

Quadratic and other graphs

Exam questions

Foundation and Higher tiers

Please write clearly in block capitals.

Name

Class

Teacher

Time allowed: 95 minutes

Materials

For this booklet you need a black pen, a pencil, a ruler, a rubber and a calculator for Section B.

Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- **Section A** (questions 1 to 12): you must not use a calculator.
- **Section B** (questions 13 to 21): you may use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 83.

Advice

- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

For teacher’s use

Q	Mark	Q	Mark
1		12	
2		13	
3		14	
4		15	
5		16	
6		17	
7		18	
8		19	
9		20	
10		21	
11			
TOTAL			

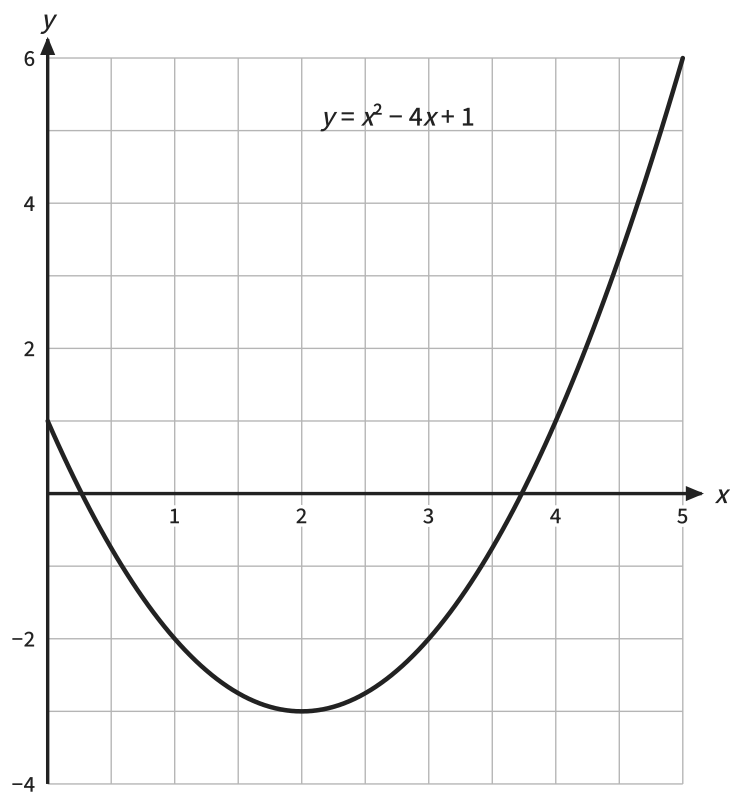
Section A



You must not use a calculator

Do not
write
outside
the box

- 1** Here is the graph of $y = x^2 - 4x + 1$ for values of x from 0 to 5



- (a)** Use the graph to find the value of y when $x = 4.5$

Answer _____

[1 mark]

- (b)** Use the graph to find the two values of x when $y = -2$

Answer _____

[2 marks]

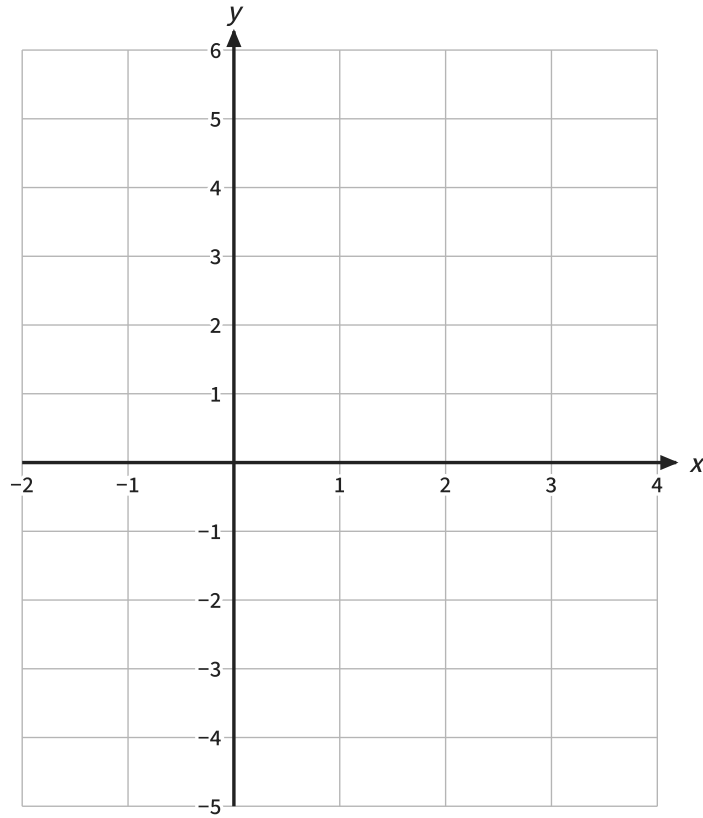
2

- (a) Complete the table of values for $y = x^2 - 2x - 3$

x	-2	-1	0	1	2	3	4
y	5		-3	-4			5

[2 marks]

