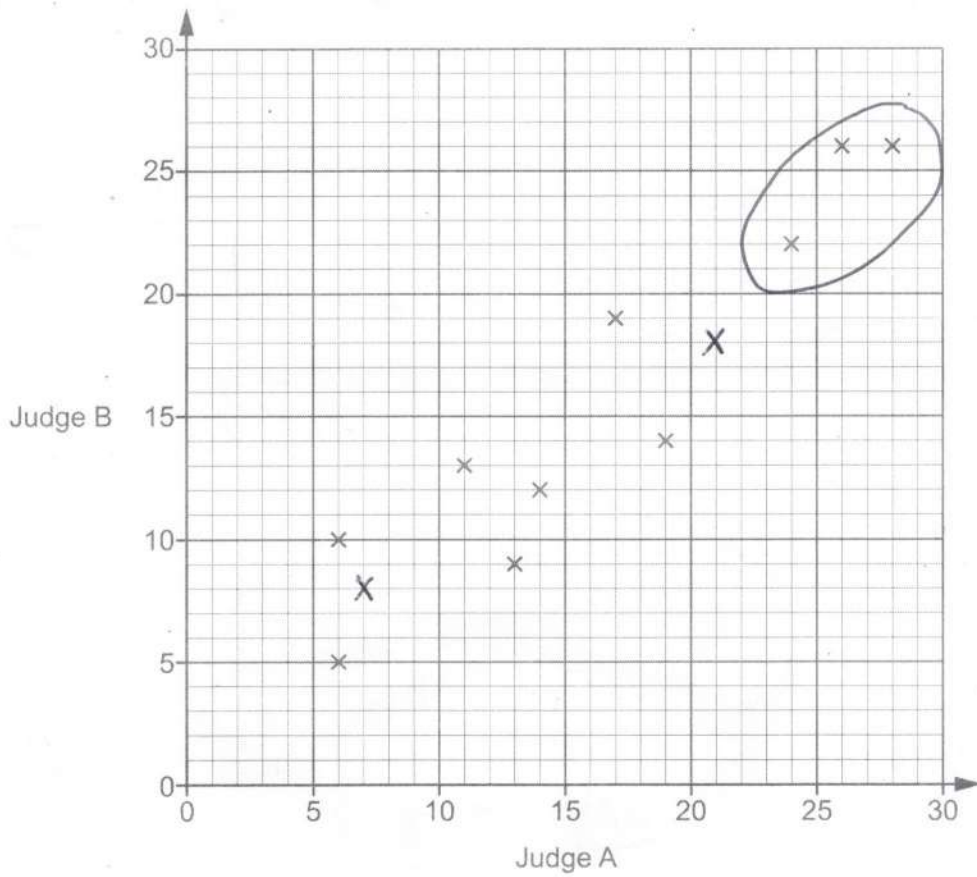


Answer **all** the questions.

- 1 In a dance competition, two judges each award scores out of 30. The scatter diagram shows the scores awarded to the first 10 dancers.



- (a) Here are the scores for the next two dancers.

Judge A	21	7
Judge B	18	8

x

y



Plot their scores on the scatter diagram.

[1]

- (b) Dancers who are awarded a score of more than 20 by **both** judges receive a medal.

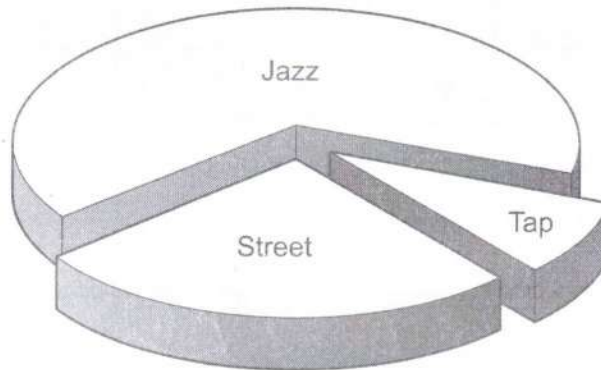
For the 12 dancers, express the ratio of medal winners to non-medal winners in its simplest form.

