

Answer all the questions.

- 1 Jamie was paid £14.00 per hour.
Jamie receives a pay increase of 20%.

Work out how much Jamie is now paid per hour.

10% = £1.40
20% = £2.80



14.00
+ 2.80

16.80

£..... [3]

- 2 Find all the possible integer values that satisfy the inequality $-4 \leq x - 3 < 1$.

(+3)

(+3)

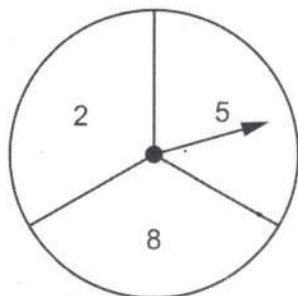
$-1 \leq x < 4$ ✓

-1, 0, 1, 2, 3



..... [3]

- 3 Azmi has a fair spinner numbered 2, 5 and 8.



Azmi spins the spinner twice and adds the two scores to get a total.

- (a) Complete the table to show all of the possible totals.

		First spin		
		2	5	8
Second spin	2	4	7	10
	5	7	10	13
	8	10	13	16



[1]

- (b) Find the probability that the total is a square number.

4, 16



$\frac{2}{9}$



(b) [2]

- 4 Layla and Jamal open a box of sweets.
Layla and Jamal share all of the sweets in the ratio 2 : 3.

(a) Write down the fraction of the sweets that Layla receives.

$$\frac{2}{5} \quad \checkmark$$

(a) [1]

- (b) Layla eats some of **her** sweets.
She is then left with 18% of the sweets that were in the box.

Work out the percentage of **her** sweets that Layla has eaten.

$$\frac{2}{5} = 40\% \quad \checkmark$$

$$40 - 18 = 22\% \text{ of original eaten} \quad \checkmark$$

$$\frac{22\%}{40\%} = \frac{11}{20} = \frac{55}{100} \quad \checkmark$$

$$55\% \quad \checkmark$$

(b) % [4]

5 Ashley goes on a journey.

She travels by taxi for $\frac{1}{8}$ of the journey.

She travels by train for $\frac{4}{5}$ of the journey.

She walks for the remaining 900 m of the journey.

Find the length of this journey in kilometres.
You must show your working.