- (b) On the grid, draw the graph of $y = x^2 - 2x - 3$ for values of x from -2 to 4

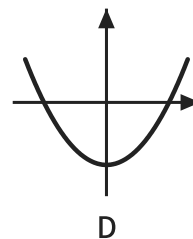
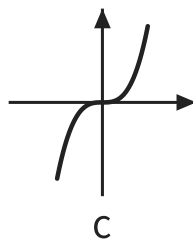
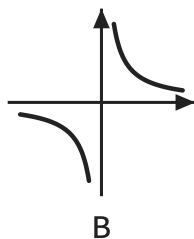
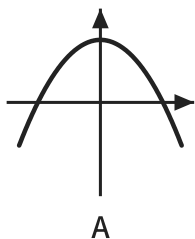


[2 marks]

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3 Here are sketches of four graphs.

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Write the letter of each graph next to its equation.

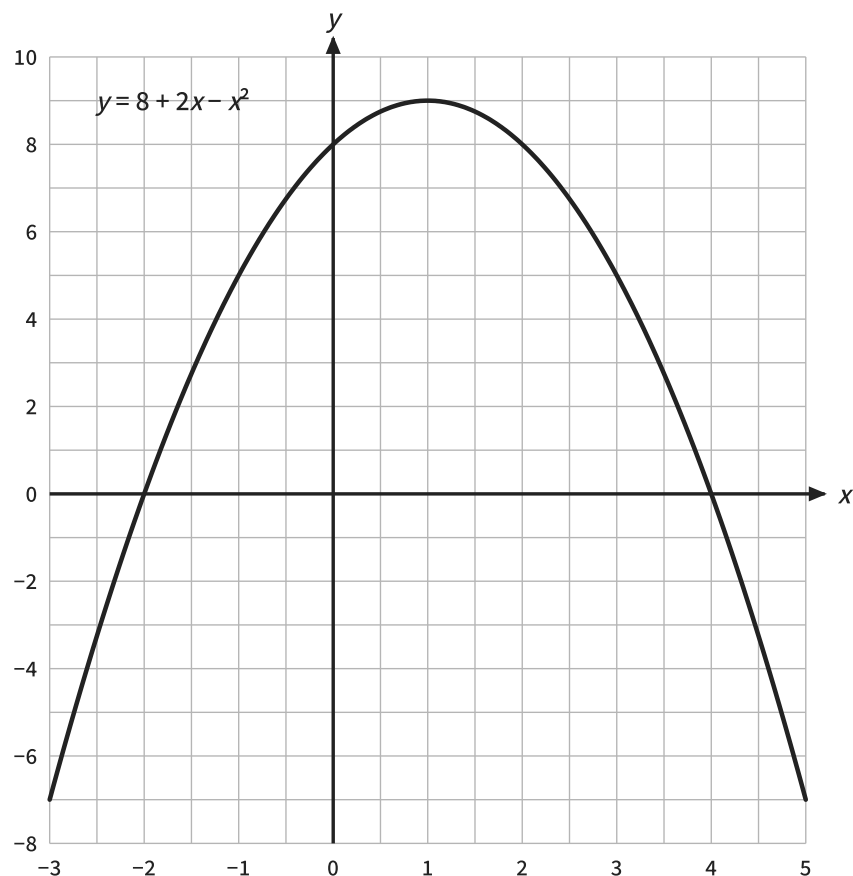
Equation	Graph
$y = x^3$	
$y = 4 - x^2$	
$y = \frac{1}{x}$	
$y = x^2 - 4$	

[3 marks]

4

Here is the graph of $y = 8 + 2x - x^2$

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- (a) Write down the roots of $8 + 2x - x^2 = 0$

Answer _____

[1 mark]

- (b) Write down the coordinates of the turning point of the graph.

Answer _____

[1 mark]

- (c) Use the graph to estimate the solutions of $8 + 2x - x^2 = 6$

Answer _____

[2 marks]

5 The graph of $y = x^2 + bx + c$ crosses the x -axis at $(2, 0)$ and $(6, 0)$

(a) Work out the coordinates of the turning point of the graph.

Answer _____

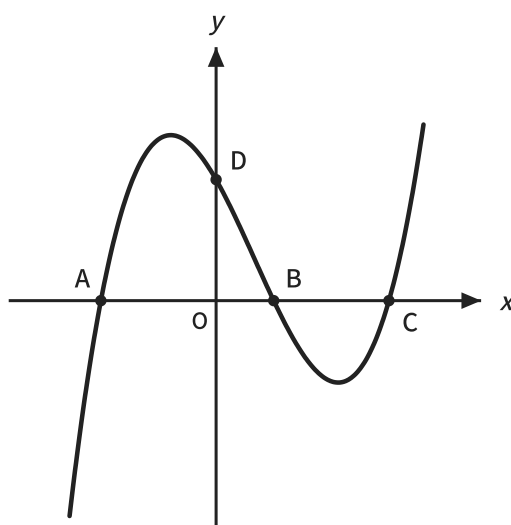
[2 marks]

(b) Write down the coordinates of the point where the graph crosses the y -axis.

