

Show that Zayn is **not** correct. **[4]**

17000 x 0.85 x 0.9 ✓

= £13005 ✓

21 The length of a word is classed as short, medium or long depending on the number of characters in the word.

This table shows the percentage, in terms of x, of each word length found in a book.

Length of word	Percentage (%)
Short	$2x + 5$
Medium	$3x - 1$
Long	x

Total = $6x + 4$ %

Find the percentage of words in this book which are classed as short words.
You must show your working.

$6x + 4\ \% = 100\ \%$

$6x = 96\ \%$

$x = 16\ \%$

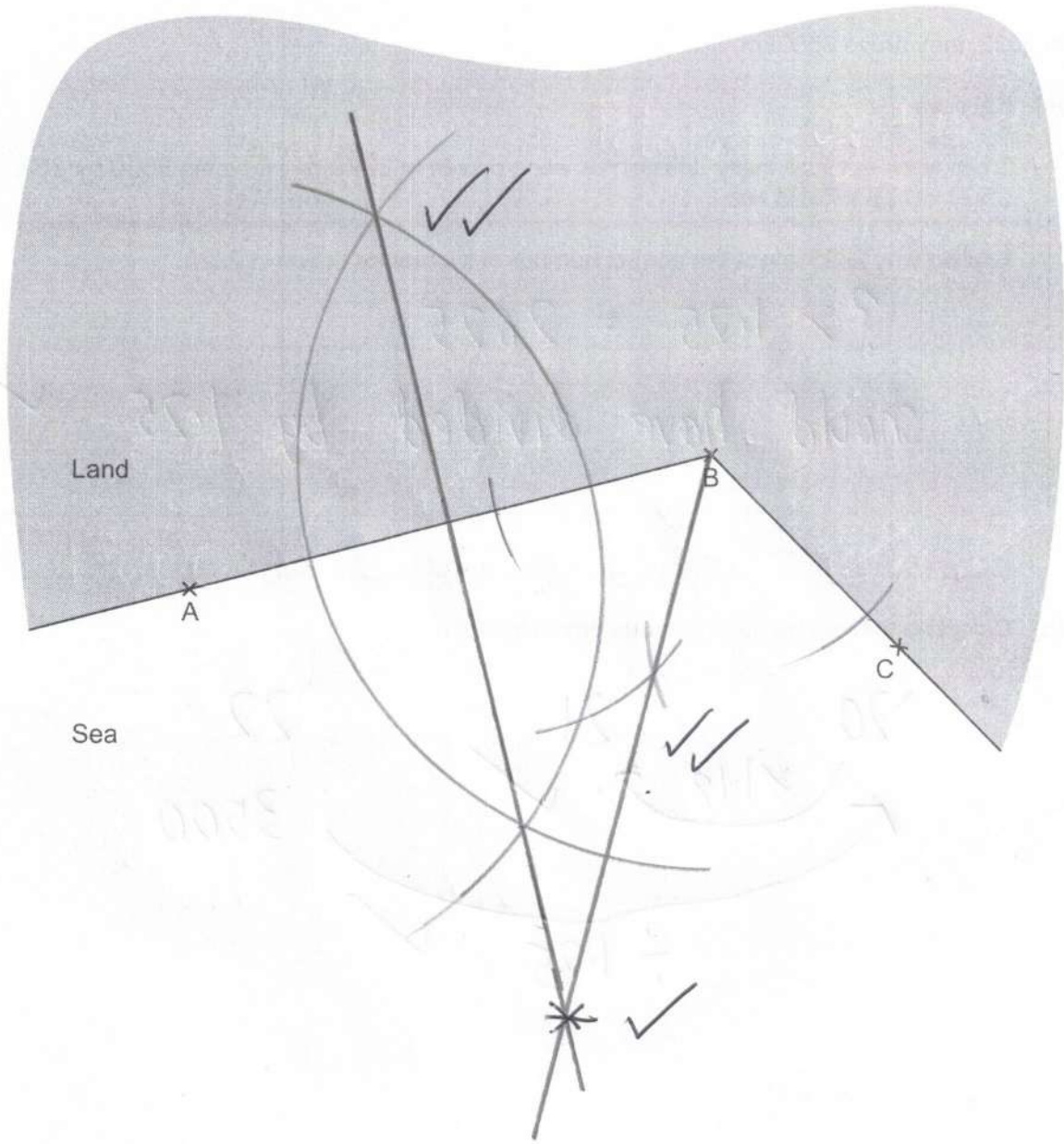
Short = $2 \times 16 + 5$

37

..... % **[5]**

22 The diagram represents a coastline.

A, B and C are lighthouses.



