Math 2201 Unit 6: Quadratic Functions

Summary of Standard Form: $y = ax^2 + bx + c$

	In General $y=ax^2+bx+c$	**Example 1** $y=-3x^2+3x+10$	**Example 2** $y=2x^2+12x-13$
Direction of Opening	a > 0, graph opens up a < 0, graph opens down	a = -3, graph opens down	a = 2, graph opens up
Y-Intercept	c-value	c = 10, so y-int. = 10 or (0,10)	c = -13, so y-int. = -13 or (0,-13)
Equation for axis of Symmetry	$x = \frac{-b}{2a}$	a = -3, b = 3, c = 10 $x = \frac{-b}{2a}$ $x = \frac{-3}{2(-3)}$ $x = \frac{1}{2}$ *or* 0.5	a = 2, b = 12, c = -13 $x = \frac{-b}{2a}$ $x = \frac{-12}{2(2)}$ $x = -3$
Vertex	x-value is the same as the axis of symmetry. To find y-coordinate, plug x-value into equation.	x = 0.5 (see above) $y = -3x^2 + 3x + 10$ $y = -3(0.5)^2 + 3(0.5) + 10$ y = 10.75 Vertex: (-0.5, 10.75)	x = -3 (see above) $y = 2x^2 + 12x - 13$ $y = 2(-3)^2 + 12(-3) - 13$ y = -31 Vertex: (-3, -31)
Maximum/Minimum Value	When the graph opens down, the y-coordinate of the vertex is called the max. value. When the graph opens up, the y-coordinate of the vertex is called the min. value.	Since the graph opens down, it has a maximum value , and the value is 10.75	Since the graph opens up, it has a minimum value, and the value is -31
Range	Opens Down $\{y \mid y \leq y - value\ of\ vertex, y \epsilon R\}$ Opens Up $\{y \mid y \geq y - value\ of\ vertex, y \epsilon R\}$	$\{y \mid y \leq 10.75, y \epsilon R\}$	$\{y \mid y \geq -31, y \epsilon R\}$

Math 2201 Unit 6: Quadratic Functions

Summary of Factored Form: $y = a(x - r)(x - s)$

	In General $y=a(x-r)(x-s)$	**Example 1** $y = 2(x + 3)(x - 4)$	**Example 2** $y = -3x(x + 4)$
Direction of Opening	a > 0, graph opens up a < 0, graph opens down	a = 2, opens up	a = -3, opens down
Y-Intercept	Set x = 0 and solve for y.	y = 2(0+3)(0-4) y = -24 or (0,-24)	y = -3(0)(0+4) y = 0(4) = 0 or (0,0)
X - Intercepts	x – r = 0, therefore x = r x – s = 0, therefore x = s	x + 3 = 0 x – 4 = 0 x = -3 x = 4 (-3, 0) and (4, 0)	-3x = 0 x + 4 = 0 x = 0 x = -4 (0, 0) and (-4, 0)
Equation for axis of Symmetry	Take the average of the x-intercepts. $x = \frac{r+s}{2}$	$x = \frac{r+s}{2}$ $x = \frac{-3+4}{2}$ $x = \frac{1}{2}$ or 0.5	$x = \frac{r+s}{2}$ $x = \frac{0+(-4)}{2}$ $x = \frac{-4}{2}$ or -2
Vertex	x-value is the same as the axis of symmetry. To find y-coordinate, plug x-value into equation.	x = 0.5 (see above) y = 2(0.5+3)(0.5-4) y = 2(3.5)(-3.5) y = -24.5 Vertex: (0.5, -24.5)	x = -2 (see above) y = -3x(x+4) y = -3(-2)[-2 +4] y = 6 [2] =12 Vertex: (-2, 12)
Maximum/Minimum Value	When the graph opens down, the y-coordinate of the vertex is called the max. value. When the graph opens up, the y-coordinate of the vertex is called the min. value.	Minimum Value, y = -24.5	Maximum Value, y = 12
Range	Opens Down $\{y \mid y \leq y - value\ of\ vertex, y \epsilon R\}$ Opens Up $\{y \mid y \geq y - value\ of\ vertex, y \epsilon R\}$	$\{y \mid y \geq -24.5, y \epsilon R\}$	$\{y \mid y \leq 12, y \epsilon R\}$

Math 2201 Unit 6: Quadratic Functions

Summary of Vertex Form: $y = a(x-h)^2+k$

	In General $y = a(x-h)^2+k$	**Example 1** $y = 4(x-2)^2+3$	**Example 2** $y = -2(x+5)^2-6$
Direction of Opening	a > 0, graph opens up a < 0, graph opens down	a = 4, opens up	a = -2, opens down
y - Intercept	Set x = 0 and solve for y.	$y = 4(x-2)^2+3$ $y = 4(0-2)^2+3$ $y = 4(4)+3 = 16+3 = 19$	$y = -2(x+5)^2-6$ $y = -2(0+5)^2-6$ $y = -2(25)-6 = -50-6=-56$
Equation for axis of Symmetry	$x = h$	$x = 2$	$x = -5$
Vertex	Takes the form (h, k)	(h, k) = (2, 3)	(h, k) = (-5, -6)
Maximum/Minimum Value	When the graph opens down, the y-coordinate of the vertex is called the max. value. When the graph opens up, the y-coordinate of the vertex is called the min. value.	Minimum Value, y = 3	Maximum Value, y = -6
Range	Opens Down $\{y \mid y \leq y-value\ of\ vertex, y \epsilon R\}$ Opens Up $\{y \mid y \geq y-value\ of\ vertex, y \epsilon R\}$	$\{y \mid y \geq 3, y \epsilon R\}$	$\{y \mid y \leq -6, y \epsilon R\}$