Answer _____

[1 mark]

6 The sketch shows the graph of $y = (x + 2)(x - 1)(x - 3)$
The graph crosses the x -axis at A, B and C, and the y -axis at D.



Not drawn accurately

Write down the coordinates of A, B, C and D.

A (_____, _____)

B (_____, _____)

C (_____, _____)

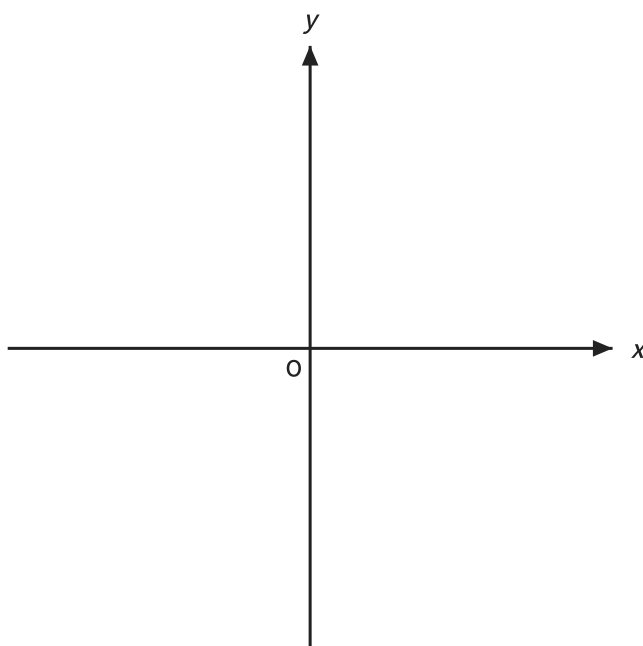
D (_____, _____)

[3 marks]

7

Sketch the graph of $y = (x - 3)^2 - 4$

Label the coordinates of the turning point and of any points where the graph crosses the axes.



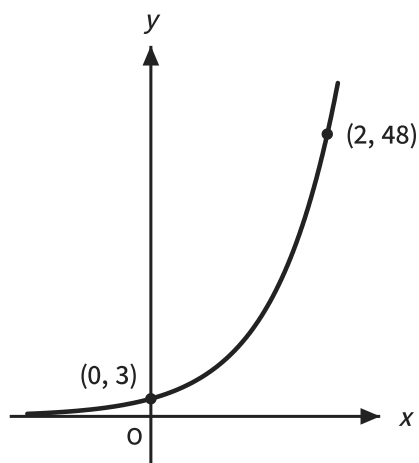
[3 marks]

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8

The sketch shows the graph of $y = ab^x$ where a and b are positive numbers. The graph passes through the points $(0, 3)$ and $(2, 48)$

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Not drawn accurately

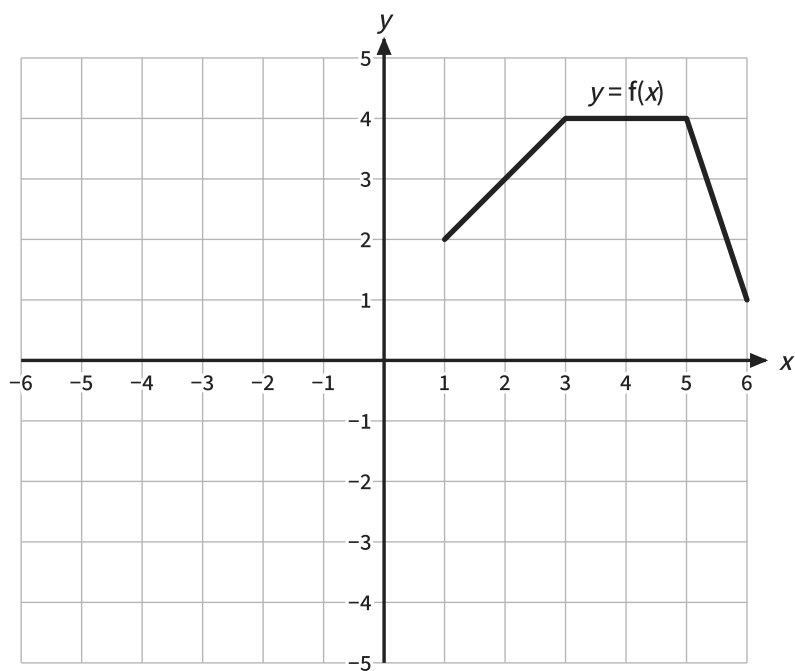
Work out the values of a and b .

