



1 The curve $y = x^2 - 6x + 8$ crosses the x -axis at $x = 2$ and at $x = 4$.

- Write down the solutions of $x^2 - 6x + 8 = 0$
- Write down the x -coordinate of the turning point of the curve.



(2 marks)

a) The solutions of $x^2 - 6x + 8 = 0$ are the x -values where the curve crosses the x -axis: $x = 2$ and $x = 4$

b) By symmetry, the turning point is halfway between the roots: $x = \frac{2 + 4}{2} = 3$

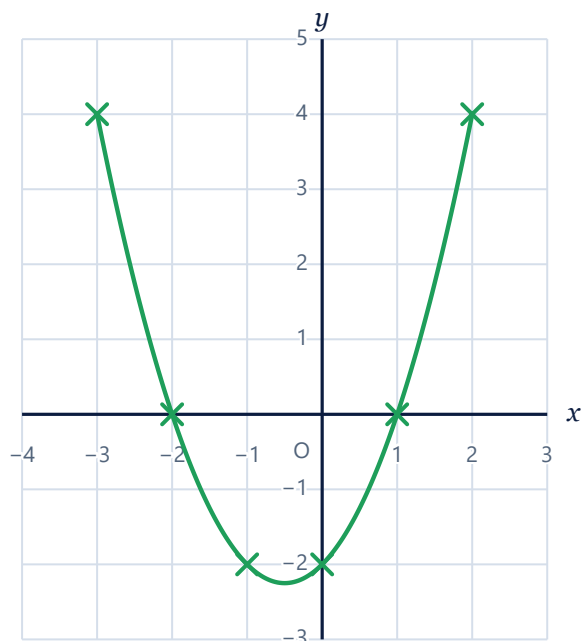
2

Here is a table of values for $y = x^2 + x - 2$

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

a. Complete the table.

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



(4 marks)

a)

$$x = -2: (-2)^2 + (-2) - 2 = 4 - 2 - 2 = 0$$

$$x = 0: 0 + 0 - 2 = -2$$

$$x = 1: 1 + 1 - 2 = 0$$

0, -2, 0

b) plot the six points

join with a smooth curve, not a ruler

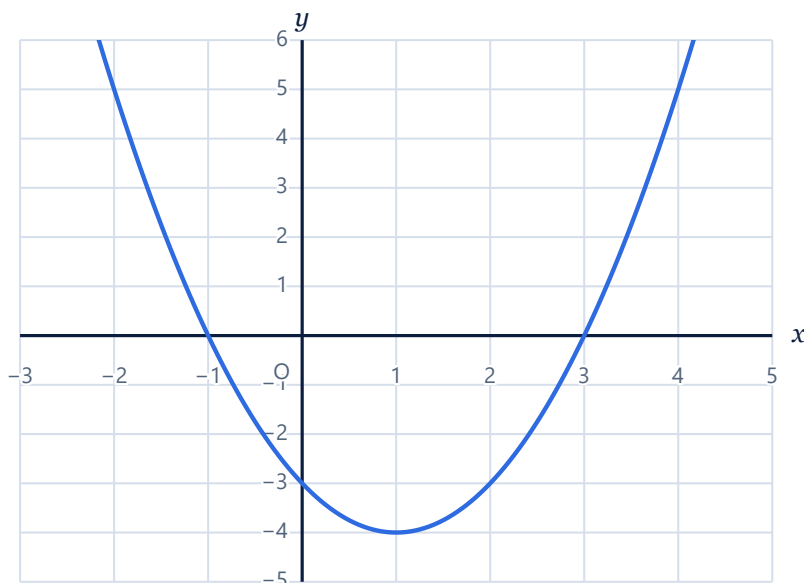
lowest point between $x = -1$ and $x = 0$

smooth U-shaped curve drawn

3

The diagram shows the graph of $y = x^2 - 2x - 3$

- Write down the coordinates of the point where the graph crosses the y -axis.
- Write down the solutions of $x^2 - 2x - 3 = 0$
- Write down the coordinates of the turning point of the graph.



