Names (pair) _____ Date _____

Completing the Square

Example

Half the coefficient of x is 3, and $3^2 = 9$. Add and subtract 9:

$$x^2 + 6x + 5 = (x^2 + 6x + 9) - 9 + 5 = (x + 3)^2 - 4 \Rightarrow V(-3, -4)$$

With tiles: arrange x^2 and six x tiles into a square with side $x + 3$; 9 unit tiles are missing in the corner.

Remember

Completing the square: if k is half of the coefficient b, then $x^2 + bx + c = (x + k)^2 - k^2 + c$. We read the vertex $V(-k, c - k^2)$ straight from the vertex form.

1 ON YOUR OWN Step by step: complete the table.

b	2	6	8	-4	-10
$k = \frac{b}{2}$					
k^2					

2 ON YOUR OWN Complete the square and read off the vertex.

$x^2 + 4x + 1 = (x\square)^2 \square \Rightarrow V(\square, \square)$

$x^2 - 6x + 10 = (x\square)^2 \square \Rightarrow V(\square, \square)$

$x^2 + 2x - 3 = (x\square)^2 \square \Rightarrow V(\square, \square)$

$x^2 - 8x + 12 = (x\square)^2 \square \Rightarrow V(\square, \square)$

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

Completing the square mode: in the *Display* menu choose the letters x, y, z, then arrange $x^2 + bx + c$ into a square and see how many unit tiles are missing or left over.

Names (pair) _____ Date _____

3 ON YOUR OWN **How many tiles are missing?** Find c so that the expression is a perfect square, and write it.

Expression	c	Perfect square
$x^2 + 4x + c$	☐	☐
$x^2 + 10x + c$	☐	☐
$x^2 - 6x + c$	☐	☐

4 ON YOUR OWN Write in vertex form and read off the vertex.

$x^2 + 8x + 10 =$ ☐ $V($☐,☐$)$

$x^2 - 2x + 5 =$ ☐ $V($☐,☐$)$

Challenge: $x^2 + 3x + 1 =$ ☐ $V($☐,☐$)$

5 IN PAIRS **Are there any zeros?** Without calculating, decide whether the function has zeros. Explain using the vertex.

Function	Has zeros?	Why?
$(x + 2)^2 - 3$	**yes** / **no**	☐
$(x - 3)^2 + 1$	**yes** / **no**	☐

Working:

_____

_____

_____

★ ON YOUR OWN **Exit card.** Write in vertex form: $x^2 - 2x - 8 =$ ☐