Answer _____

[3 marks]

- 9 The graph of $y = f(x)$ is drawn on the grid.

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- (a) On the same grid, draw the graph of $y = f(x) - 3$

[2 marks]

- (b) The graph of $y = f(x)$ is reflected in the y -axis.
Write down the equation of the new graph.

Answer _____

[1 mark]

- 10** The graph of $y = f(x)$ has a turning point at $(3, -5)$

(a) Write down the coordinates of the turning point of $y = f(x - 2)$

Answer _____

[1 mark]

(b) Write down the coordinates of the turning point of $y = -f(x)$

Answer _____

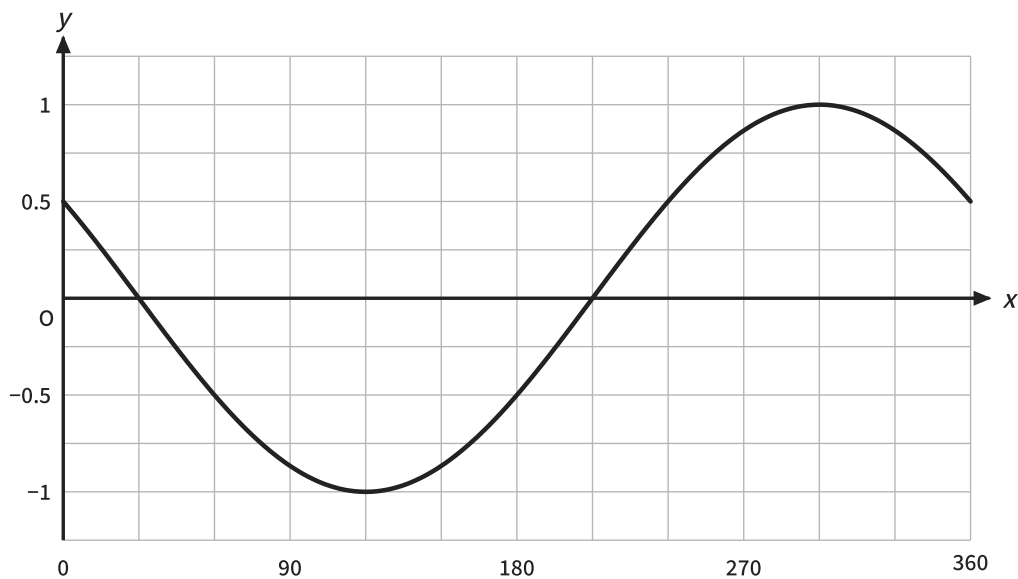
[1 mark]

(c) Write down the coordinates of the turning point of $y = f(-x) + 1$

Answer _____

[1 mark]

- 11** The graph shows $y = \cos(x + a)$ for $0^\circ \leq x \leq 360^\circ$, where $0 < a < 180$



(a) Work out the value of a .

Answer _____

[2 marks]

(b) Write down the coordinates of the minimum point of the graph.

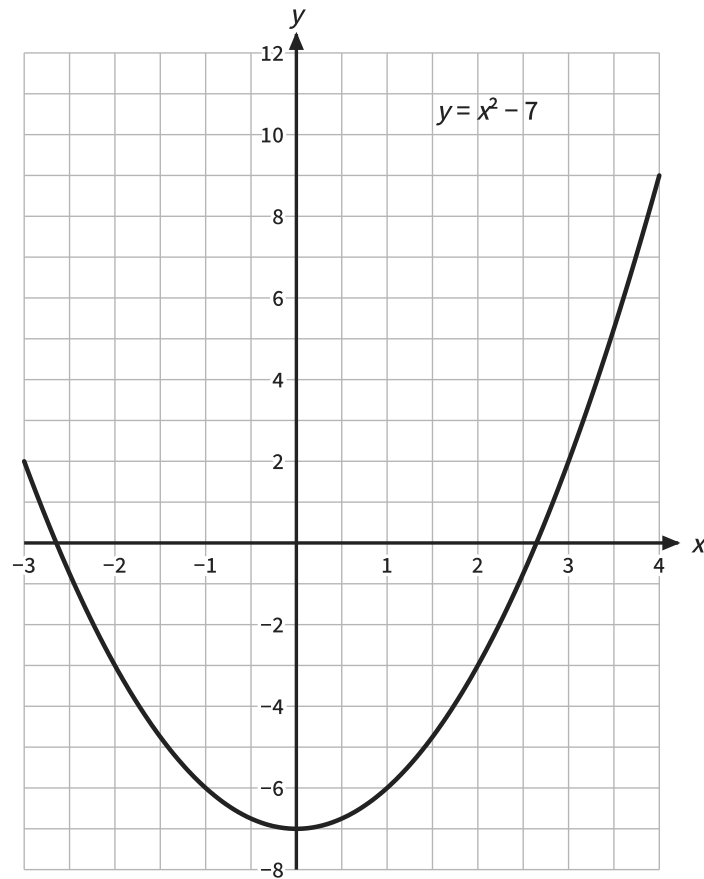
Answer _____

[1 mark]