✓ 3 : 9 ✓

(b) 1 : 3 ✓ [3]

- (c) This chart shows the types of dance performed by the 12 dancers.

3 performed a street dance, 8 performed a jazz dance and 1 performed a tap dance.



Why is this diagram misleading?

Wedges at the front look bigger ✓

[1]

- 2 The police record the speed of vehicles passing a speed checkpoint. The speeds are recorded in the table below.

Speed (s mph)	Number of vehicles	mid pt	
$0 < s \leq 20$	5	10	50
$20 < s \leq 40$	8	30	240
$40 < s \leq 50$	37	45	1665
$50 < s \leq 60$	47	55	2585
$60 < s \leq 80$	3	70	210

- (a) Calculate an estimate of the mean speed of the vehicles.

$$\frac{4750}{100}$$

✓

47.5

✓

(a) mph [4]

- (b) Explain why it is not possible to use the information from this table to calculate the exact value of the mean speed.

Data is grouped

Exact values are unknown

✓

[1]

- 3 A newborn baby has an approximate mass of 3.5 kilograms.

$$= 3500g \quad \checkmark$$

A human cell has an approximate mass of 2.7×10^{-11} grams.

Use these values to estimate the number of human cells in a newborn baby.
Give your answer in standard form, correct to 2 significant figures.

$$3500 \div (2.7 \times 10^{-11}) \quad \checkmark \checkmark$$

$$= 1.296... \times 10^{14} \quad \checkmark$$

$$1.3 \times 10^4 \quad \checkmark$$

[5]

- 4 Use the symbols $<$, $\leq$, $=$, $>$, or $\geq$ to complete this statement.

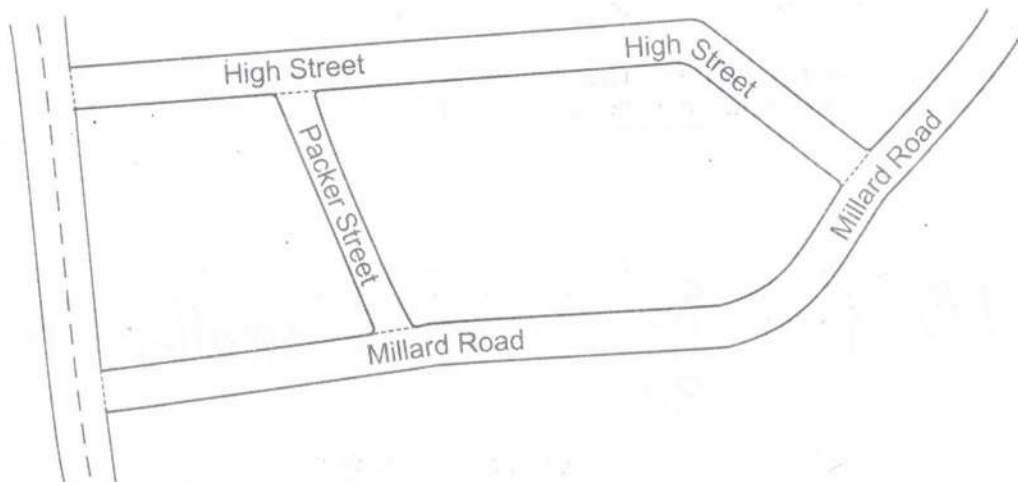
If $x = 4.7$, **truncated** to 1 decimal place, then $4.7 \dots \leq \dots x \dots < \dots 4.8$

[2]

✓

✓

- 5 This map shows part of a village.



Neil knows that Packer Street is 180 m long in real life.

- (a) Neil measures the map.

He says

Packer Street is 3.5 cm long.

High Street is 11.2 cm long.

Therefore, I calculate that High Street is 576 m long in real life.

Use Neil's figures to show that the answer to his calculation is correct.

[3]

$$\frac{180}{3.5} \times 11.2 = 576 \quad \checkmark \checkmark \checkmark$$

- (b) Jodie measures the same map.

