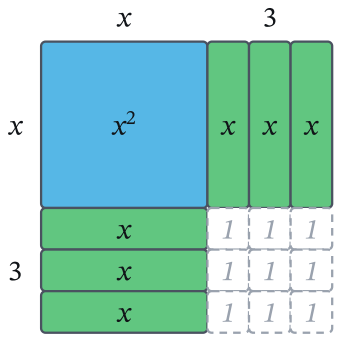
Name _____ Date _____

Solving by Completing the Square

Example



Let us solve $x^2 + 6x = 16$ as al-Khwarizmi did more than a thousand years ago. We split $6x$ into two strips of $3x$ and place them along two sides of the square x^2.

The big square is missing a corner of $3 \times 3 = 9$. We add 9 to **both sides**:

$x^2 + 6x + 9 = 25 \Rightarrow (x+3)^2 = 25 \Rightarrow x + 3 = \pm 5$

$x_1 = 2, x_2 = -8$

1 ON YOUR OWN How much must you add to get a perfect square? Fill in.

$x^2 + 8x + \square = (x + \square)^2$

$x^2 + 10x + \square = (x + \square)^2$

$x^2 - 4x + \square = (x - \square)^2$

$x^2 - 12x + \square = (x - \square)^2$

$x^2 + 3x + \square = (x + \square)^2$

2 ON YOUR OWN Solve by completing the square.

$x^2 + 4x = 12$

$x_1 = \square \quad x_2 = \square$

$x^2 - 6x = 7$

$x_1 = \square \quad x_2 = \square$

$x^2 + 10x + 16 = 0$

$x_1 = \square \quad x_2 = \square$

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

$x_1 = \square \quad x_2 = \square$

Names (pair) _____ Date _____

Remember

To $x^2 + bx$ we add the **square of half** the coefficient b: $x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$.

Whatever we add to the left side, we add to the right side too. If $a \neq 1$, we first divide the equation by a.

3 IN PAIRS We could not solve $x^2 + 4x + 1 = 0$ by factorising. Solve it by completing the square.

$x^2 + 4x =$ ☐

$x^2 + 4x +$ ☐ $=$ ☐

$(x +$ ☐ $)^2 =$ ☐

$x_1 =$ ☐ $x_2 =$ ☐

4 IN PAIRS Solve. Watch the coefficient a and the right side.

$2x^2 + 12x - 14 = 0$

$x^2 + 6x + 13 = 0$

5 IN PAIRS Why is the method called *completing the square*? Explain using the picture on the first page.

The Algebra Tiles app · otooly.com/algebra-tiles

On the **Completing the square** mat, build $x^2 + 6x$ into a square and count the missing unit tiles. Then on the **Equation** mat, build $x^2 + 6x = 16$ and add the same to both sides.

★ ON YOUR OWN **Exit card.** Solve by completing the square: $x^2 - 8x = 9$.