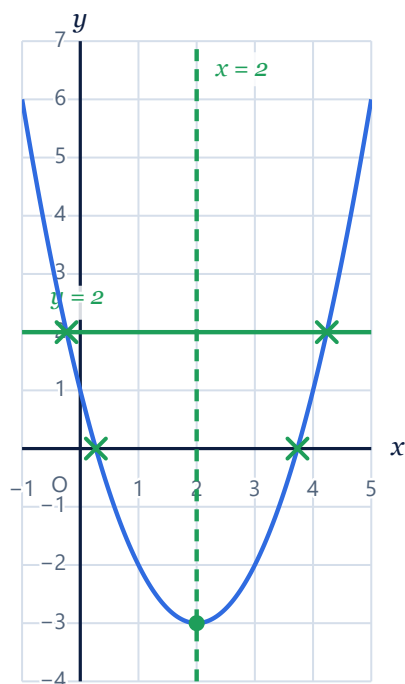
(3 marks)

- The graph crosses the y -axis where $x = 0$: $y = -3$, so $(0, -3)$
- The graph crosses the x -axis at $x = -1$ and $x = 3$
- The lowest point of the curve is at $(1, -4)$

4

The graph of $y = x^2 - 4x + 1$ is drawn on the grid.

- Write down the equation of the line of symmetry of the graph.
- Write down the coordinates of the turning point.
- Use the graph to estimate the solutions of $x^2 - 4x + 1 = 0$
- Use the graph to estimate the solutions of $x^2 - 4x + 1 = 2$



(4 marks)

a) vertical line through the lowest point

$$x = 2$$

b) lowest point

$$(2, -3)$$

c) = 0: where the curve crosses the x-axis

$$x \approx 0.3 \text{ and } x \approx 3.7$$

d) = 2: draw the line $y = 2$

read down from where it meets the curve

$$x \approx -0.2 \text{ and } x \approx 4.2$$

5

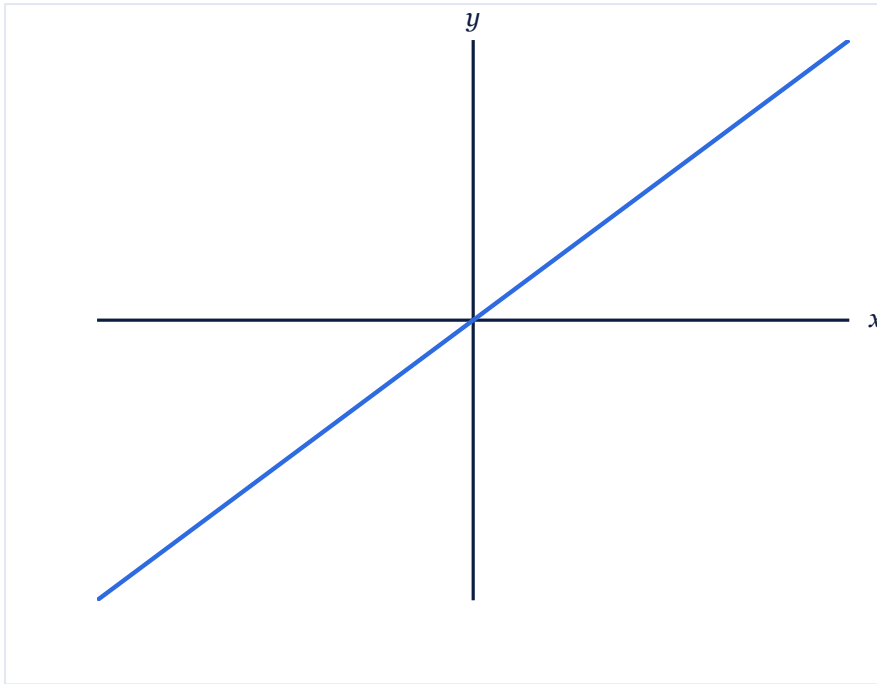
The diagram shows five sketch graphs, labelled **A**, **B**, **C**, **D** and **E**.

Match each equation below to the letter of its graph.