12

Here is the graph of $y = x^2 - 7$

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By drawing a suitable straight line on the grid, find estimates for the solutions of $x^2 - x - 5 = 0$

Answer _____

[3 marks]

Section B



You may use a calculator

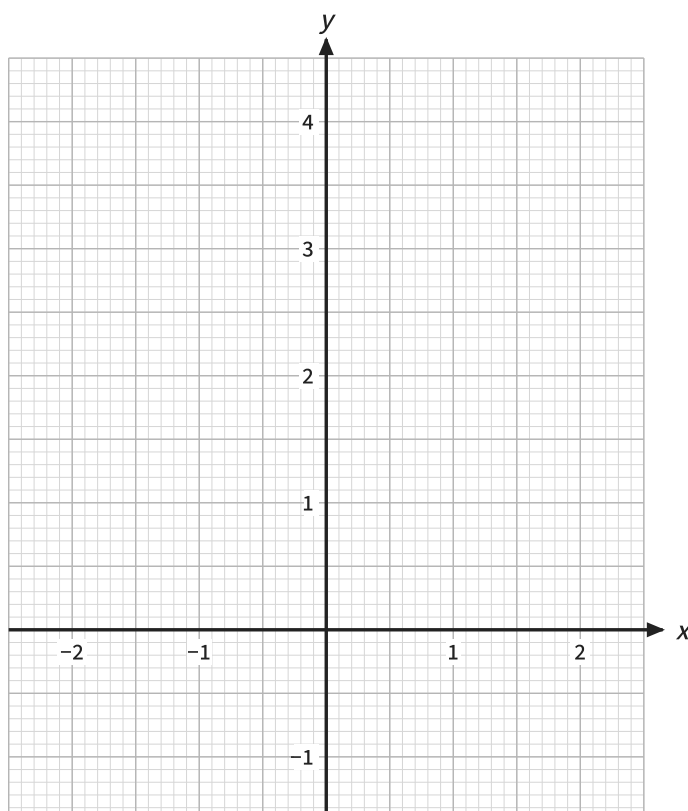
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- 13** (a) Complete the table of values for $y = x^3 - 3x + 1$

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	-1		3		1		-1		3

[2 marks]

- (b) On the grid, draw the graph of $y = x^3 - 3x + 1$ for values of x from -2 to 2



[2 marks]

- (c) Use your graph to estimate the three solutions of $x^3 - 3x + 1 = 0$

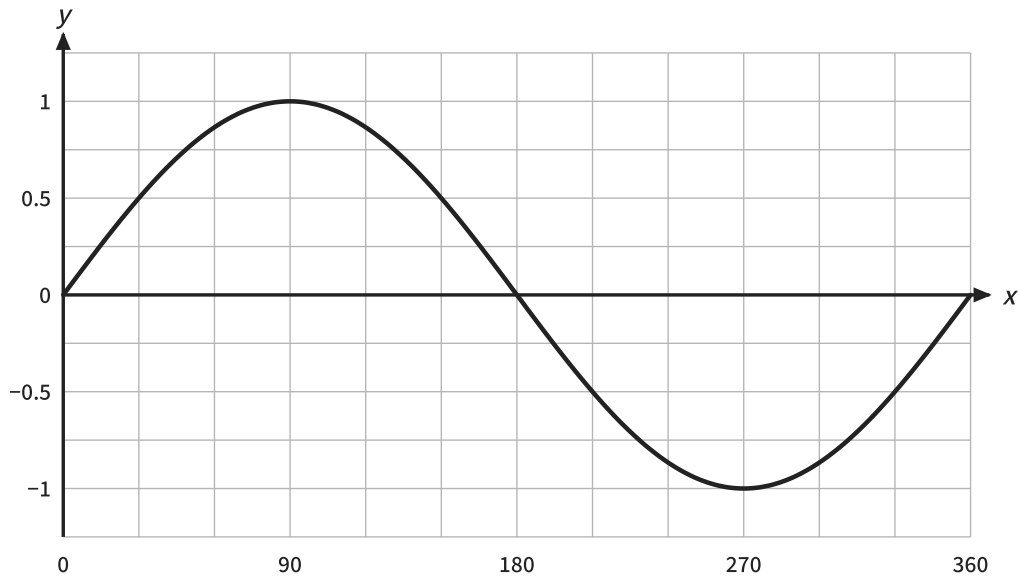
Answer _____

[2 marks]

14

Here is the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$

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- (a) Write down the coordinates of the maximum point of the graph.

Answer _____

[1 mark]

- (b) $\sin 30^\circ = 0.5$

Use the graph to find another value of x between 0° and 360° for which $\sin x = 0.5$

Answer _____ degrees

[1 mark]

- (c) Solve $\sin x = -0.5$ for $0^\circ \leq x \leq 360^\circ$

Answer _____ degrees

[2 marks]

- 15** The value, £ V , of an e-bike t years after it is bought is given by

$$V = 2450 \times 0.82^t$$

- (a) By what percentage does the value of the e-bike go down each year?