$$\frac{1}{8} + \frac{4}{5} \quad \checkmark$$

$$= \frac{5}{40} + \frac{32}{40} = \frac{37}{40} \quad \checkmark \checkmark$$

$$\frac{3}{40} = 900\text{m} \quad \checkmark$$

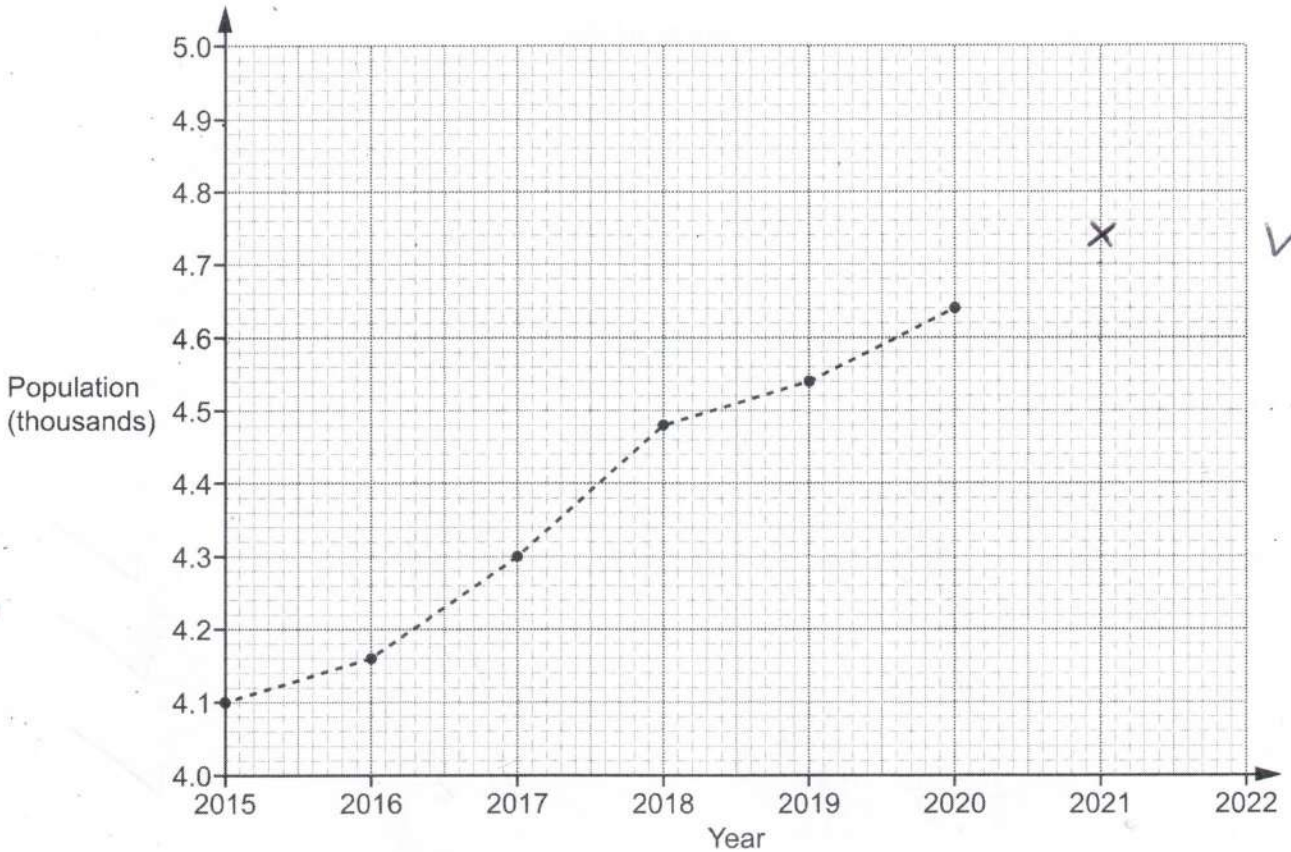
$$\frac{1}{40} = 300\text{m}$$

$$\text{Whole} = \frac{40}{40} = 300 \times 40 = 12000\text{m} \quad \checkmark$$

$$= 12 \quad \checkmark$$

..... km [6]

6 The graph shows information about the population of a village.



(a) The population of the village in 2021 was 4740.
Plot this point on the graph. [1]

(b) Work out the increase in the population of the village between 2016 and 2018.

4160 → 4480 ✓

320 ✓

(b) [2]

(c) Rowan says that there was a huge increase in the population of the village between 2015 and 2020.

Describe how Rowan may have been misled by the graph.

y-axis is missing 0 → 4000 ✓ OE

..... [1]

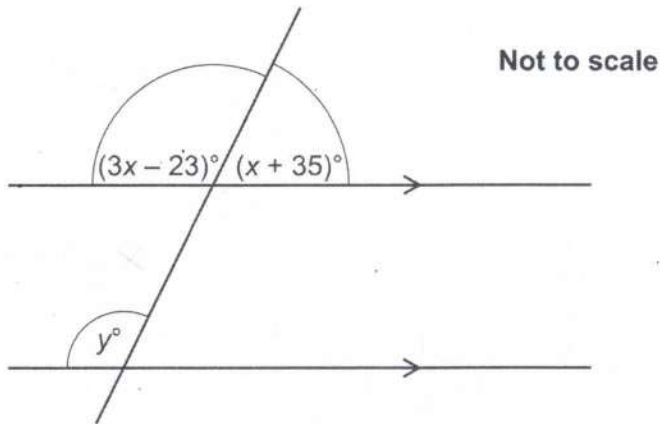
(d) Blake says that the population of the village will be greater than 4800 in 2022.

Write down an assumption Blake has made.

Increasing trend will continue ✓

..... [1]

- 7 The diagram shows a straight line crossing a pair of parallel lines.



