

A level Maths

Summer Assignment

EDEXCEL 9MA0

<https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html>

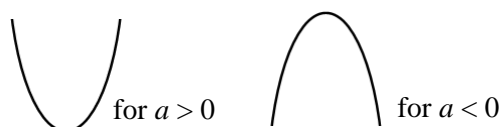
1b-4 Sketching quadratic graphs

A LEVEL LINKS

Scheme of work: 1b. Quadratic functions – factorising, solving, graphs and the discriminants

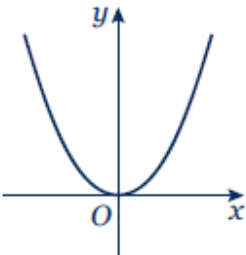

Key points

- The graph of the quadratic function $y = ax^2 + bx + c$, where $a \neq 0$, is a curve called a parabola.
- Parabolas have a line of symmetry and a shape as shown.
- To sketch the graph of a function, find the points where the graph intersects the axes.
- To find where the curve intersects the y -axis substitute $x = 0$ into the function.
- To find where the curve intersects the x -axis substitute $y = 0$ into the function.
- At the turning points of a graph the gradient of the curve is 0 and any tangents to the curve at these points are horizontal.
- To find the coordinates of the maximum or minimum point (turning points) of a quadratic curve (parabola) you can use the completed square form of the function.



Examples

Example 1 Sketch the graph of $y = x^2$.

	<p>The graph of $y = x^2$ is a parabola.</p> <p>When $x = 0$, $y = 0$.</p> <p>$a = 1$ which is greater than zero, so the graph has the shape:</p> 
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Example 2 Sketch the graph of $y = x^2 - x - 6$.

When $x = 0$, $y = 0^2 - 0 - 6 = -6$
 So the graph intersects the y -axis at $(0, -6)$

When $y = 0$, $x^2 - x - 6 = 0$

$$(x + 2)(x - 3) = 0$$

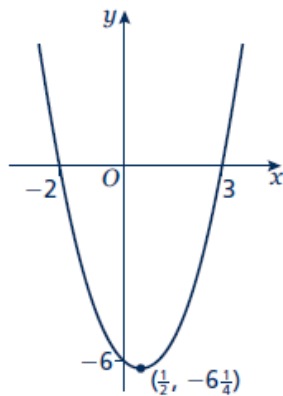
$$x = -2 \text{ or } x = 3$$

So,
 the graph intersects the x -axis at $(-2, 0)$ and $(3, 0)$

$$\begin{aligned} x^2 - x - 6 &= \left(x - \frac{1}{2}\right)^2 - \frac{1}{4} - 6 \\ &= \left(x - \frac{1}{2}\right)^2 - \frac{25}{4} \end{aligned}$$

When $\left(x - \frac{1}{2}\right)^2 = 0$, $x = \frac{1}{2}$ and

$y = -\frac{25}{4}$, so the turning point is at
 the point $\left(\frac{1}{2}, -6\frac{1}{4}\right)$



- 1 Find where the graph intersects the y -axis by substituting $x = 0$.
- 2 Find where the graph intersects the x -axis by substituting $y = 0$.
- 3 Solve the equation by factorising.

- 4 Solve $(x + 2) = 0$ and $(x - 3) = 0$.

- 5 $a = 1$ which is greater than zero, so the graph has the shape:



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- 6 To find the turning point, complete the square.
- 7 The turning point is the minimum value for this expression and occurs when the term in the bracket is equal to zero.

Practice

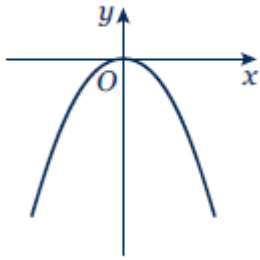
- 1 Sketch the graph of $y = -x^2$.
- 2 Sketch each graph, labelling where the curve crosses the axes.
a $y = (x + 2)(x - 1)$ **b** $y = x(x - 3)$ **c** $y = (x + 1)(x + 5)$
- 3 Sketch each graph, labelling where the curve crosses the axes.
a $y = x^2 - x - 6$ **b** $y = x^2 - 5x + 4$ **c** $y = x^2 - 4$
d $y = x^2 + 4x$ **e** $y = 9 - x^2$ **f** $y = x^2 + 2x - 3$
- 4 Sketch the graph of $y = 2x^2 + 5x - 3$, labelling where the curve crosses the axes.