She says

I think Packer Street is longer than Neil's measurement of 3.5 cm.
Therefore, High Street must be longer than 576 m in real life.

Is Jodie's reasoning correct?
Show how you decide.

NO, $\frac{180}{3.5}$ gives a smaller multiplier ✓
making High St shorter ✓

..... [2]

- (c) On another map, Packer Street is 2.4 cm long.

Express the scale of this map in the form 1 : n.

$$2.4 \text{ cm} : 180 \text{ m} \quad (\times 100) \quad \checkmark$$

$$2.4 \text{ cm} : 18000$$

$$(\div 2.4)$$

$$7500 \quad \checkmark$$

(c) 1 : [2]

- 6 In a box of mixed nuts, the total number of almonds, cashews and peanuts is 1025.
 The ratio of almonds to cashews is 1 : 3.
 The ratio of cashews to peanuts is 5 : 7.

Calculate the number of cashews in the box.

A	C	P
1	3	
5	15	21
	5	7

✓✓

$$C = 1025 \times \frac{15}{41}$$

✓

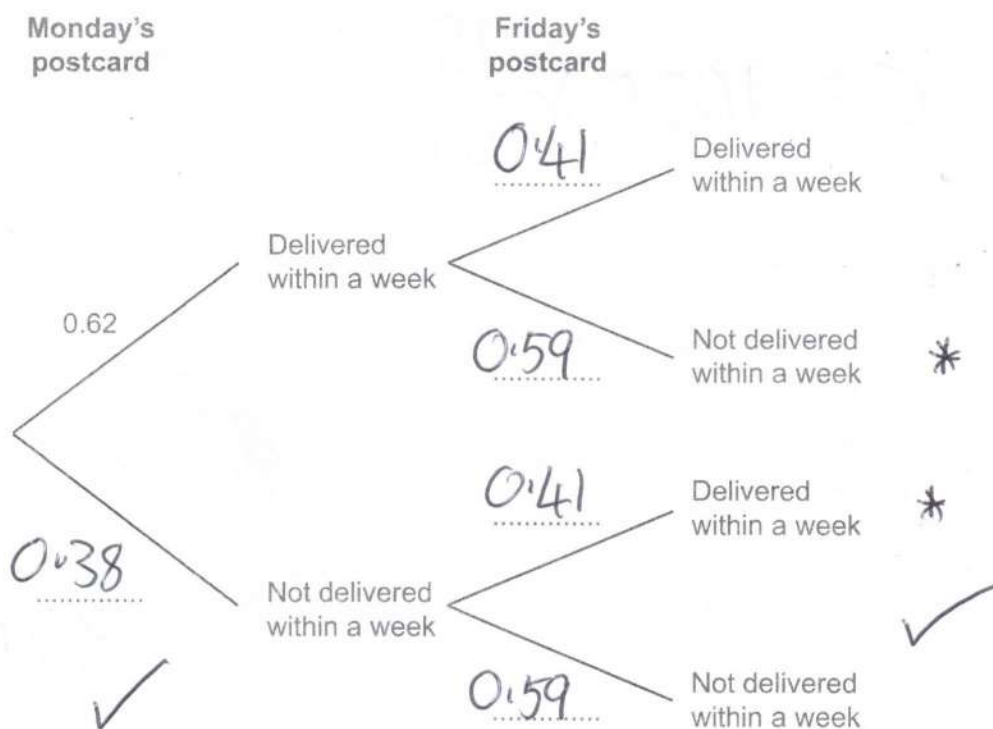
375 ✓

..... [4]

- How many of her postcards can she expect to be delivered within a week?

(a) [2]
(or 10 ww)

- (i) Complete the probability tree to show the possible outcomes for the postcards.



