Names (pair) _____ Date _____

The Vertex from Standard Form

Example

When $a \neq 1$, first factor a out of the terms with x:

$$2x^2 - 8x + 3 = 2(x^2 - 4x) + 3 = 2[(x-2)^2 - 4] + 3 = 2(x-2)^2 - 5$$

With the formula: $p = -\frac{b}{2a} = -\frac{-8}{4} = 2$, and $q = f(2) = 8 - 16 + 3 = -5$.

Remember

The vertex of $f(x) = ax^2 + bx + c$ is $V(p, q)$, where $p = -\frac{b}{2a}$ and $q = f(p)$. For $a > 0$ the value q is the **smallest** value of the function, and for $a < 0$ the **largest**.

1 ON YOUR OWN Write in vertex form. First factor out a.

$2x^2 + 4x - 1 =$ ☐

$-x^2 + 6x - 5 =$ ☐

$3x^2 - 12x + 7 =$ ☐

Working:

Names (pair) _____ Date _____

2 IN PAIRS **Two ways.** One student completes the square, the other works out $p = -\frac{b}{2a}$ and $q = f(p)$. Compare the vertices and swap roles.

Function	Completing the square	$p = -\frac{b}{2a}$	$q = f(p)$
$x^2 - 10x + 21$			
$2x^2 + 8x + 3$			
$-x^2 + 4x$			

3 ON YOUR OWN **Largest or smallest value?** Use the formula to find the vertex and say whether q is the largest or the smallest value of the function.

Function	p	q	The value q is
$f(x) = -2x^2 + 8x - 1$			largest / smallest
$g(x) = 3x^2 + 6x + 4$			largest / smallest

4 IN A GROUP **The fence again.** The area of a garden with 20 m of fencing is $A(x) = -x^2 + 10x$. Use the vertex formula to find the x that gives the largest area, and the area itself.

$x =$ _____ m $A =$ _____ m²

★ ON YOUR OWN **Exit card.** The vertex of $f(x) = 2x^2 + 4x - 3$ is $V($_____, _____$)$