Find the value of y .
You must show your working.

$$3x - 23 + x + 35 = 180 \quad \checkmark$$

$$4x = 168 \quad \checkmark$$

$$x = 42 \quad \checkmark$$

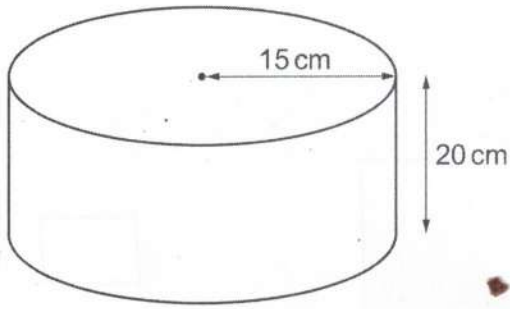
$$y = 3x - 23$$

$$= 3 \times 42 - 23 \quad \checkmark$$

$$= 126 - 23$$

$$y = \dots\dots\dots 103 \quad \checkmark \quad [5]$$

- 8 The diagram shows a cylinder with radius 15 cm and height 20 cm.

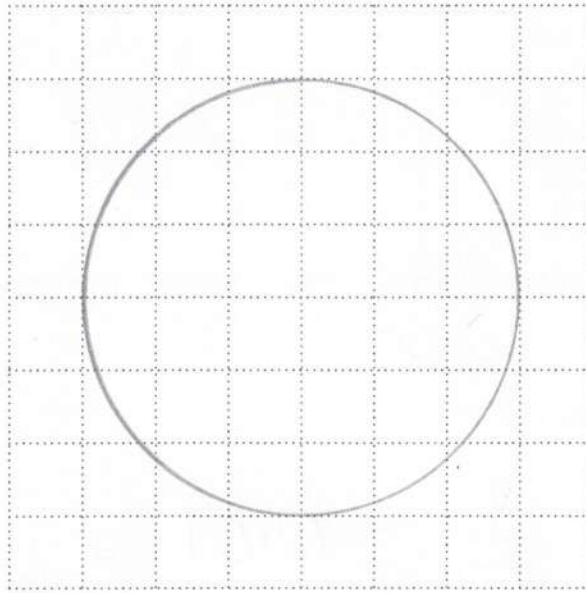


Not to scale

$$15\text{ cm} \rightarrow 3\text{ cm}$$

$$20\text{ cm} \rightarrow 4\text{ cm}$$

- (a) On the grid below, draw the plan view of the cylinder.
Use the scale 1 cm represents 5 cm.

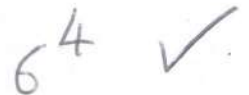
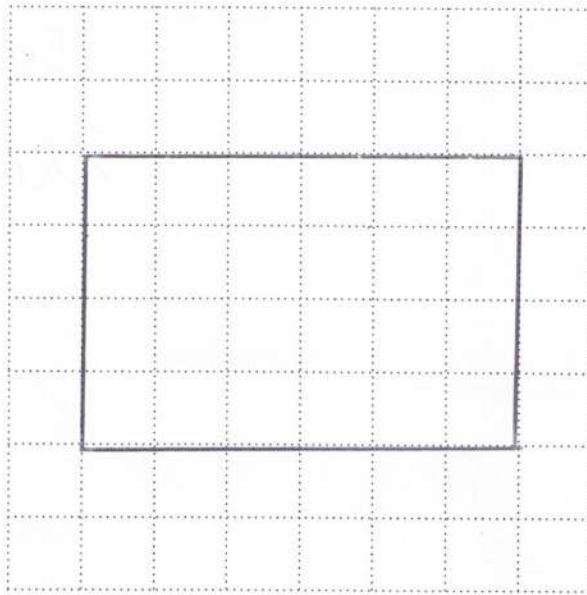


0 ✓
3 ✓

[2]

- (b) On the grid below, draw the front elevation of the cylinder.
Use the scale 1 cm represents 5 cm.

$$30\text{cm} \\ = 6\text{cm}$$



[2]

- 9 A student says that they have placed the following values in order starting with the smallest.