[2]

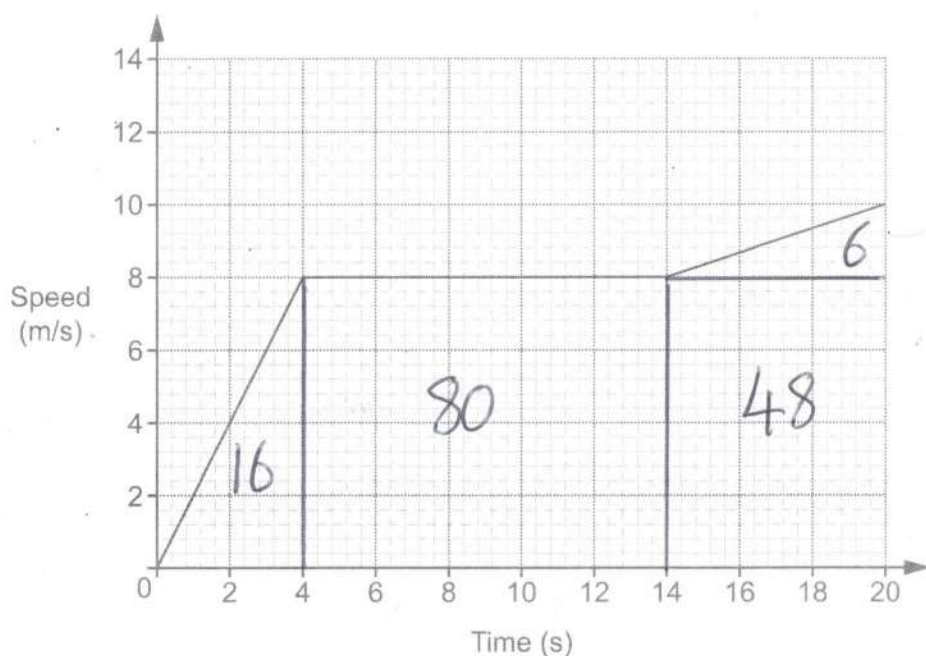
- (ii) Calculate the probability that only one of Sergio's postcards is delivered within a week.

$$(0.62 \times 0.59) + (0.38 \times 0.41)$$

$$\begin{array}{r} 326 \\ \hline 625 \end{array}$$

(b)(ii) 0.25 [3]

- 8 The graph shows the speed of a cyclist during 20 seconds of a journey.



- (a) Find the acceleration of the cyclist

- (i) for the first 4 seconds

$$\frac{8}{4}$$

(a)(i) m/s^2 [2]

- (ii) between 4 seconds and 14 seconds.

(ii) m/s^2 [1]

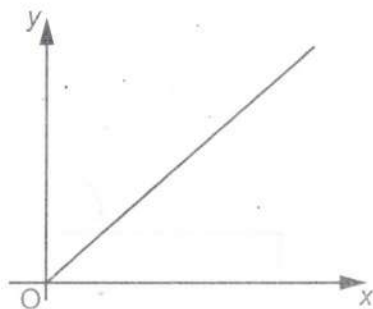
- (b) Work out the distance travelled by the cyclist during the 20 seconds.

$$16 + 80 + 48 + 6$$

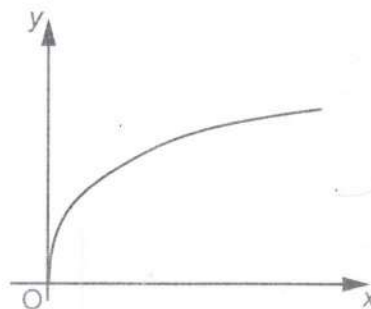
(b) m [4]

- 9 These graphs show different relationships between the variables x and y .

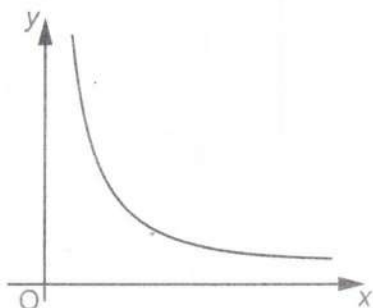
Graph A



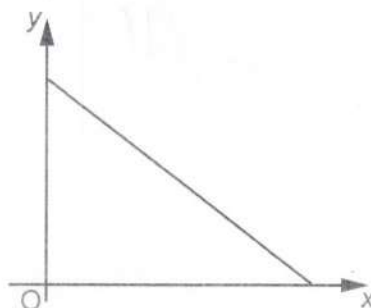
Graph B



Graph C



Graph D



Identify the graph which shows the following.

