Name: ______________________

Quadratic Details Part 1

EXAMPLE

$f(x) = 3x^2 - 30x + 33$

Vertex: *In standard form, you find the vertex with the formula* $x = \frac{-b}{2a}$, *then you plug in that x-value to find y.*

$x = \frac{-b}{2a} = \frac{-(-30)}{2(3)} = \frac{30}{6} = 5$

$x = 5$

The axis of symmetry is the x-value.

$y = 3x^2 - 30x + 12$
$y = 3(5)^2 - 30(5) + 12$
$y = 3(25) - 150 + 12$
$y = 75 - 150 + 12 = -63$

$y = -63$

Graph is positive, so it faces Up.
It has a minimum at the y-value.

Vertex: $(5, -63)$

***y*-int:** *The y-intercept is always the point where* $x = 0$. *In standard form,* $x = 0$ *cancels out everything except c, so you know what the y-intercept is: (0, c). If you are unsure, though, you can simply plug in* $x = 0$.

$x = 0, so\ y\ is\ c$

$y = 3(0)^2 - 30(0) + 33$
$y = 0 - 0 + 33 = 33$

y-int: $(0, 33)$

Roots: *In standard form (assuming you don't choose to convert to another form), you can determine the roots by using the quadratic formula.*

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(-30) \pm \sqrt{(-30)^2 - 4(3)(33)}}{2(3)}$

$x = \frac{30 \pm \sqrt{900 - 396}}{6} = \frac{30 \pm \sqrt{504}}{6}$

$x = \frac{30 \pm \sqrt{36}\sqrt{14}}{6} = \frac{30 \pm 6\sqrt{14}}{6}$

$x = \frac{30}{6} \pm \frac{6\sqrt{14}}{6} = 5 \pm \sqrt{14}$

$x = 5 \pm \sqrt{14}$

Vertex	$(5, -63)$
Axis of Symm	$x = 5$
Max or Min?	Minimum at $y = -63$
y-int.	$(0, 33)$
x-int.'s/ roots/ zeros/ solutions	$x = 5 \pm \sqrt{14}$

EXAMPLE

$g(x) = -2(x + 7)(x - 1)$

Vertex:
In factored form, you find the vertex with the formula $x = \frac{r_1 + r_2}{2}$, *then you plug in that x-value to find y.*

$x = \frac{r_1 + r_2}{2} = \frac{(-7) + (1)}{2} = \frac{-6}{2}$

$x = -3$

The axis of symmetry is the x-value.

$y = -2(x + 7)(x - 1)$
$y = -2(-3 + 7)(-3 - 1)$
$y = -2(4)(-4)$

$y = 32$

Graph is negative, so it faces down.
It has a maximum at the y-value.

Vertex: $(-3, 32)$

***y*-int:** *The y-intercept is always the point where* $x = 0$. *So, plug in* $x = 0$.

$y = -2(0 + 7)(0 - 1)$
$y = -2(7)(-1) = 14 \quad (0, 14)$

Roots: *In factored form, the roots are given to you – they're the numbers in the parentheses with x. Don't forget to witch the signs!*

$-2(x + 7)(x - 1), so\ x = -7\ \&\ x = 1$

Vertex	$(-3, 32)$
Axis of Symm	$x = -3$
Max or Min?	Maximum at $y = 32$
y-int.	$(0, 14)$
x-int.'s/ roots/ zeros/ solutions	$x = -7$ $x = 1$

EXAMPLE

$h(x) = 5(x - 3)^2 + 625$

Vertex: *In vertex form, the vertex is given to you – the x-value is inside the parentheses with x (don't forget to switch the sign), and the y-value is the number added to the end (keep the sign you have).*

$h(x) = 5(x - 3)^2 + 625$
$x = h\ (switch\ the\ sign)$

$x = +3$

The axis of symmetry is the x-value.

$y = k\ (keep\ the\ sign)$

$y = 625$

Graph is positive, so it faces Up.
It has a minimum at the y-value.