$$\left(\frac{1}{10}\right)^2 \quad \sqrt{0.25} \quad 4^{-1}$$

Has the student done this correctly?
Show how you decide.

$$\frac{1}{10} \times \frac{1}{10} = \frac{1}{100} = 0.01 \quad \checkmark$$

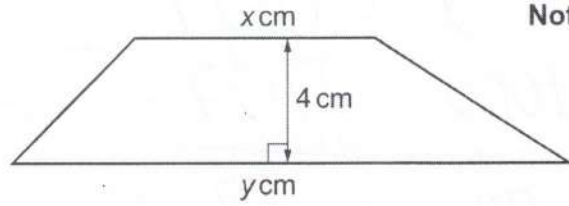
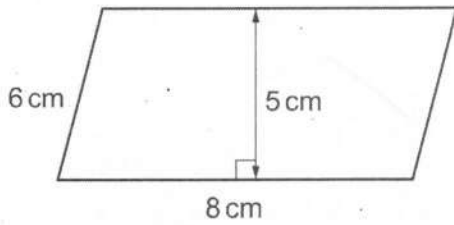
$$\sqrt{0.25} = \sqrt{\frac{1}{4}} = \frac{1}{2} = 0.5 \quad \checkmark$$

$$4^{-1} = \frac{1}{4} = 0.25 \quad \checkmark$$

No because $\left(\frac{1}{10}\right)^2$, 4^{-1} , $\sqrt{0.25}$ is correct

10

10 The parallelogram and the trapezium have the same area.



Not to scale

The ratio of $x : y$ is $3 : 5$.

Find the value of x and the value of y .
You must show your working.

$$P = 8 \times 5 = 40 \quad \checkmark$$

$$T = \frac{(x+y) \times 4}{2} = 40 \quad \checkmark \checkmark$$

$$x + y = 20 \quad \checkmark$$

$$x = \frac{3}{8} \times 20 = \frac{60}{8} = \frac{30}{4} = \frac{15}{2} = 7.5 \quad \checkmark$$

$$x = 7.5$$

$$y = 12.5 \quad \checkmark$$

[6]

11 Write $0.\dot{2}\dot{7}$ as a fraction in its simplest form.

Let

$$x = 0.\dot{2}\dot{7}$$

$$100x = 27.\dot{2}\dot{7}$$

$$\hline 99x = 27$$

$$x = \frac{27}{99} = \frac{9}{33} = \frac{3}{11}$$

..... [3]

- 12 The time, t seconds, taken by each of 60 students to complete a puzzle is recorded.

The table shows information about these times.

Time (t seconds)	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$	$50 < t \leq 70$	$70 < t \leq 90$
Frequency	8	0	12	30	10

- (a) Two students are picked at random.
Reece works out the probability that they both took longer than 50 seconds to complete the puzzle.
Reece's working is shown below.

The number of students who took longer than 50 seconds is $30 + 10 = 40$

The probability that one student took longer than 50 seconds is $\frac{40}{60} = \frac{2}{3}$

The probability they both took longer than 50 seconds is $\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$

Explain the error in their method and write the correct calculation that Reece needs to do.
You do not need to work out the answer to the calculation.

The error is *2nd probability is affected by the first* ✓

The correct calculation is $\frac{40}{60} \times \frac{39}{59}$ [2] ✓

- (b) Two students are picked at random from those who took 50 seconds or less.

Find the probability that one of them took 30 seconds or less and the other took more than 40 seconds.