A boat is
- the same distance from A and B
- the same distance from AB and BC.

Using a ruler and compasses only, construct the position of the boat.
Label the position of the boat clearly. **[5]**

23 At the end of each year, a driver records how many kilometres they have driven.

In 2021, they drove 18% more kilometres than in **2020**.
In 2022, they drove 25% more kilometres than in **2020**.

In 2022, they drove 3500 km.

(a) Kai says

I can work out how many kilometres were driven in 2020 by reducing 3500 by 25%.
3500 × 0.75 = 2625 km.

Explain why 2625 is **not** the correct number of kilometres driven in 2020.

? × 1·25 = 2625

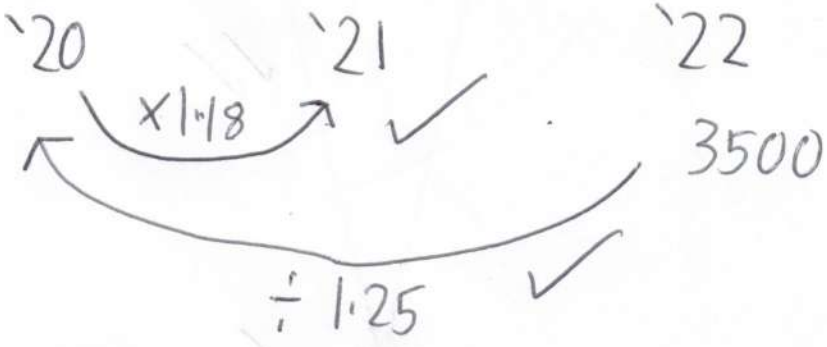
should have divided by 1·25 ✓

.....

.....

..... **[1]**

(b) Calculate the number of kilometres driven in **2021**.



