The Vertex Form of a Quadratic Function

Date: _____

VERTEX FORM **vs.** **STANDARD FORM**

$g(w) = -(w-15)^2 + 225$ (Show by expanding) $f(w) = -w^2 + 30w$

$= -(w^2 - 30w + 225) + 225$

$= -w^2 + 30w - 225 + 225$

$= -w^2 + 30w$

Ex. 1: Given $f(x) = 3(x+4)^2 - 8$, determine:

a) direction of opening — upwards (a is positive)

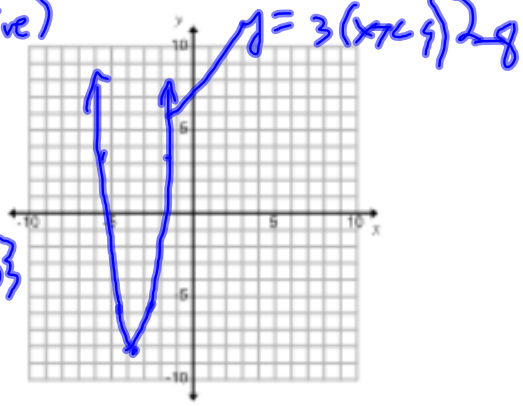
b) the axis of symmetry — $x = -4$ $x+4=0$

c) the max/min value — -8

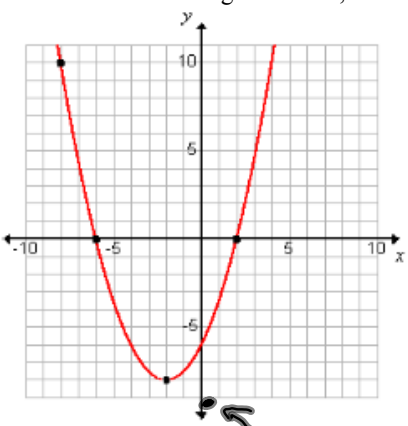
d) the vertex — $(-4, -8)$

e) State the Domain and Range — $D = \{x \in \mathbb{R}\}$, $R = \{y \in \mathbb{R} \mid y \geq -8\}$

f) the sketch of the graph (no technology)



Ex. 2: Given the diagram below, write the quadratic equation in each of the 3 forms.



$y = a(x+2)^2 - 8$

$10 = a(-8+2)^2 - 8$

$10 = a(-6)^2 - 8$

$10 + 8 = 36a$

$18 = 36a$

$\frac{18}{36} = a$

$a = \frac{1}{2}$

$\therefore y = \frac{1}{2}(x+2)^2 - 8$ is the eqn in vertex form

$y = \frac{1}{2}(x^2 + 4x + 4) - 8$

$= \frac{1}{2}x^2 + 2x + 2 - 8$

$= \frac{1}{2}x^2 + 2x - 6$

$y = a(x+6)(x-2)$

$10 = a(-8+6)(-8-2)$

$10 = a(-2)(-10)$

$10 = 20a$

$\frac{10}{20} = a$

$a = \frac{1}{2}$

$\therefore y = \frac{1}{2}(x+6)(x-2)$ is the equation in factored form

$y = \frac{1}{2}(x^2 + 4x - 12)$

$y = \frac{1}{2}x^2 + 2x - 6$

is the equation in standard form

Ex. 3: What information about the parabola does each form provide?

Standard Form	Factored Form	Vertex Form
gives the y-intercept ("c" value)	gives the x-intercepts (zeros)	vertex * the max/min value and when it occurs

Ex. 4: Write the equation of the quadratic function, first in vertex form and then in standard form.

a) vertex $(-6,7)$ and passing through $(2,-9)$

$y = a(x+6)^2 + 7$

$(-9) = a((2)+6)^2 + 7$

$-9 = a(8)^2 + 7$

$-9 - 7 = 64a$

$-16 = 64a$

$\frac{-16}{64} = a$

$a = -\frac{1}{4}$

$\therefore y = -\frac{1}{4}(x+6)^2 + 7$ is the eq'n in vertex form.

$y = -\frac{1}{4}(x^2 + 12x + 36) + 7$

$= -\frac{1}{4}x^2 - 3x - 9 + 7$

$= -\frac{1}{4}x^2 - 3x - 2$