

Name: \_\_\_\_\_

### Using the Middle $x$ to Graph a Quadratic

Every quadratic graph needs three parts to be complete:

1. The vertex
2. The  $x$ -intercept(s)
3. The  $y$ -intercept

The most important of these – when it comes to graphing, at least – is the vertex (the turning point). The vertex  $x$ -value is the middle  $x$ -value on the graph. You need points on both sides (preferably the intercepts) in order to complete the graph. Graphing a quadratic without knowing the vertex requires time-consuming guesswork, because you have to keep plugging in  $x$ 's until you luck into it.

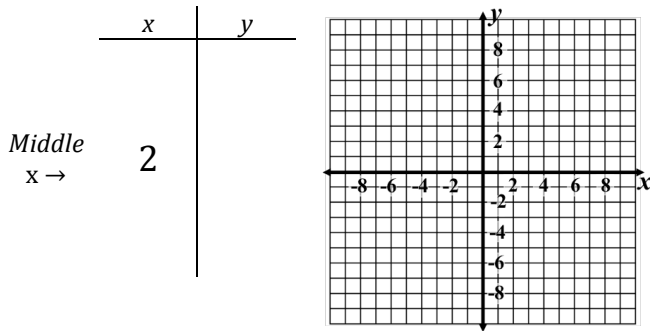
Depending on how the quadratic equation is written, though, you will be able to determine the vertex  $x$  using one of the three traditional methods:

Standard Form	Vertex Form	Factored Form
$f(x) = ax^2 + bx + c$	$f(x) = a(x - h)^2 + k$	$f(x) = a(x - r_1)(x - r_2)$
$x = \frac{-b}{2a}$ <i>(take the opposite sign of the <math>b</math>, and divide it by the result of 2 times <math>a</math>)</i>	$x = +h$ <i>(take the opposite sign of the <math>h</math>)</i>	$x = \frac{(+r_1) + (+r_2)}{2}$ <i>(take the opposite sign of both <math>r</math>'s, add them up, then divide by 2)</i>

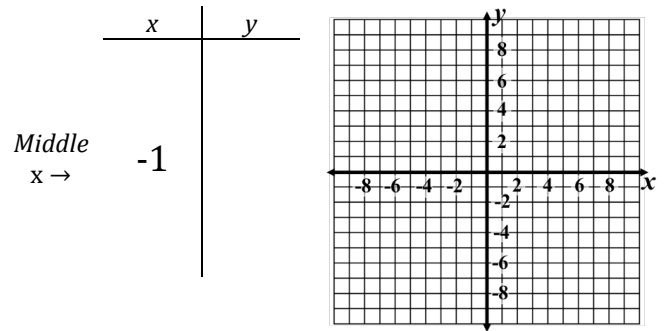
**For each equation below, determine the middle  $x$ -value. You will be graphing each quadratic on the back.**

Standard Form	Vertex Form	Factored Form
<p><b>Example</b></p> $g(x) = 3x^2 - 12x + 8$	<p><b>Example</b></p> $h(x) = -(x + 3)^2 - 5$	<p><b>Example</b></p> $j(x) = -2(x - 7)(x + 9)$
$f(x) = \boxed{a}x^2 \boxed{+b}x \boxed{+c}$	$f(x) = \boxed{a}(x \boxed{-h})^2 \boxed{+k}$	$f(x) = \boxed{a}(x \boxed{-r_1})(x \boxed{-r_2})$
$g(x) = \boxed{3}x^2 \boxed{-12}x \boxed{+8}$	$h(x) = \boxed{-1}(x \boxed{+3})^2 \boxed{-5}$	$j(x) = \boxed{-2}(x \boxed{-7})(x \boxed{+9})$
$x = \frac{-b}{2a}$ I need the opp. sign of $b$ : $+12$ & $a$ : $3$	$x = +h$ I need the opp. sign of $h$ : $-3$	$x = \frac{(+r_1) + (+r_2)}{2}$ I need the opp. sign of $r_1$ : $+7$ & the opp. sign of $r_2$ : $-9$
$x = \frac{+12}{2(3)}$	$x = -3$ The middle $x$ is $\boxed{x = -3}$ .	$x = \frac{(+7) + (-9)}{2}$
$x = \frac{12}{6}$		$x = \frac{7 - 9}{2}$
$x = 2$ The middle $x$ is $\boxed{x = 2}$ .		$x = \frac{-2}{2}$
		$x = -1$ The middle $x$ is $\boxed{x = -1}$ .
1. $k(x) = -3x^2 + 12x - 9$	3. $n(x) = 3(x - 1)^2 - 3$	5. $q(x) = -(x + 7)(x + 1)$
2. $m(x) = -2x^2 - 4x - 2$	4. $p(x) = 2(x + 3)^2 - 8$	6. $r(x) = (x + 2)(x - 4)$

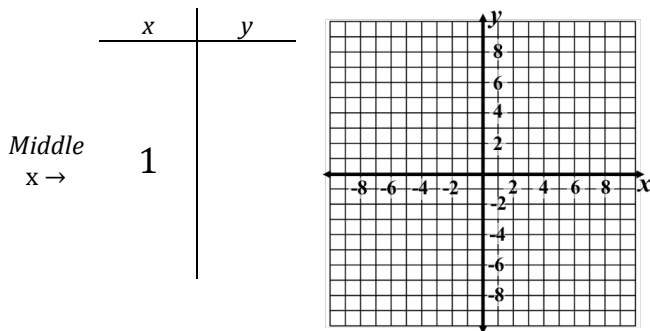
$$1b. k(x) = -3x^2 + 12x - 9$$



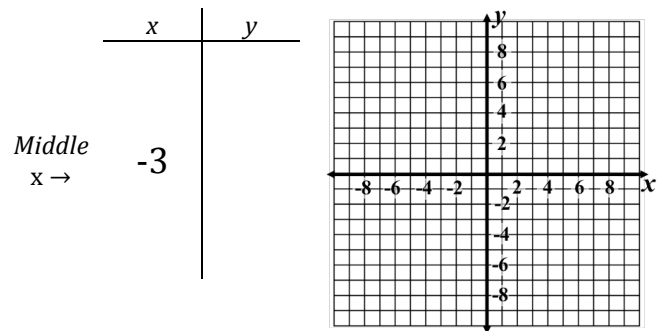
$$2b. m(x) = -2x^2 - 4x - 2$$



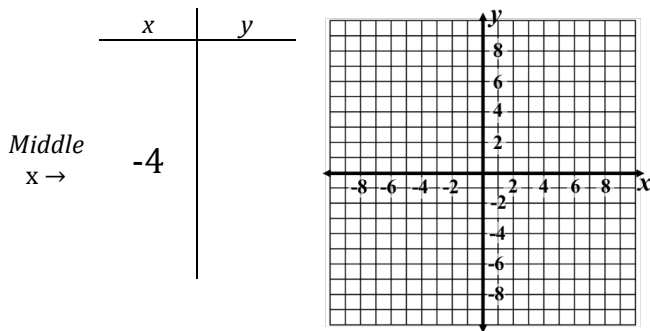
$$3b. n(x) = 3(x - 1)^2 - 3$$



$$4b. p(x) = 2(x + 3)^2 - 8$$



$$5b. q(x) = -(x + 7)(x + 1)$$



$$6b. r(x) = (x + 2)(x - 4)$$