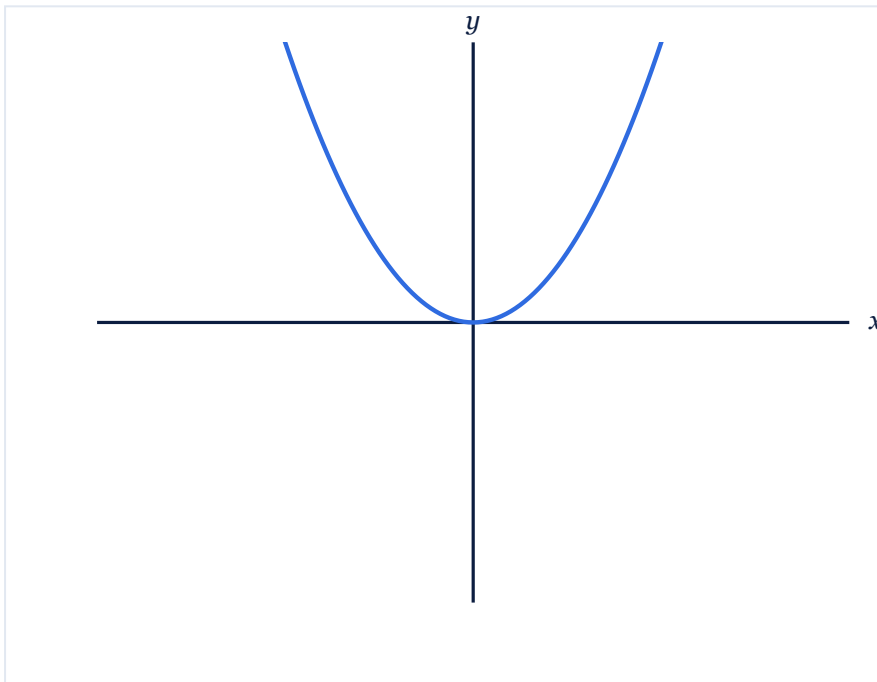
a. $y = -x^2$

b. $y = x^3$

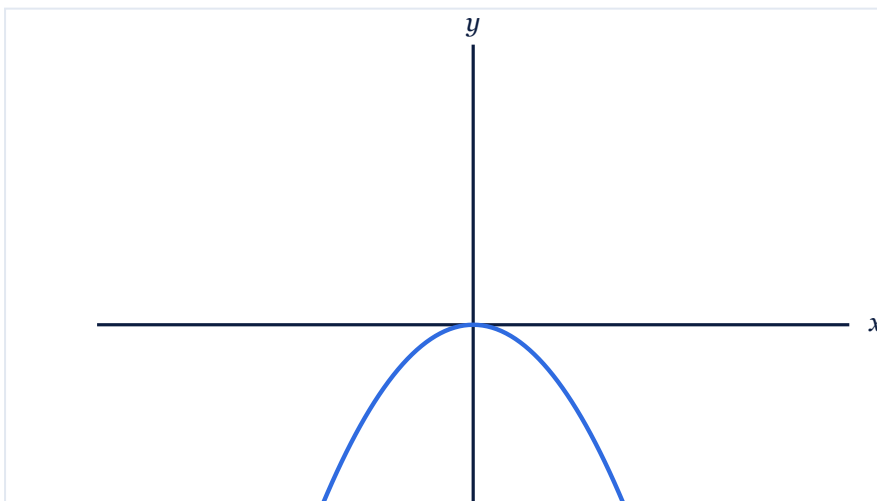
c. $y = \frac{5}{x}$



