GCSE HIGHER · REVISION MAT 4

# Completing the square and turning points

**1** Find the roots of

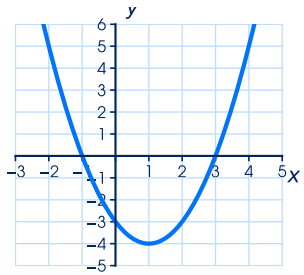
$$y = x^2 + x - 12$$

**2** Write $x^2 + 2x - 8$ in the form $(x + a)^2 + b$.

**3** $x^2 + 2x - 8 = (x + 1)^2 - 9$

Explain how this shows that the minimum value is $-9$.

**4** The curve crosses the $x$-axis at $-1$ and 3 and passes through $(0, -3)$.




Find the turning point.

**5** Show that the curve $y = x^2 - 8x + 20$ does not cross the $x$-axis.

**6** For $y = x^2 - 2x - 15$, find where it crosses each axis and its turning point.

**7** Write $2x^2 - 8x + 3$ in the form $2(x - a)^2 - b$.

**8** $y = x^2 + bx + c$ has turning point $(-3, 2)$.

Find $b$ and $c$.

Explain why the curve does not meet the $x$-axis.

Mr&Mrs MATHS

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# Completing the square and turning points

**1** $(x + 4)(x - 3) = 0$

**$x = -4$ and $x = 3$**

**2** **$(x + 1)^2 - 9$**

**3** $(x + 1)^2$ is never negative.

**Its smallest value is 0 (at $x = -1$), giving $-9$.**

**4** Symmetry: $x = 1$

$y = 1 - 2 - 3$

**$(1, -4)$**

**5** $(x - 4)^2 + 4$

**Minimum value $4 > 0$, so it never reaches $y = 0$.**

**6** $(x - 5)(x + 3)$: !$(5, 0)$, $(-3, 0)$

**$(0, -15)$**

$(x - 1)^2 - 16$: !$(1, -16)$

**7** $2(x^2 - 4x) + 3$

$2[(x - 2)^2 - 4] + 3$

**$2(x - 2)^2 - 5$**

**8** $(x + 3)^2 + 2 = x^2 + 6x + 11$

**$b = 6$, $c = 11$**

Minimum $y$ is $2 > 0$.

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