7.6 Vertex Form of the Quadratic Function $y = a(x-h)^2 + k$ or $y = a(x-p)^2 + q$ Concept #11, 12

VERTEX-GRAPHING FORM

Foundations 20 textbook uses: $y = a(x-h)^2 + k$ or Pre- Calculus 20 textbook uses: $y = a(x-p)^2 + q$

- the vertex is at (p,q) or (h,q)
- if a > 0 (is positive), the parabola opens up
- if a < 0 (is negative), the parabola opens down

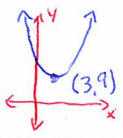
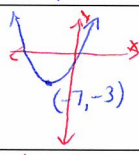
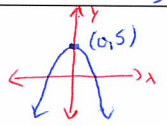
Note: a ≠0

- the equation of the axis of symmetry is x=h or x=p

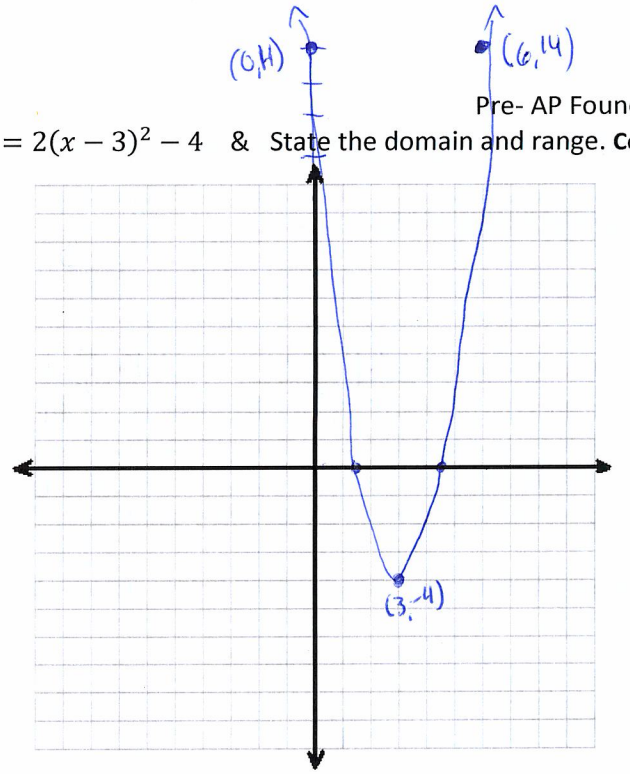
The graph of the function can be sketched more easily using this form.

Example1: For each quadratic function below, identify the following: **(CONCEPT #11)**

a) $f(x) = (x-3)^2 + 9$ b) $m(x) = 2(x+7)^2 - 3$ c) $r(x) = -2x^2 + 5$

	a) $f(x) = (x-3)^2 + 9$	b) $m(x) = 2(x+7)^2 - 3$	c) $r(x) = -2x^2 + 5$
i) Does the parabola open up or down? Max or Min?	up Min at y=9	up Min at y=-3	down Max y=5
ii)Coordinates of the vertex	(3,9)	(-7,-3)	(0,5)
iii)Equation of axis of symmetry	x=3	x=-7	x=0
iv)Domain ad Range	D={x|x∈ℝ} R={y| y≥9, y∈ℝ}	D={x|x∈ℝ} R={y| y≥-3, y∈ℝ}	D={x|x∈ℝ} R={y| y≤5, y∈ℝ}
v) How many zeros the function will have?	none 	Two 	Two 
vi) x and y–intercepts (Solve the x- int. using the square root property)	No x-intercepts y-int = set x=0 and solve $y = (0-3)^2 + 9$ $y = (9) + 9$ $y = 18$ y-int = (0,18)	x-int set y=0 and solve using the square root property $0 \overset{+3}{=} 2(x+7)^2 - 3 \overset{+3}{}$ get $(x+7)^2$ by itself $\frac{3}{2} = \frac{2(x+7)^2}{2}$ $\pm\sqrt{\frac{3}{2}} = \sqrt{(x+7)^2}$ $\pm\sqrt{\frac{3}{2}} \overset{-7}{=} x+7 \overset{-7}{}$ $\pm\sqrt{\frac{3}{2}} - 7 = x$ xintercepts y-int. $y = 2(0+7)^2 - 3$ $y = 2(49) - 3$ $y = 98 - 3$ $y = 95$ y-intercept (0, 95)	x-intercepts $0 \overset{-5}{=} -2x^2 + 5 \overset{-5}{}$ $\frac{-5}{-2} = \frac{-2x^2}{-2}$ $\sqrt{\frac{5}{2}} = \sqrt{x^2}$ $\pm\sqrt{\frac{5}{2}} = x$ xintercepts y-intercept $y = -2(0)^2 + 5$ $y = 5$ y-int = (0,5)

Example 2: Sketch the graph of the following function: $f(x) = 2(x-3)^2 - 4$ & State the domain and range. **Concept #11**



- Which way does it open? up
- Where is the vertex? (3,-4)
- Where is the axis of symmetry? $x=3$
- What are the x- intercepts?

set $y=0$ or $f(x)=0$

$0 = 2(x-3)^2 - 4$ (+4 +4) "Get the squared term by itself"

$\frac{4}{2} = \frac{2(x-3)^2}{2}$

$\sqrt{2} = \sqrt{(x-3)^2}$

$\pm\sqrt{2} = x-3$ (+3 +3)

$x = \{\pm\sqrt{2}-3\}$

$\approx 4.4, 1.585$

- What is the y-intercept? (0,14)
  - Reflect this point about the axis of symmetry to find the y intercepts reflection point

y-int = set $x=0$

$y = 2(0-3)^2 - 4$

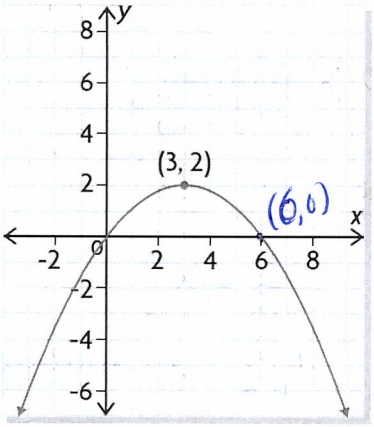
$y = 2(-3)^2 - 4$

$y = 2(9) - 4$

$y = 18 - 4$

$y = 14$

Example 3: Determine the equation of the quadratic function in vertex form **(Concept #12)**



$y = a(x-p)^2 + q$

$y = a(x-3)^2 + 2$

Point (6,0) (x y)

$0 = a(6-3)^2 + 2$

$0 = a(3)^2 + 2$ (-2 -2)

$\frac{-2}{9} = \frac{9a}{9}$

$-\frac{2}{9} = a$

$y = -\frac{2}{9}(x-3)^2 + 2$

Assignment: pg 417 #2(Pick 3 to sketch) 3,4, 5, 7, 11, 14