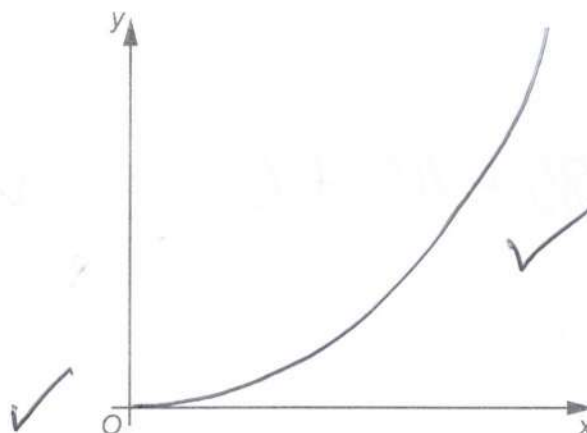
- (a) y is directly proportional to x .

(a) Graph A ✓ [1]

- (b) y is inversely proportional to x .

(b) Graph C ✓ [1]

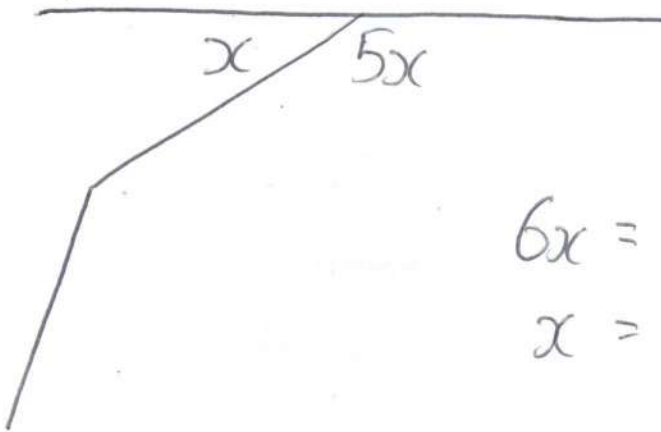
- 10 Sketch a graph which shows that y is directly proportional to x^2 .



[2]

- 11 A regular polygon has n sides.
The polygon's interior angle is 5 times the size of its exterior angle.

Find n .



$$6x = 180$$

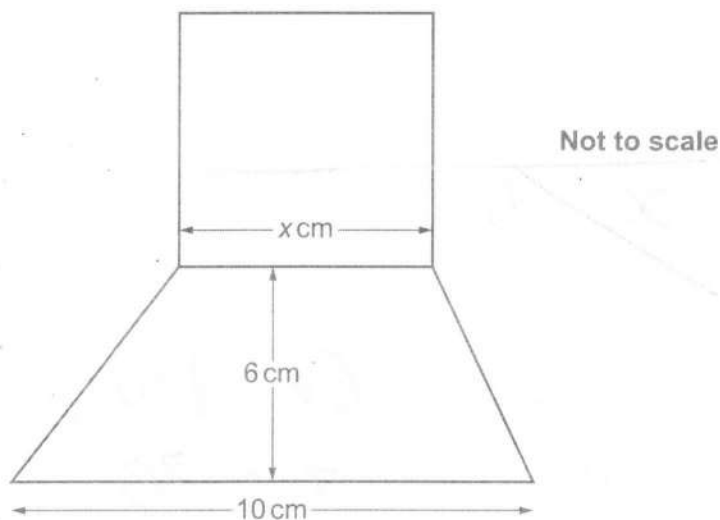
$$x = 30$$

$$\frac{360}{30}$$

$$12$$

$$n = \dots\dots\dots [5]$$

- 12 In the diagram, the square and the trapezium share a common side of length x cm.