You must show your working.

$$2 \times \frac{8}{20} \times \frac{12}{19}$$



$$= \frac{8}{10} \times \frac{12}{19}$$

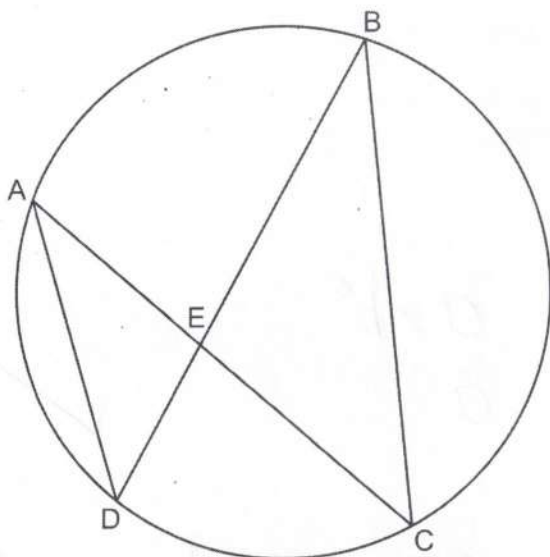
$$= \frac{4}{5} \times \frac{12}{19}$$

$$\frac{48}{95}$$



(b) [5]

- 13 Points A, B, C and D lie on the circumference of a circle. Line AC intersects line BD at point E.



Not to scale

Prove that triangle AED is similar to triangle BEC.

$$\angle AED = \angle BEC \quad (\text{opposite angles are equal}) \quad \checkmark$$

$$\angle DAE = \angle EBC \quad (\text{angles in the same segment are equal}) \quad \checkmark$$

and

$$\angle ADE = \angle ECB \quad \checkmark$$

AAA hence similar

[3]

- 14 The number of bees, P , in a colony is given by the formula

$$P = ab^x$$

where x is the number of months after the start of July.

At the start of July, there were 25 000 bees in the colony.
After one month, there were 23 500 bees in the colony.

Find the value of a and the value of b .
Give the value of b as a decimal.

$$x=0 \quad 25000 = a \times b^0$$

$$25000 = a \quad \checkmark$$

$$x=1 \quad 23500 = 25000 \times b \quad \checkmark$$

$$b = \frac{23500}{25000} \quad \checkmark$$

$$= \frac{47}{50}$$

$$= \frac{94}{100}$$

$$a = \frac{25000}{\dots\dots\dots}$$

$$b = \frac{0.94}{\dots\dots\dots} \quad [4] \quad \checkmark$$

15 (a) Simplify.

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

$= \sqrt{45}$

$= \sqrt{9} \times \sqrt{5}$

✓

(a) [2]

$3\sqrt{5}$

✓

(b) Rationalise the denominator and simplify.

$\frac{40}{\sqrt{15}}$

$\times \frac{\sqrt{15}}{\sqrt{15}}$

✓

=

$\frac{40\sqrt{15}}{15}$

✓

(b) [3]

$\frac{8\sqrt{15}}{3}$

✓ OE

(c) Work out.