A

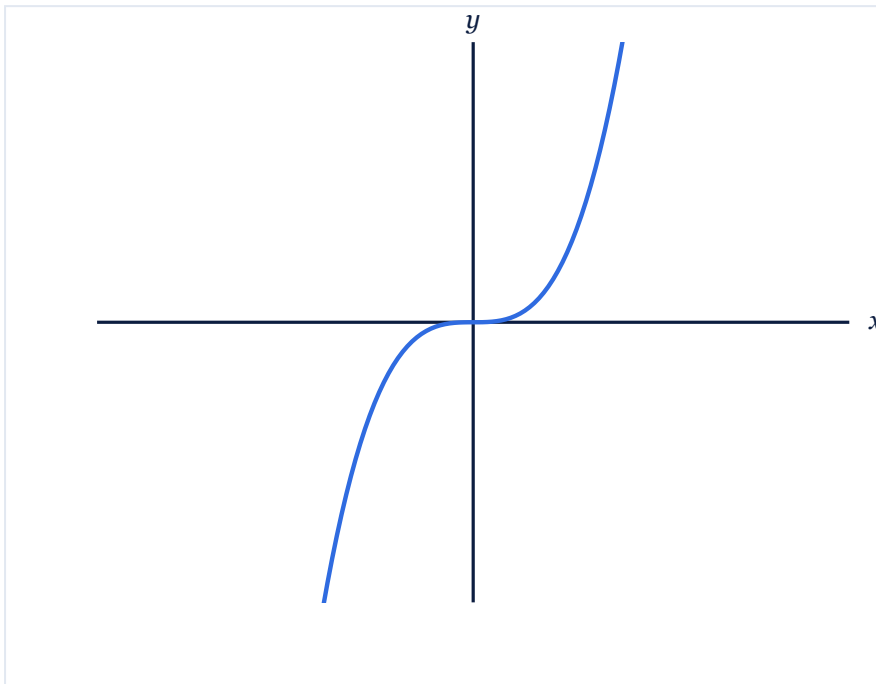


B

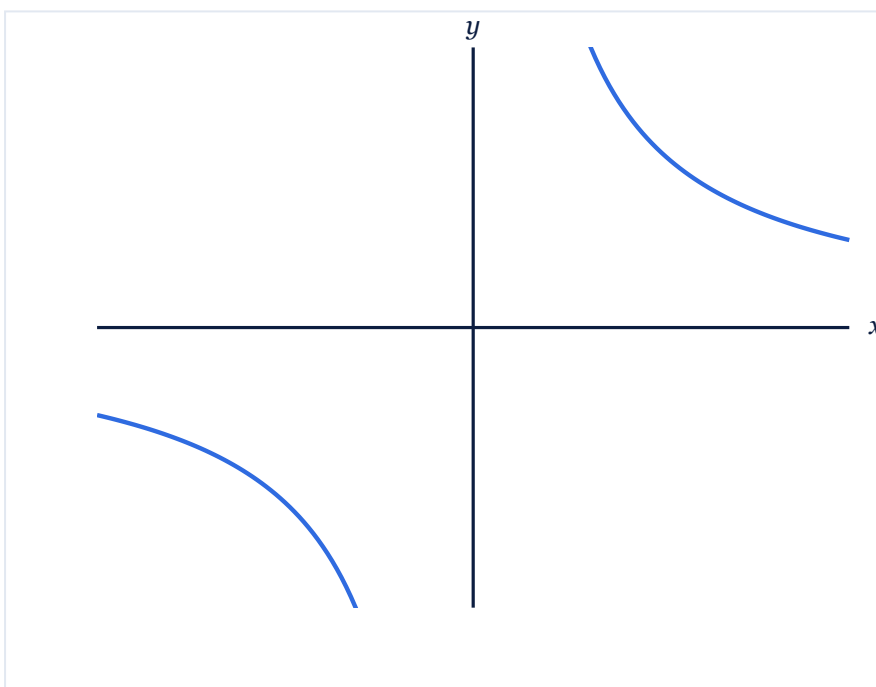




C



D



E

(3 marks)