Extend

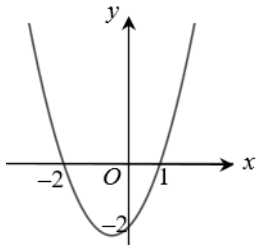
- 5 Sketch each graph. Label where the curve crosses the axes and write down the coordinates of the turning point.
a $y = x^2 - 5x + 6$ **b** $y = -x^2 + 7x - 12$ **c** $y = -x^2 + 4x$
- 6 Sketch the graph of $y = x^2 + 2x + 1$. Label where the curve crosses the axes and write down the equation of the line of symmetry.

Answers

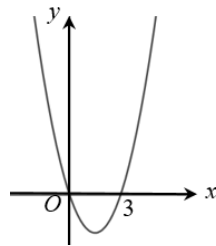
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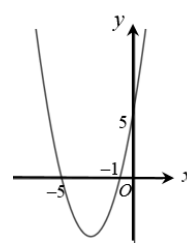
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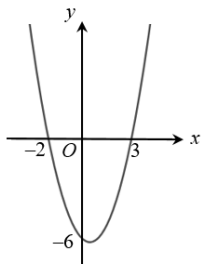
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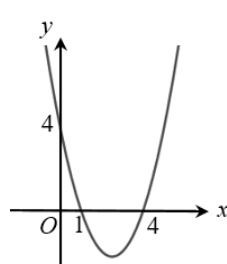
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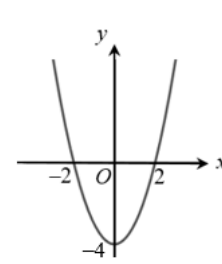
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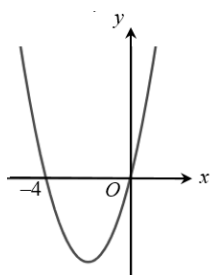
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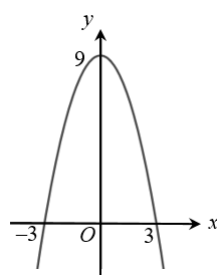
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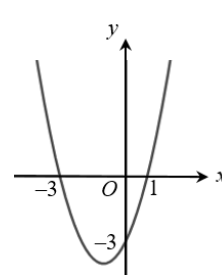
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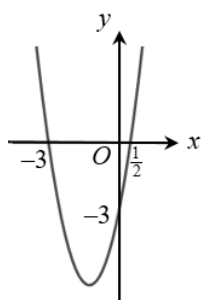
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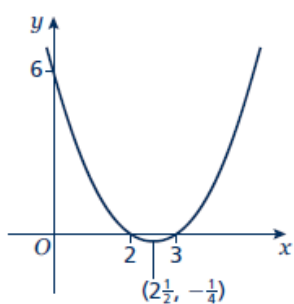
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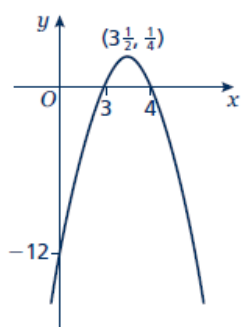
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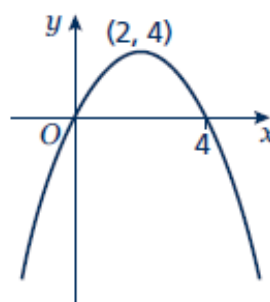
5 a



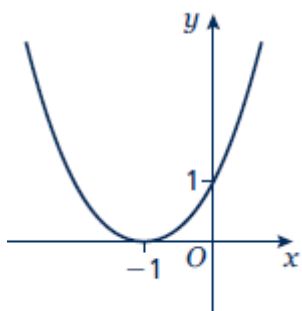
b



c



6



Line of symmetry at $x = -1$.