$27^{\frac{4}{3}}$

$\sqrt[3]{27^4}$

$= 3^4$

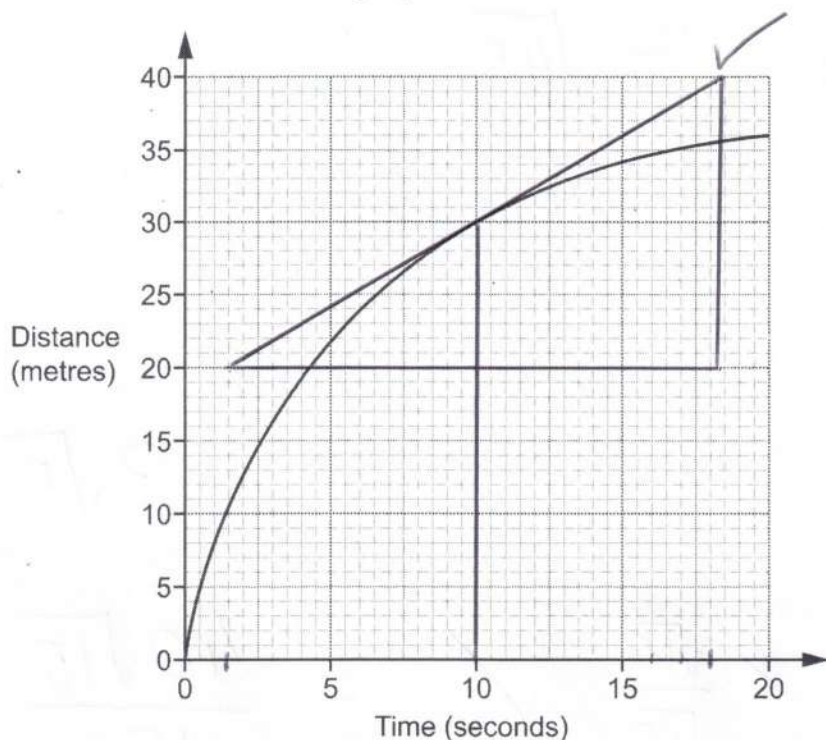
✓

(c) [2]

81

✓

- 16 The graph shows the distance travelled by a particle over the first 20 seconds of its motion.



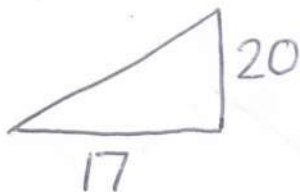
- (a) Show that the average speed of the particle over the first 20 seconds of its motion is 1.8 m/s.

[1]

$$s = \frac{D}{T} = \frac{36}{20} = \frac{3.6}{2} = 1.8$$

✓

- (b) Estimate the speed of the particle at 10 seconds.
You must show working to support your estimate.



$$\frac{20}{17} \approx \frac{10}{8} = \frac{5}{4}$$

m ✓

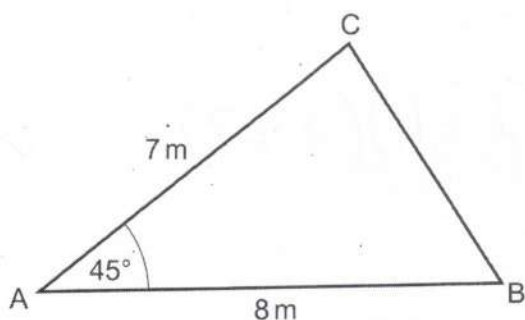
1.25 ✓

- (b) m/s [3]

Turn over

$$[ms \ 1.0 \rightarrow 1.25]$$

17 The diagram shows triangle ABC.



Not to scale

Find the area of the triangle.

Give your answer in the form $a\sqrt{b}$ where a and b are integers.

$$A = \frac{1}{2} ab \sin C$$

$$= \frac{1}{2} \times 7 \times 8 \times \sin 45 \quad \checkmark$$

$$= 28 \times \frac{\sqrt{2}}{2} \quad \checkmark$$

$$14\sqrt{2} \quad \checkmark$$

..... m^2 [3]

18 (a) By factorising, find the roots of $y = x^2 + 18x + 77$.

$$(x+11)(x+7) \quad \checkmark\checkmark$$

(a) $x = \dots -11 \dots$ and $x = \dots -7 \dots$ [3] \checkmark

(b) (i) Write $y = x^2 + 18x + 77$ in the form $y = (x+a)^2 - b$.

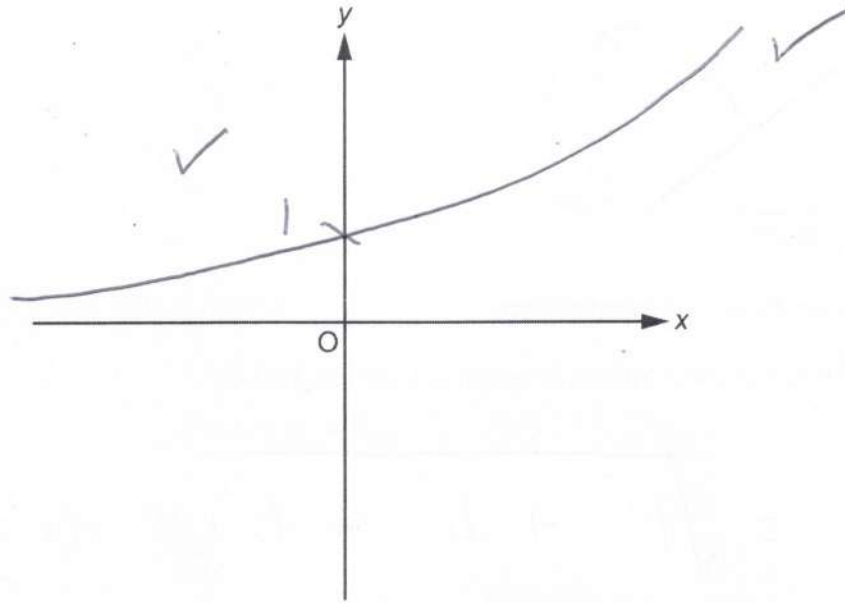
$$y = (x+9)^2 - 81 + 77 \quad \checkmark$$