a) $y =$

b) $y = x^3$ is an S-shaped cubic curve through the origin: graph
0

c) $y = \frac{5}{x}$ is a reciprocal curve with two branches: graph E

6

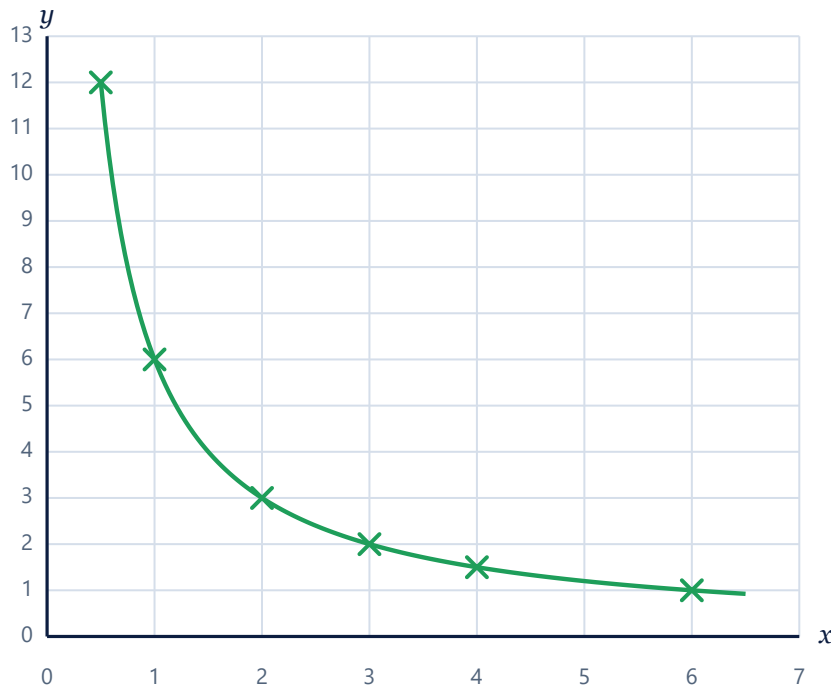
Here is a table of values for $y = \frac{6}{x}$

x	0.5	1	2	3	4	6
y		6		2		

a. Complete the table.

b. On the grid, draw the graph of $y = \frac{6}{x}$ for values of x from 0.5 to 6

c. Explain why the graph never meets the y -axis.



(4 marks)

a) $y = 6 \div x$

$$6 \div 0.5 = 12$$

$$6 \div 2 = 3$$

$$6 \div 4 = 1.5$$

$$6 \div 6 = 1$$

12, 3, 1.5, 1

b) plot and join with a smooth curve

curve drawn, getting closer to both axes

c) on the y -axis, $x = 0$

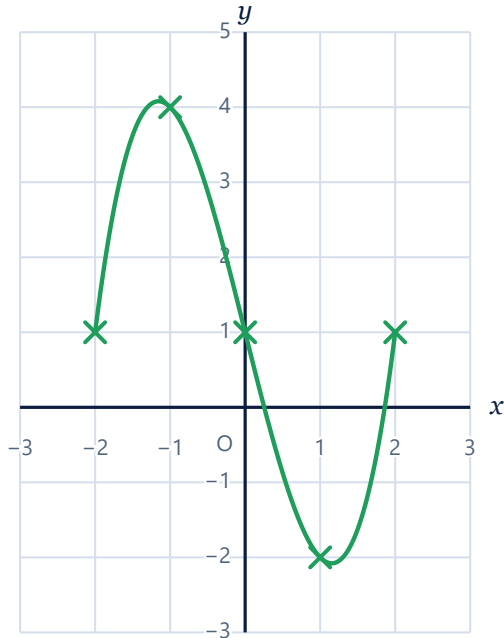
$6 \div 0$ cannot be worked out

7

Here is a table of values for $y = x^3 - 4x + 1$

x	-2	-1	0	1	2
y	1		1		

a. Complete the table.

b. On the grid, draw the graph of $y = x^3 - 4x + 1$ for values of x from -2 to 2

(4 marks)

a)