Answer _____ %

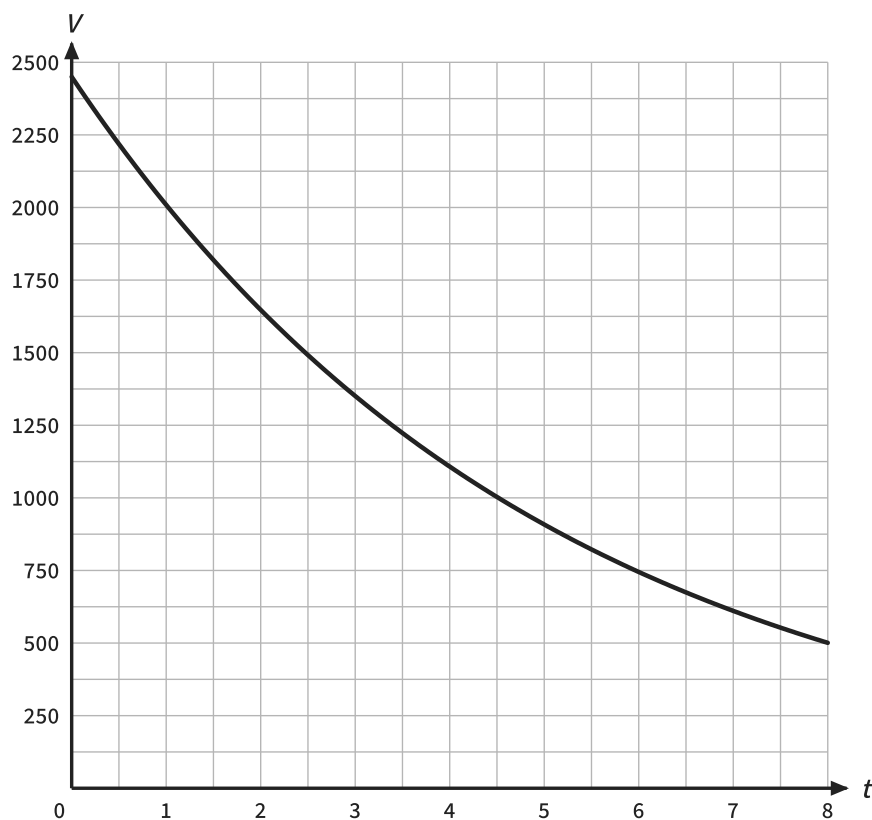
[1 mark]

- (b) Work out the value of the e-bike 3 years after it is bought.

Answer £ _____

[2 marks]

- (c) The graph of $V = 2450 \times 0.82^t$ is drawn on the grid.
Use the graph to estimate how long it takes for the value of the e-bike to halve.



Answer _____ years

[2 marks]

16

A marathon is 42.195 km long.