(b)(i) $y = \dots (x+9)^2 - 4 \dots$ [3] $\checkmark\checkmark$

(ii) Write down the coordinates of the turning point of the graph of $y = x^2 + 18x + 77$.

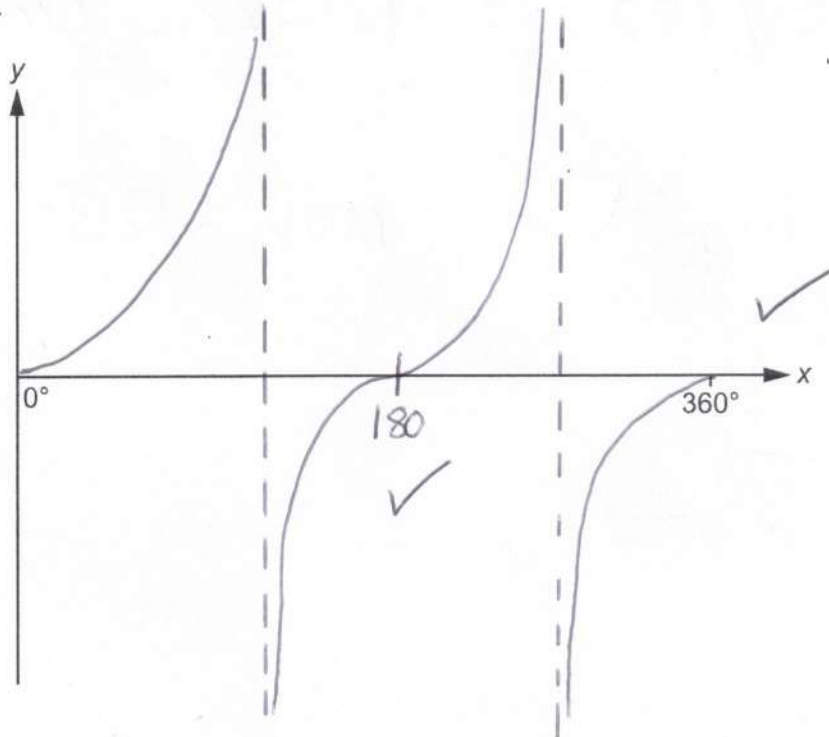
(ii) $(\dots -9 \dots, \dots -4 \dots)$ [2]

- 19 (a) Sketch the graph of $y = 5^x$ indicating any values where the graph crosses the axes.



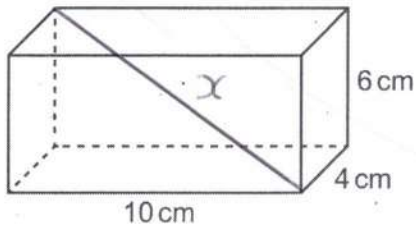
[2]

- (b) Sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$ indicating any values where the graph crosses the axes.



[2]

- 20 Kai has a box in the shape of a cuboid.
The internal dimensions of the box are 10 cm by 4 cm by 6 cm.



Kai is given a pencil of length 13 cm.

Show that the pencil does not fit completely inside the box.