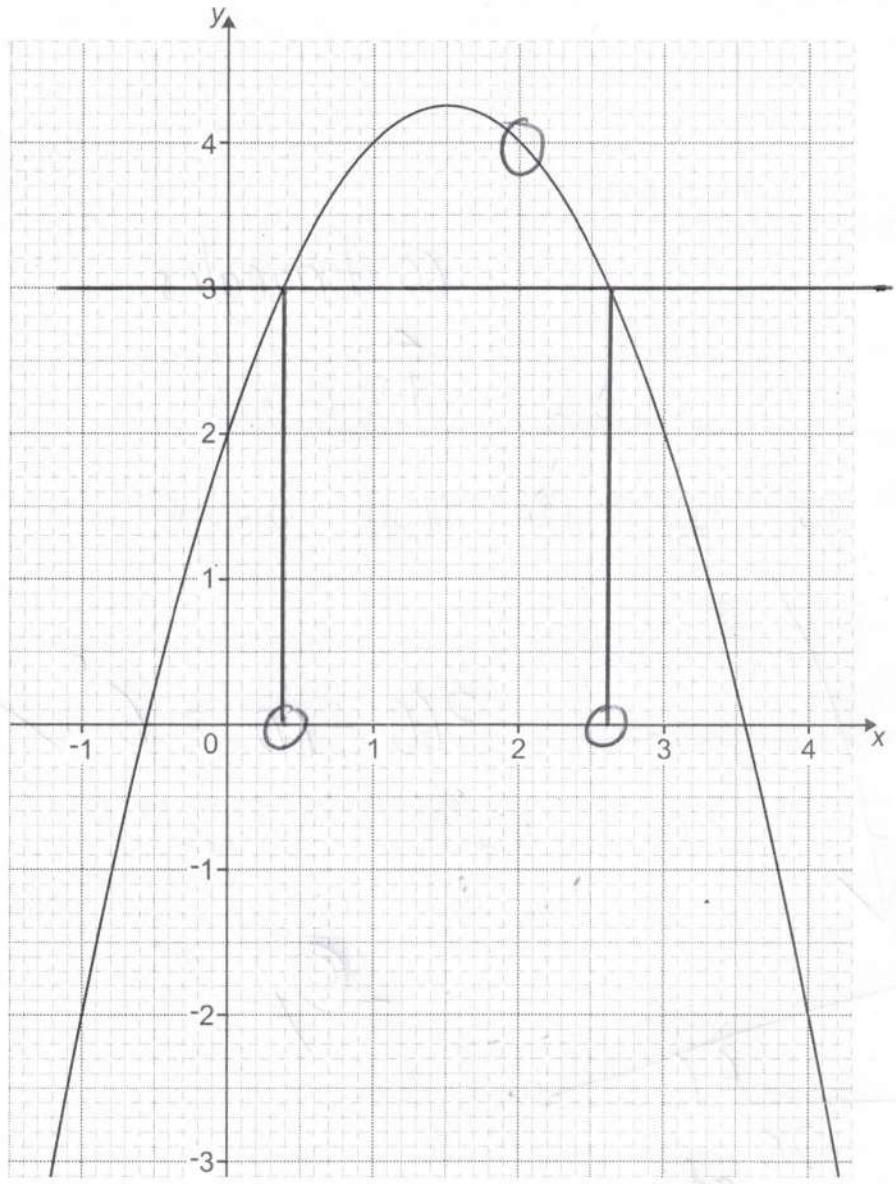
✓ ✓

3500 ÷ 1·25 × 1·18 ✓

3304 ✓

(b) ..... km **[4]**

24 The diagram shows the graph of $y = kx - x^2 + 2$, where k is an integer.



(2,4) ✓

(a) Show that $k = 3$.

$4 = 2k - 4 + 2$ ✓

$6 = 2k$ ✓

$3 = k$

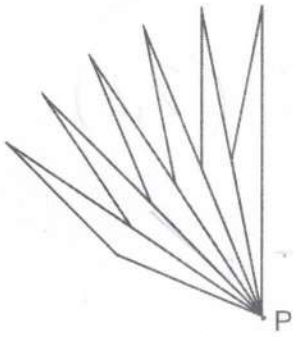
[2]

(b) Use the graph to solve $3x - x^2 + 2 = 3$.
Give your answers to **1** decimal place.

(b) $x =$ 0.4 or $x =$ 2.6 ✓ **[2]**

25 Taylor designs a logo using isosceles triangles joined at a central point, P.

This is the start of Taylor's design.

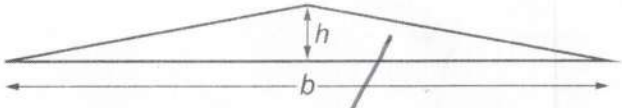


Not to scale

60 triangles

The completed design will have rotational symmetry, order 60 about point P.

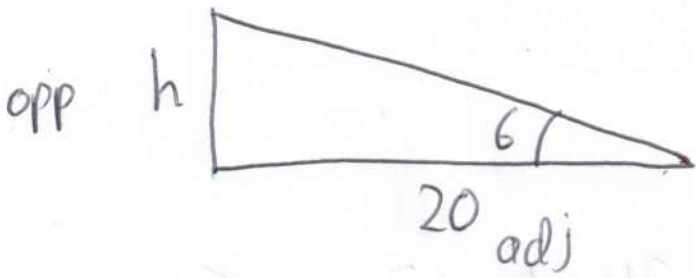
Each triangle has base, b, and height, h, measured in mm.



Not to scale

Calculate h when $b = 40$ mm.
Give your answer correct to **1** decimal place.

$360 \div 60 = 6°$ ✓



TOA

$= \tan 6 \times 20$ ✓✓

$= 2.102...$

2.1 ✓

..... mm **[4]**

END OF QUESTION PAPER