A runner who keeps to a steady speed of v km/h takes t hours to finish, where

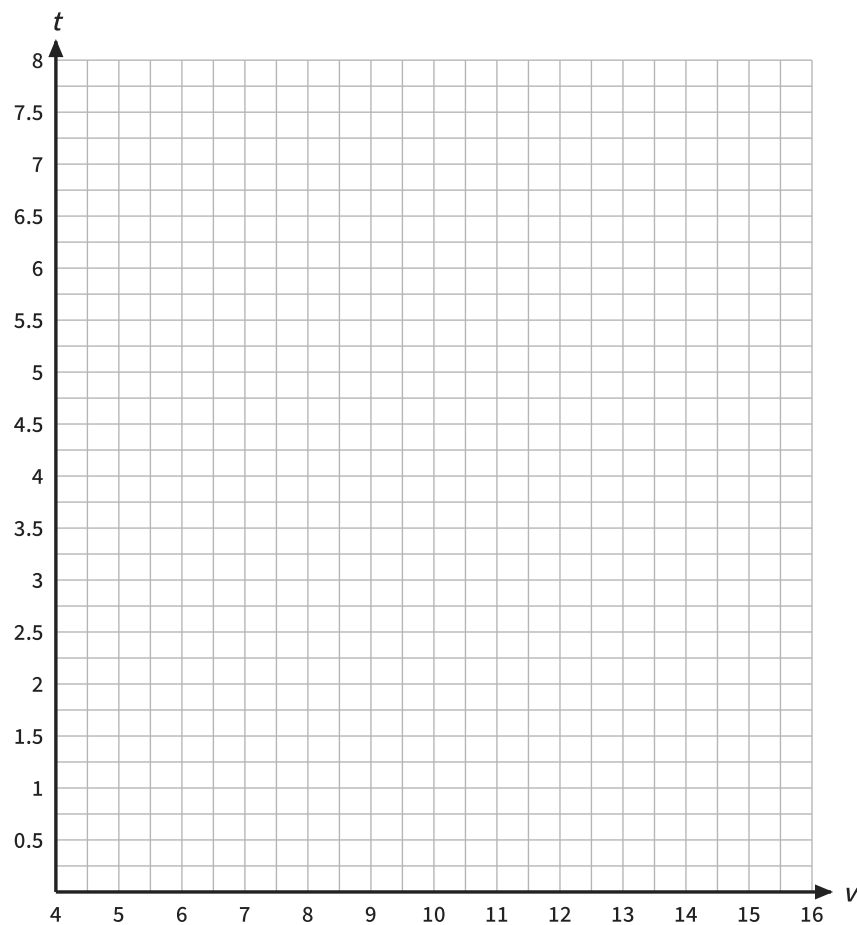
$$t = \frac{42.195}{v}$$

- (a) Complete the table. Give the times to 2 decimal places.

Speed (v km/h)	6	8	10	12	14	16
Time (t hours)	7.03		4.22		3.01	

[2 marks]

- (b) On the grid, draw the graph of $t = \frac{42.195}{v}$ for values of v from 6 to 16



[2 marks]

- (c) Kai wants to finish the marathon in 3 hours 45 minutes or less.
Use your graph to estimate the slowest steady speed Kai could run at.

Answer _____ km/h

[2 marks]

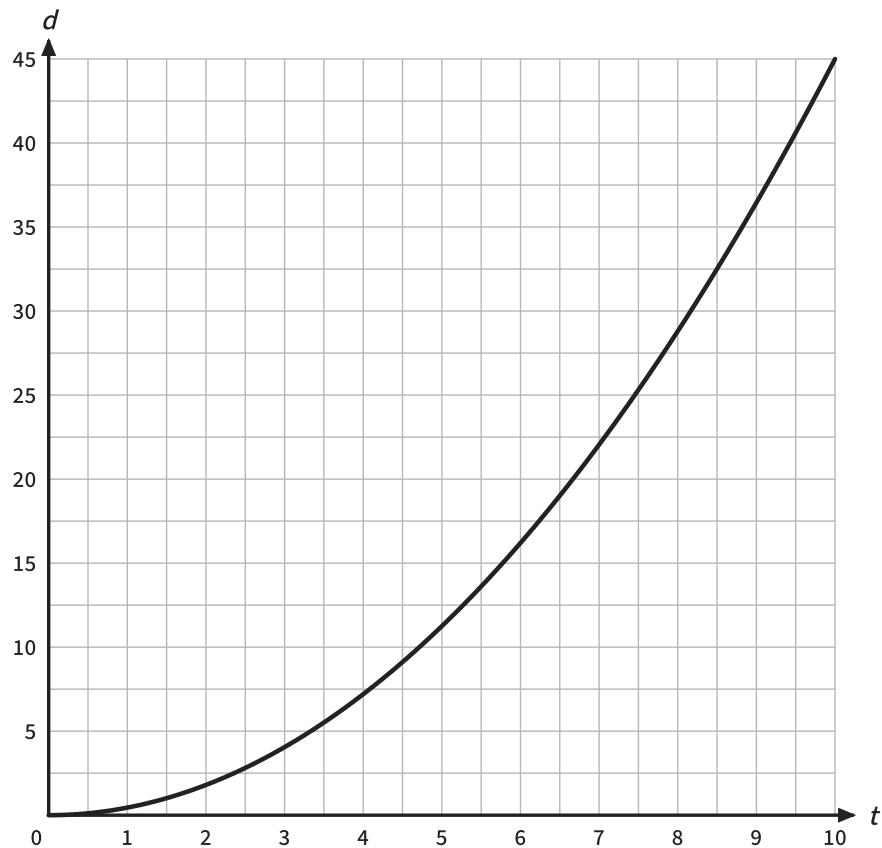
17

An e-scooter starts from rest.

The graph shows the distance, d metres, it has travelled after t seconds.

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- (a) Use the graph to estimate the speed of the e-scooter when $t = 6$



Answer _____ m/s

[3 marks]

- (b) Work out the average speed of the e-scooter between $t = 2$ and $t = 8$

Answer _____ m/s

[2 marks]