[4]

$$x = \sqrt{10^2 + 4^2 + 6^2}$$

✓✓

$$x = \sqrt{152}$$

✓

✓ OE

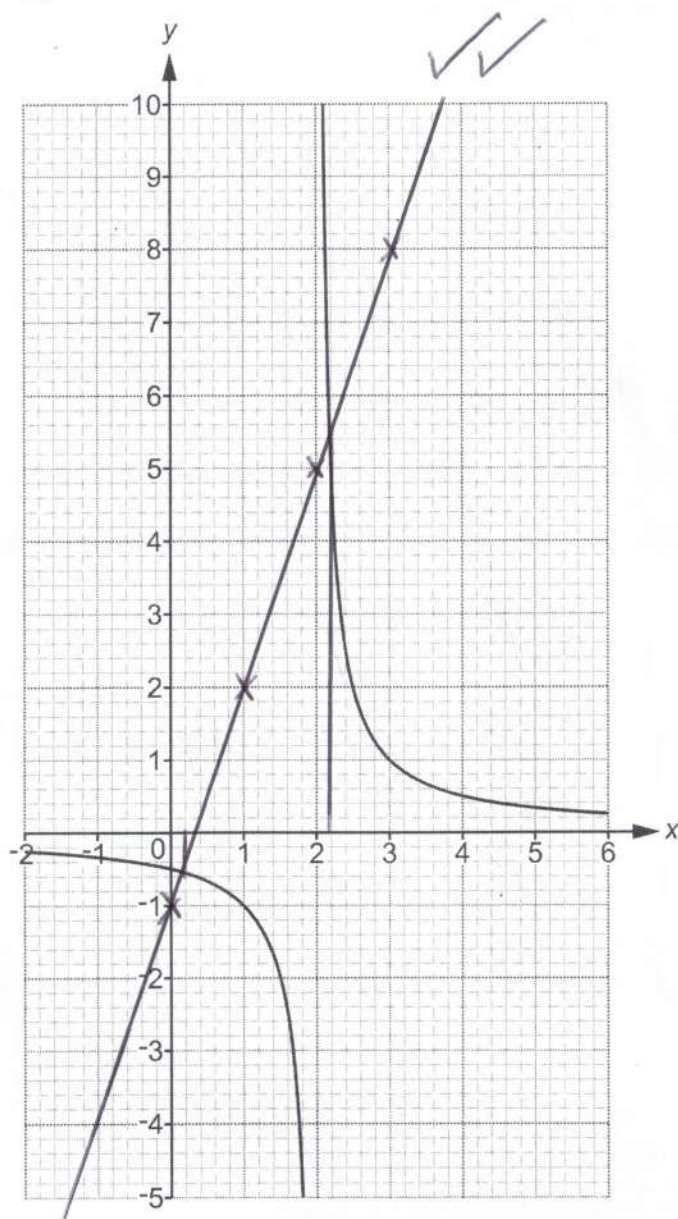
$$13^2 = 169$$

or Kai's pencil $> x$

$$13^2 > 152$$

✓ OE
etc

- 21 The graph of $y = \frac{1}{x-2}$ is drawn on the grid for $-2 \leq x \leq 6$.



- (a) There are no values of x for which $\frac{1}{x-2} = k$.

Find the value of k .

no solutions / no contact with
x-axis

(a) $k = \dots\dots\dots$ [1]

- (b) (i) Use the graph to find approximate solutions to the equation $\frac{1}{x-2} = 3x - 1$.
Give your answers to 1 decimal place.
Show your working on the graph.

$$\begin{array}{l} \Downarrow \\ c = -1 \\ m = 3 \end{array}$$

$$[ms \pm 0.1]$$

$$(b)(i) \quad x = \overset{\checkmark}{0.2} \quad \text{or} \quad x = \overset{\checkmark}{2.2} \quad [4]$$

- (ii) Show algebraically that $\frac{1}{x-2} = 3x - 1$ has the same solutions as $3x^2 - 7x + 1 = 0$. [4]

$$1 = (3x - 1)(x - 2) \quad \checkmark$$

$$1 = 3x^2 - 6x - 1x + 2 \quad \checkmark\checkmark$$

$$1 = 3x^2 - 7x + 2 \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \checkmark$$

$$0 = 3x^2 - 7x + 1$$

END OF QUESTION PAPER