$$x = -1: (-1)^3 - 4 \times (-1) + 1 = -1 + 4 + 1 = 4$$

$$x = 1: 1 - 4 + 1 = -2$$

$$x = 2: 8 - 8 + 1 = 1$$

4, -2, 1

b) plot the five points

smooth curve: up, over the top, down, then up

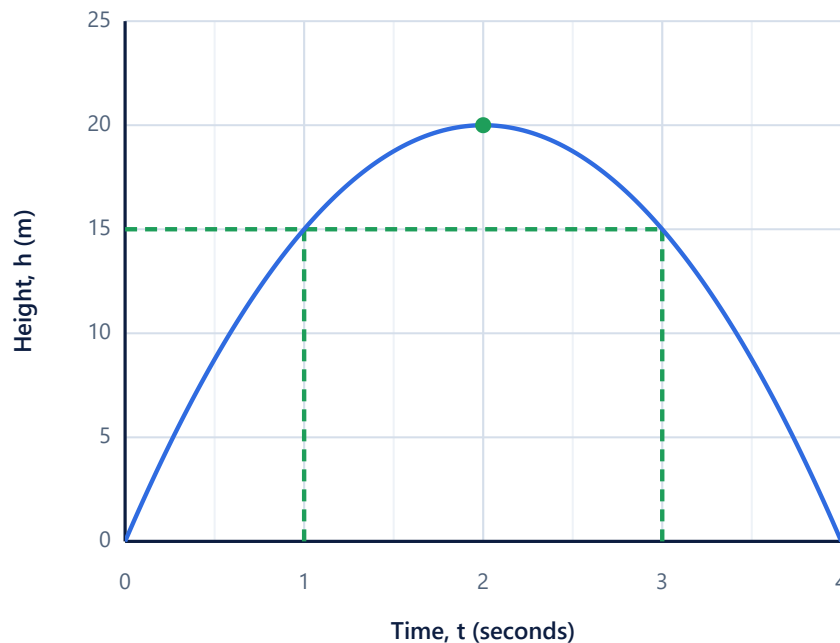
S-shaped curve drawn

8

Kwame throws a ball straight up into the air. Its height, h metres, after t seconds is given by $h = 20t - 5t^2$

The graph of h against t is drawn on the grid.

- Write down the greatest height of the ball, and the time when it reaches this height.
- Use the graph to find the two times when the ball is 15 m high.
- How long is the ball in the air?



(4 marks)

a) top of the curve

20 m after 2 seconds

b) across from 15 m, then down

meets the curve at $t = 1$ and $t = 3$

check $t = 1$

$$20 \times 1 - 5 \times 1^2 = 15$$

1 s and 3 s

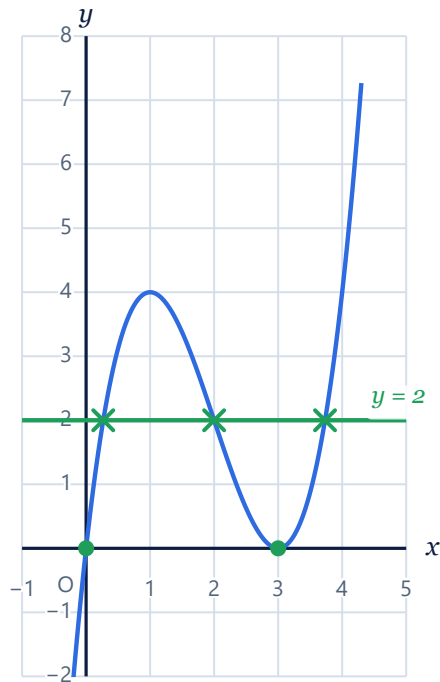
c) $h = 0$ again at $t = 4$

4 seconds

9

The graph of $y = x^3 - 6x^2 + 9x$ is drawn on the grid.

- Use the graph to write down the solutions of $x^3 - 6x^2 + 9x = 0$
- Use the graph to estimate the three solutions of $x^3 - 6x^2 + 9x = 2$



(4 marks)

a) where the curve meets the x -axis

crosses at $x = 0$, touches at $x = 3$

$$x = 0 \text{ and } x = 3$$

b) draw the line $y = 2$

meets the curve three times

check $x = 2$

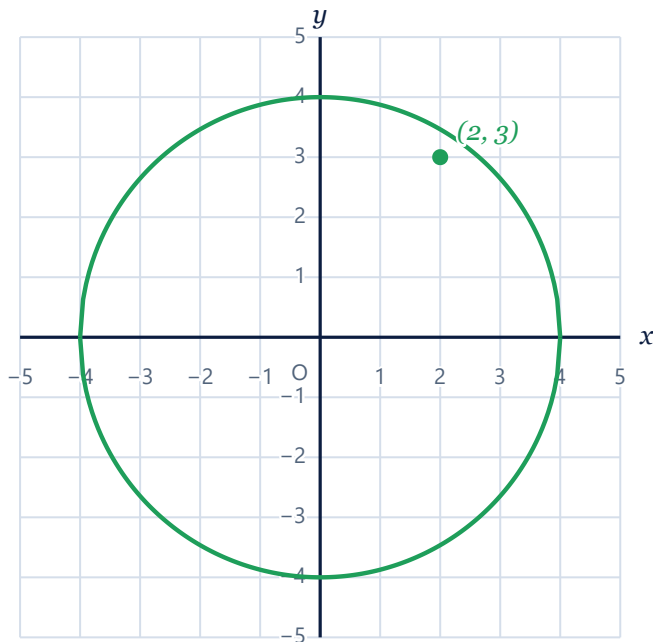
$$2^3 - 6 \times 2^2 + 9 \times 2 = 8 - 24 + 18$$