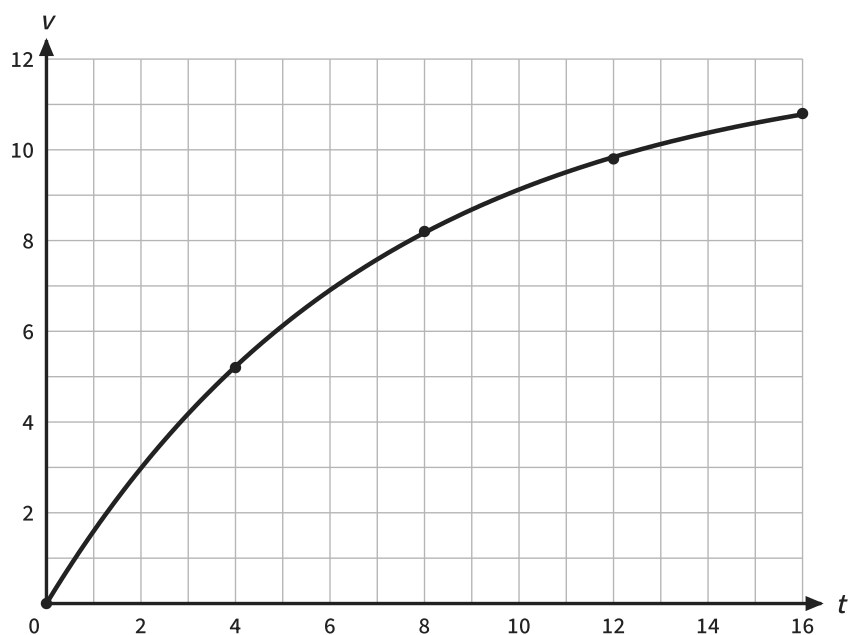
18

Lena starts cycling from rest.

The table and the graph show her speed, v m/s, t seconds after she starts.

Time (t seconds)	0	4	8	12	16
Speed (v m/s)	0	5.2	8.2	9.8	10.8

- (a) Use 4 strips of equal width to estimate the distance Lena travels in the first 16 seconds.



Answer _____ m

[3 marks]

- (b) Is your answer to part (a) an underestimate or an overestimate?
Give a reason for your answer.

[1 mark]

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- 19** **(a)** Write $x^2 - 4.6x + 3.29$ in the form $(x - a)^2 + b$

Answer _____

[2 marks]

- (b)** Write down the coordinates of the turning point of the graph of $y = x^2 - 4.6x + 3.29$

Answer _____

[1 mark]

- (c)** Hence solve $x^2 - 4.6x + 3.29 = 0$
Give your answers to 2 decimal places.

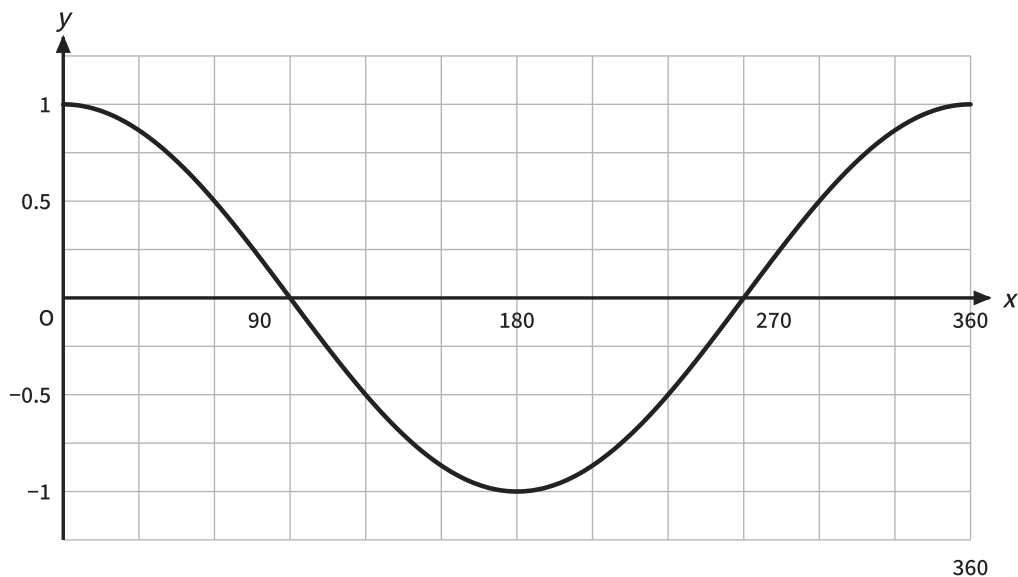
Answer _____

[2 marks]

20

Here is the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$

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the box



- (a) Solve $\cos x = -0.35$ for $0^\circ \leq x \leq 360^\circ$
Give your answers to 1 decimal place.

Answer _____ degrees
[2 marks]

- (b) Explain why the equation $\cos x = 1.2$ has no solutions.

[1 mark]

- (c) Solve $\tan x = -1.8$ for $0^\circ \leq x \leq 360^\circ$
Give your answers to 1 decimal place.

Answer _____ degrees
[2 marks]

21

Jada dives from a springboard.

Her height, h metres above the water, t seconds after she leaves the board is given by

$$h = 3 + 6.2t - 4.9t^2$$

- (a) Work out how long it takes Jada to reach the water.
Give your answer to 2 decimal places.

Answer _____ seconds

[3 marks]

- (b) Work out Jada's greatest height above the water.
Give your answer to 2 decimal places.

Answer _____ m

[2 marks]

END OF QUESTIONS