Vertex: $(3, 625)$

***y*-int:** *The y-intercept is always the point where* $x = 0$. *So, plug in* $x = 0$.

$y = 5(0 - 3)^2 + 625$
$y = 5(-3)^2 + 625 = 5(9) + 625$
$y = 45 + 625 = 670 \quad (0, 670)$

Roots: *The roots are always the points where* $y = 0$. *In vertex form, you simply plug in* $y = 0$ *and use SADMEP to solve.*

$0 = 5(x - 3)^2 + 625$
$-625 = 5(x - 3)^2$
$-25 = (x - 3)^2$
$\pm\sqrt{25} = (x - 3)$
$\pm 5 = x - 3$
$3 \pm 5 = x$
$x = 3 \pm 5$

Vertex	$(3, 625)$
Axis of Symm	$x = 3$
Max or Min?	Minimum at $y = 625$
y-int.	$(0, 670)$
x-int.'s/ roots/ zeros/ solutions	$x = 3 \pm 5$

Determine the details of each quadratic.

1. $f(x) = -4x^2 + 16x - 8$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

2. $g(x) = -3(x-2)(x+4)$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

3. $h(x) = -(x-1)^2 + 20$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

4. $j(x) = 2x^2 - 12x + 16$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

5. $k(x) = 5(x+3)(x+3)$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

6. $m(x) = 2(x+5)^2 + 32$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

7. $n(x) = 3x^2 + 24x + 48$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

8. $p(x) = -2(x-5)(x-1)$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

9. $q(x) = -5(x-2)^2 - 100$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

10. $r(x) = -(x+8)(x+2)$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

11. $t(x) = -3(x+6)^2 + 12$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

12. $v(x) = x^2 + 2x + 3$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

13. $f(x) = 4(x-3)^2 - 72$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

14. $g(x) = -5x^2 - 20x - 8$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

15. $h(x) = 4(x)(x-4)$

Vertex	
Axis of Symm	
Max or Min?	
y-int.	
x-int.'s/ roots/ zeros/ solutions	

Answers

1. V: $(2,8)$ AofS: $x = 2$ Max: $y = 8$ y-int: $(0,-8)$ Roots: $x = 2 \pm \sqrt{2}$	2. V: $(-1,27)$ AofS: $x = -1$ Max: $y = 27$ y-int: $(0,24)$ Roots: $x = 2$ $or\ x = -4$	3. V: $(1,20)$ AofS: $x = 1$ Max: $y = 20$ y-int: $(0,19)$ Roots: $x = 1 \pm 2\sqrt{5}$	4. V: $(3,-2)$ AofS: $x = 3$ Min: $y = -2$ y-int: $(0,16)$ Roots: $x = 4$ $or\ x = 2$	5. V: $(-3,0)$ AofS: $x = -3$ Min: $y = 0$ y-int: $(0,45)$ Roots: $x = -3$
6. V: $(-5,32)$ AofS: $x = -5$ Min: $y = 32$ y-int: $(0,82)$ Roots: $x = -5 \pm 4i$	7. V: $(-4,0)$ AofS: $x = -4$ Min: $y = 0$ y-int: $(0,48)$ Roots: $x = -4$	8. V: $(3,8)$ AofS: $x = 3$ Max: $y = 8$ y-int: $(0,-10)$ Roots: $x = 5$ $or\ x = 1$	9. V: $(2,-100)$ AofS: $x = 2$ Max: $y = -100$ y-int: $(0,-120)$ Roots: $x = 2 \pm 2i\sqrt{5}$	10. V: $(-5,9)$ AofS: $x = -5$ Max: $y = 9$ y-int: $(0,-16)$ Roots: $x = -8$ $or\ x = -2$
11. V: $(-6,-12)$ AofS: $x = -6$ Max: $y = 12$ y-int: $(0,-96)$ Roots: $x = -8$ $or\ x = -4$	12. V: $(-1,2)$ AofS: $x = -1$ Min: $y = 2$ y-int: $(0,3)$ Roots: $x = -1 \pm i\sqrt{2}$	13. V: $(3,-72)$ AofS: $x = 3$ Min: $y = -72$ y-int: $(0,-36)$ Roots: $x = 3 \pm 3\sqrt{2}$	14. V: $(-2,32)$ AofS: $x = -2$ Max: $y = 32$ y-int: $(0,-8)$ Roots: $x = -2 \mp \frac{2\sqrt{15}}{5}$	15. V: $(2,-16)$ AofS: $x = 2$ Min: $y = -16$ y-int: $(0,0)$ Roots: $x = 0$ $or\ x = 4$