MBF 3C1 Name: _____

Finding the Vertex of a Quadratic

To find the **vertex** of a quadratic when it is in the **factored form** $y=a(x-r)(x-t)$ you must:

1. Find zeros
2. Find a.o.s = $\frac{\text{add zeros}}{2}$ = h
3. Find opt. val = sub a.o.s into equation = k
4. vertex = (h, k)

To find the **vertex** of a quadratic when it is in the **standard form** $y=ax^2+bx+c$ you must:

1. Factor
2. See steps above

To find the **vertex** of a quadratic when it is in the **vertex form** $y=a(x-h)^2+k$ you must:

ignore switch keep

vertex = (h, k)

Factored Form	Zeros or x-int	x (axis of symm)	y (optimal val or max/min value)	Vertex and vertex Form	Convert to standard form	y-int
$y=-3(x-2)(x-8)$	$x-2=0$ $x=2$ $x-8=0$ $x=8$	$\frac{2+8}{2}$ $=\frac{10}{2}$ $=5$	$-3(5-2)(5-8)$ $-3(3)(-3)$ $=27$	vertex = (5, 27) $y=-3(x-5)^2+27$	$-3(x^2-8x-2x+16)$ $-3x^2+24x+6x-48$ $-3x^2+30x-48$	y-int = -48

Standard Form	y-int	Zeros or x-int	x (axis of symm)	y (optimal val or max/min value)	Vertex and vertex form
$y=x^2-3x-18$	-18	$y=(x-6)(x+3)$ $x-6=0$ $x=6$ $x+3=0$ $x=-3$	$\frac{6+-3}{2}$ $=\frac{3}{2}$ $=1.5$	$(1.5)^2-3(1.5)-18$ -20.25	vertex = (1.5, -20.25) $y=1(x-1.5)^2-20.25$

Vertex Form	Vertex	Is the vertex a max or a min?	Convert to standard form
$y=-3(x-2)^2+5$	vertex = (2, 5)	a = -3 opens down ∴ MAX	$y=-3(x-2)(x-2)+5$ $y=-3(x^2-2x-2x+4)+5$ $y=-3x^2+6x+6x-12+5$ $y=-3x^2+12x-7$

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Example

The flight of a baseball is modelled by $y = -4.9x^2 + 9.8x + 14.7$ where x is the time, in sec, and y is the height, in m, above the ground.

a. What is the height of the ball 0.5 seconds after it was hit?

$y = -4.9(0.5)^2 + 9.8(0.5) + 14.7$

$y = 18.375$ ∴ height was about 18.4 m

b. What is the height of the ball when it was hit?

initial y-int

∴ 14.7m height when it was hit

c. How long does it take for the ball to reach the ground?

zeros

$y = -4.9\left(\frac{-4.9x^2}{-4.9} + \frac{9.8x}{-4.9} + \frac{14.7}{-4.9}\right)$

$y = -4.9(x^2 - 2x - 3)$

$y = -4.9(x-3)(x+1)$

zeros ∴ $x - 3 = 0$, $x = 3$

$x + 1 = 0$, $x = -1$ time can't be neg.

∴ Lands on the ground in 3sec.

d. Find the maximum height.

at vertex. (optimal value)

$a.of.s = \frac{\text{add zeros}}{2} = \frac{3 + -1}{2} = \frac{2}{2} = 1$

opt. value = sub a.of.s $= -4.9(1)^2 + 9.8(1) + 14.7$

$= 19.6$

∴ max height is 19.6 m