

Completing the square is used to solve quadratic equations that cannot be factorised and allows the turning point to be found.

For example, express  $x^2 + 8x - 7$  in the form of brackets  $(x + a)^2 + b$ .

First find the value of  $a$ .

To do this, halve the coefficient of  $x$ . Half of eight is four, so our expression starts with brackets  $(x + 4)^2$ .

If  $(x + 4)^2$  is expanded it becomes  $x^2 + 8x + 16$ .

$x^2 + 8x$  matches the first two terms of the original expression, but needs adjusting for the extra 16.

So, 16 is subtracted to get the same value as the original expression.

So, our expression becomes:  $(x + 4)^2 - 16 - 7$ , which simplifies to  $(x + 4)^2 - 23$ .

Simplify like terms to complete the square to get negative 23.

Completing the square allows the turning point of the quadratic function to be stated.

If the equation is in the form  $(x + a)^2 + b$ , then the turning point is  $(-a, b)$ .

If the equation is in the form  $(x - a)^2 + b$ , then the turning point is  $(a, b)$ .

For this example, the turning point is  $(-4, -23)$ .