Guide to:
Completing the square

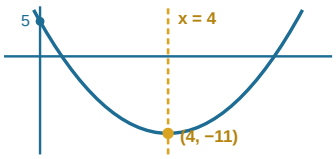
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Explanation:

To write $\mathbf{x^2 + bx + c}$ in completed square form $\mathbf{(x + p)^2 + q}$, halve the coefficient of x to get $\mathbf{p = \frac{b}{2}}$, then subtract p^2: $\mathbf{(x + \frac{b}{2})^2 - (\frac{b}{2})^2 + c}$. The graph of $y = (x + p)^2 + q$ has its **turning point (vertex) at (−p, q)** and line of symmetry $x = -p$.

When the coefficient of x^2 is not 1 ($\mathbf{ax^2 + bx + c}$), factorise **a** out of the first two terms before completing the square inside the square brackets, then multiply out by a at the end.

Example 1: Write $x^2 - 8x + 5$ in the form $(x - a)^2 + b$ and state the turning point of $y = x^2 - 8x + 5$.



Solution:

Halve −8 to get −4: $(x - 4)^2 - (-4)^2 + 5$

$= (x - 4)^2 - 16 + 5 =$ **$(x - 4)^2 - 11$**

Minimum occurs when $x - 4 = 0 \Rightarrow x = 4$, $y = -11$

Answer: $(x - 4)^2 - 11$; turning point (4, −11)

Example 2: Write $2x^2 + 12x + 7$ in the form $a(x + b)^2 + c$.

Solution:

Factorise 2 from first two terms: $2[x^2 + 6x] + 7$

Complete square inside: $2[(x + 3)^2 - 9] + 7$

Multiply out by 2: $2(x + 3)^2 - 18 + 7$

Answer: $2(x + 3)^2 - 11$

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