The area of the square is equal to the area of the trapezium.

Work out the value of x .



$$\frac{1}{2}(x+10) \times 6 = x^2$$

$$3x + 30 = x^2$$

$$0 = x^2 - 3x - 30$$

$$x = \frac{3 \pm \sqrt{9 + 120}}{2} = 7.17...$$

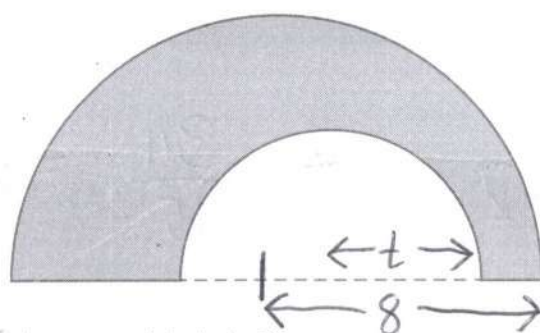
(ignore negative)

✓✓

7.2

$x = \dots\dots\dots$ [6]

- 13 The shape below is formed from two semicircles and a straight line.



Not to scale

The radius of the large semicircle is 8 cm.
The radius of the small semicircle is t cm.

Find an expression, in terms of t , for the **exact perimeter** of the shaded shape.

$$\left(\frac{1}{2} \times 2 \times \pi \times 8\right) + \left(\frac{1}{2} \times 2 \times \pi \times t\right) + 8 - 2t \quad \checkmark \checkmark$$

$$8\pi + \pi t + 16 - 2t \quad \checkmark$$

..... cm [3]

- 14 (a) Without using a calculator, show that $0.\dot{1}\dot{9}$ can be written as $\frac{19}{99}$.

[3]

$$\begin{array}{r} x = 0.\dot{1}\dot{9} \\ 100x = 19.\dot{1}\dot{9} \\ \hline 99x = 19 \end{array} \quad \checkmark \checkmark \quad x = \frac{19}{99}$$

- (b) Explain how $\frac{19}{99} = 0.\dot{1}\dot{9}$ can be used to find $\frac{19}{990}$ as a decimal and write down its value.

$$0.\dot{1}\dot{9} \div 10$$

✓ OE

$$\frac{19}{990} = 0.019 \quad \checkmark$$

..... [2]

- 15 Use the formula $x_{n+1} = \frac{(x_n)^3}{30} + 2$ with $x_1 = 2$ to calculate x_2 and x_3 .

Round your answers correct to 4 decimal places.

$$x_2 = \frac{2^3}{30} + 2 = \frac{34}{15} = 2.26\dot{6} \quad \checkmark$$

$$x_3 = \frac{\left(\frac{34}{15}\right)^3}{30} + 2 = 2.388187\dots$$

$$x_2 = 2.2667 \quad \text{and} \quad x_3 = 2.3882 \quad [3]$$

✓

✓

- 16 A £1 coin weighs 8.75 g, correct to the nearest 0.01 g.
Mitul weighs the contents of a large bag of £1 coins.
The coins weigh 2.63 kg, correct to the nearest 10 g.

Mitul says

I am sure that the bag contains exactly £300 because, using bounds,
 $2625 \div 8.755 = 299.8$ to 1 decimal place.

Show that Mitul may not be correct.