$$2^3 - 6 \times 2^2 + 9 \times 2 = 2$$

$$x \approx 0.3, x = 2, x \approx 3.7$$

10

- a. On the grid, draw the graph of $x^2 + y^2 = 16$
- b. Write down the radius of the circle $x^2 + y^2 = 49$
- c. Does the point $(2, 3)$ lie inside, on or outside the circle $x^2 + y^2 = 16$? Show how you decide.



(4 marks)

a) $x^2 + y^2 = r^2$: centre $(0, 0)$, radius r

$$r^2 = 16$$

$$r = 4$$

compasses at 4 squares, centre $(0, 0)$

circle through $(4, 0)$, $(0, 4)$, $(-4, 0)$, $(0, -4)$

b)

$$r = \sqrt{49} = 7$$

7

c)

$$2^2 + 3^2 = 4 + 9$$

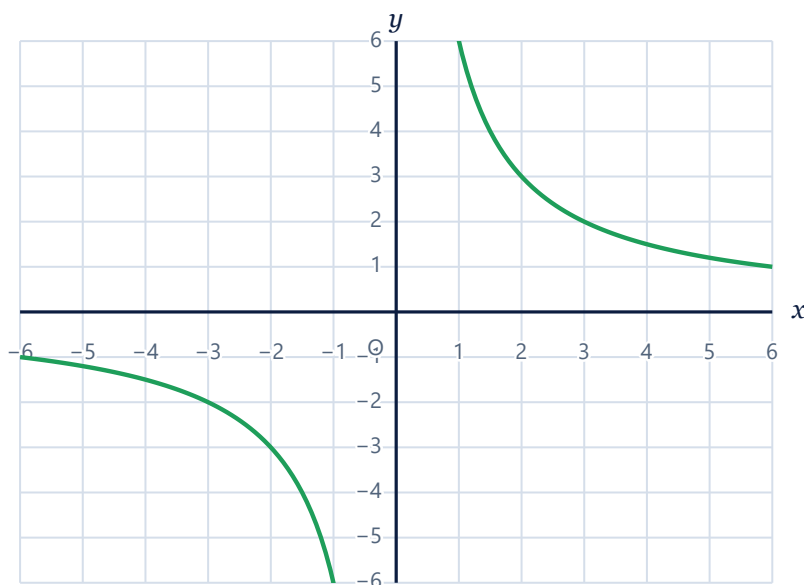
$$2^2 + 3^2 = 13$$

$$13 < 16$$

inside the circle

11

- a. On the axes, sketch the graph of $y = \frac{6}{x}$ for negative and positive values of x
- b. Write down the coordinates of any points where the graph crosses the coordinate axes.



(4 marks)

a) For positive x , y is positive (branch in the first quadrant); for negative x , y is negative (branch in the third quadrant)

a) As x gets large the curve gets closer to the x -axis; as x gets close to 0 the curve gets closer to the y -axis

b) $y = \frac{6}{x}$ can never equal 0, and x can never equal 0, so the graph never crosses either axis