$$8.75 < \begin{matrix} 8.755 \\ 8.745 \end{matrix}$$

$$2.63 < \begin{matrix} 2.635 \\ 2.625 \end{matrix}$$

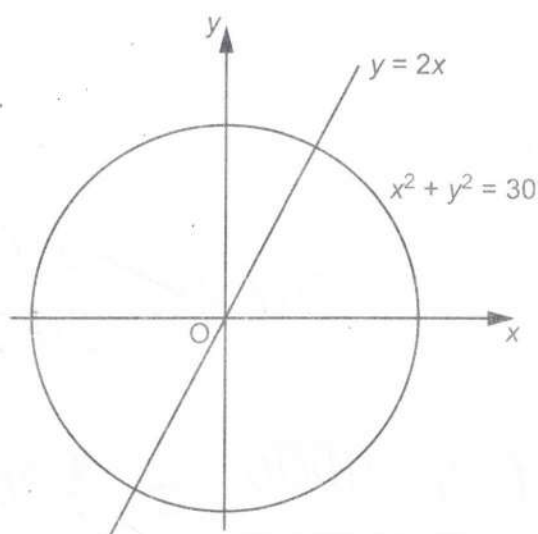
✓

$$\text{max } \pounds = \frac{2.635 \times 1000}{8.745} = \pounds 301.3...$$

so there could be $\pounds 301$ ✓

..... [3]

- 17 Find the exact coordinates of the two intersections of the line $y = 2x$ and the circle $x^2 + y^2 = 30$.



Not to scale

$$x^2 + (2x)^2 = 30 \quad \checkmark$$

$$x^2 + 4x^2 = 30 \quad \checkmark$$

$$5x^2 = 30$$

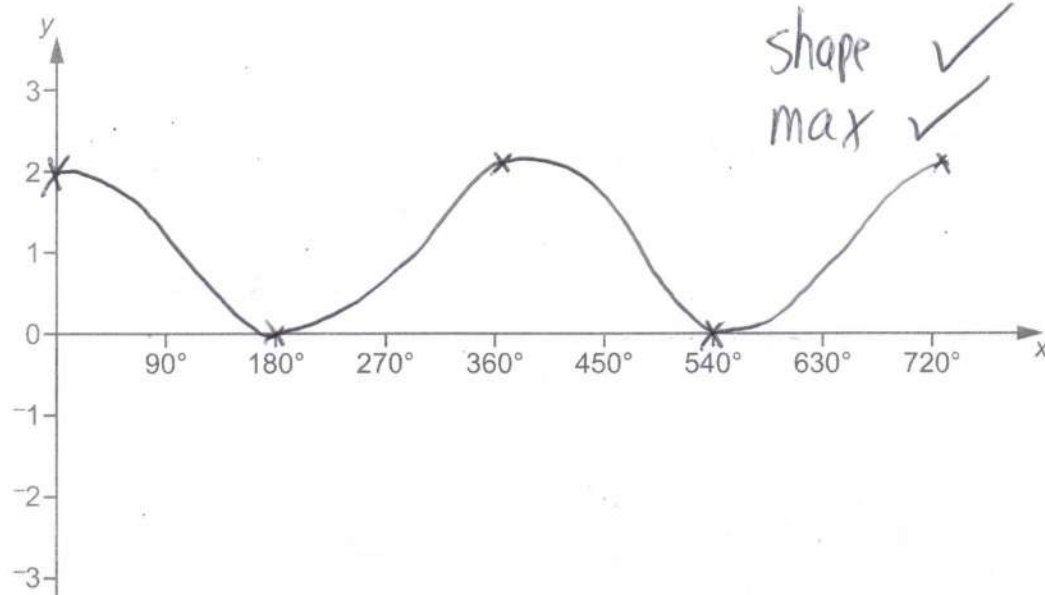
$$x^2 = 6 \quad \checkmark$$

$$x = \pm\sqrt{6} \quad \checkmark$$

$$y = 2x \pm\sqrt{6}$$

$$(\sqrt{6}, 2\sqrt{6}) \text{ and } (-\sqrt{6}, -2\sqrt{6}) [5] \quad \checkmark$$

- 18 (a) Sketch the graph of $y = \cos x + 1$ for $0^\circ \leq x \leq 720^\circ$.



[3]

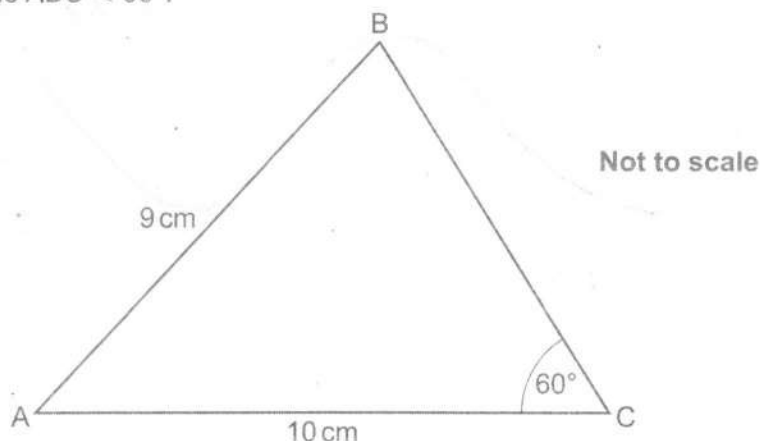
- (b) Explain why the equation $\cos x + 1 = 2.7$ has no solutions.

Graph has a max value of 2 ✓OE

[1]

19 In this triangle:

- $AB = 9 \text{ cm}$
- $AC = 10 \text{ cm}$
- $BC > 5 \text{ cm}$
- $\text{angle } BCA = 60^\circ$
- $\text{angle } ABC < 90^\circ$



Calculate the area of triangle ABC.

$$\frac{\sin B}{10} = \frac{\sin 60}{9}$$

$$B = \sin^{-1}(0.96225...) = 74.2^\circ \checkmark$$

$$\text{so } \angle BAC = 180 - 60 - 74.2 = 45.8^\circ \checkmark$$

$$\begin{aligned} \text{Area} &= \frac{1}{2} \times 9 \times 10 \times \sin 45.8^\circ \checkmark \\ &= 32.257... \end{aligned}$$

$$32.3 \checkmark$$

cm² [6]

$$[ms: 32.2 \rightarrow 32.3]$$

Turn over

20 (a) $\mathbf{b}$ is a vector.

Given that $\mathbf{b} + \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ is parallel to $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$, find two possible answers for $\mathbf{b}$.

$$\begin{bmatrix} 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 5 \\ 2 \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \end{bmatrix} = 3 \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} 3 \\ 2 \end{bmatrix} + \begin{bmatrix} 5 \\ 2 \end{bmatrix} = \begin{bmatrix} 8 \\ 4 \end{bmatrix} = 4 \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

✓✓✓
✓2

$$(a) \mathbf{b} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \text{ or } \begin{pmatrix} 3 \\ 2 \end{pmatrix} [3]$$

(b) Given that

$$m \begin{pmatrix} 4 \\ 1 \end{pmatrix} + n \begin{pmatrix} 5 \\ 2 \end{pmatrix} = \begin{pmatrix} 12 \\ 6 \end{pmatrix}$$

find the value of m and the value of n .

$$4m + 5n = 12$$

$$m + 2n = 6$$

(x4)

✓✓

$$4m + 8n = 24$$

$$- \quad 4m + 5n = 12$$

$$\hline 3n = 12$$

$$n = \frac{12}{3} = 4$$

✓

$$m + 2 \times 4 = 6$$

$$m = 6 - 8$$

$$(b) \begin{array}{l} m = \frac{-2}{4} \\ n = \end{array} [5]$$

✓✓

21 Show that $\frac{5x}{x+5} + \frac{25}{x-7} - \frac{300}{(x+5)(x-7)}$ simplifies to an integer.

[6]

$$\frac{5x(x-7)}{(x+5)(x-7)} + \frac{25(x+5)}{(x+5)(x-7)} - \frac{300}{(x+5)(x-7)} \quad \checkmark$$

$$= \frac{5x^2 - 35x + 25x + 125 - 300}{(x+5)(x-7)} \quad \checkmark$$

$$= \frac{5x^2 - 10x - 175}{x^2 + 5x - 7x - 35} \quad \checkmark$$

$$= \frac{5(x^2 - 2x - 35)}{(x^2 - 2x - 35)} \quad \checkmark$$

$$= 5 \quad \checkmark \text{ nfuw}$$

END OF QUESTION PAPER