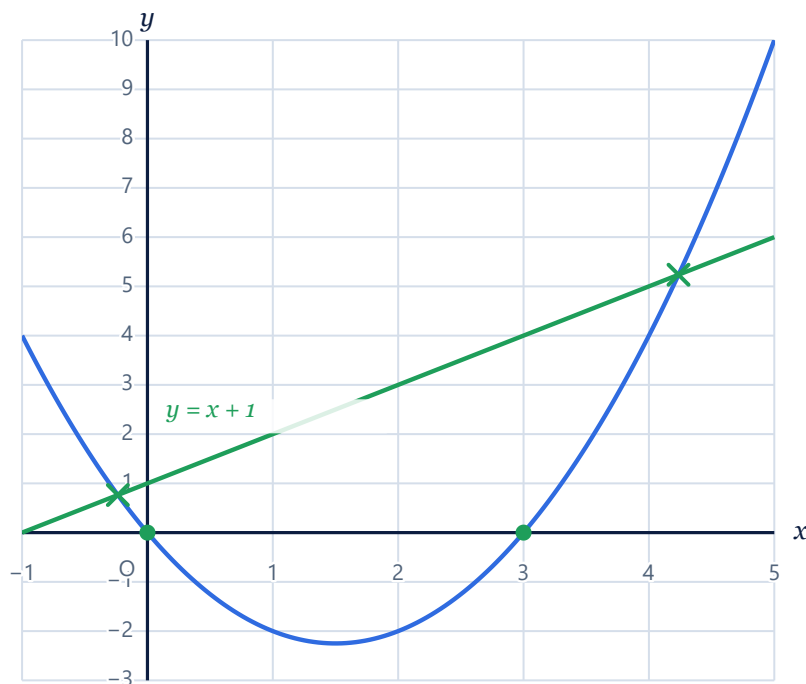
EXTENSION QUESTIONS

12

The graph of $y = x^2 - 3x$ is drawn on the grid.

a. Use the graph to solve $x^2 - 3x = 0$

b. By drawing a suitable straight line on the grid, estimate the solutions of $x^2 - 4x - 1 = 0$



(5 marks)

a) where the curve crosses the x -axis

$$x = 0 \text{ and } x = 3$$

b) make the left side $x^2 - 3x$

$$x^2 - 4x - 1 = 0$$

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

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

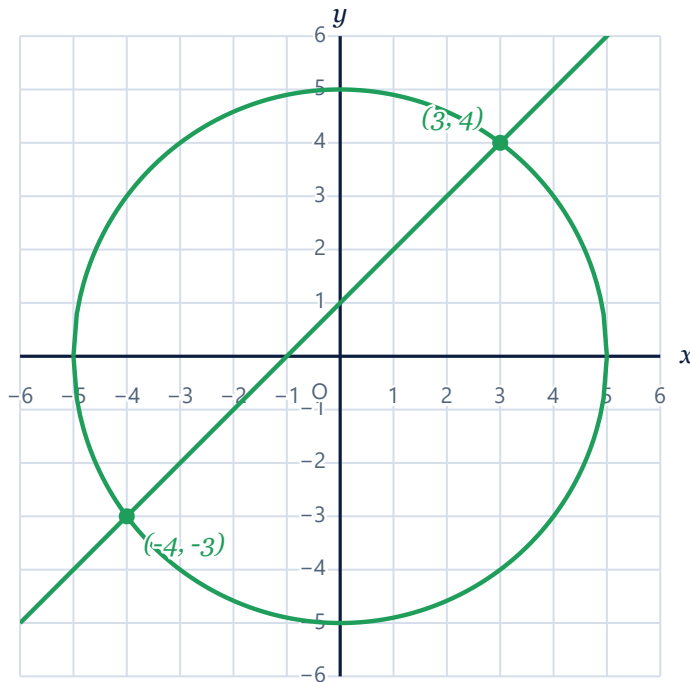
draw $y = x + 1$ through $(0, 1)$ and $(4, 5)$

read the x values where it meets the curve

$$x \approx -0.2 \text{ and } x \approx 4.2$$

13

- On the grid, draw the graph of $x^2 + y^2 = 25$
- On the same grid, draw the line $y = x + 1$
- Write down the coordinates of the points where the line meets the circle.



(4 marks)

a) radius = $\sqrt{25} = 5$, centre (0, 0)

circle drawn with radius 5

b) gradient 1, y-intercept 1

line through (0, 1) and (3, 4)

c) read the crossing points

(3, 4) and (-4, -3)

check (3, 4)

$$3^2 + 4^2 = 9 + 16 = 25$$

$$3 + 1 = 4$$

check (-4, -3)

$$(-4)^2 + (-3)^2 = 16 + 9 = 25$$

$$= -$$

(3, 4) and (-4, -3)