Name: _____ Date: _____ Hour: ____Alg 1____

Unit 7B Day 16: Standard form of Quadratic Functions

Focus Question: What is standard form of a quadratic function?

A. Review standard form of polynomials

Use the polynomial $6x^3 + 2x^5 - 3x^4$

1. Write the polynomial in standard form.

$2x^5 - 3x^4 + 6x^3$

2. What makes a polynomial in standard form?

terms from highest to lowest degree

B. Vertex Form to Standard Form

Use the quadratic $f(x) = 3(x-2)^2 + 4$

1. What information can you automatically tell?

Vertex (2, 4)

2. Can every quadratic be written in this form? Explain

Yes, b/c every quad has a real vertex

3. Expand it so that it is in standard form of a polynomial.

$3(x-2)(x-2)+4$

$3(x^2-4x+4)+4$

$3x^2-12x+12+4$

$f(x)=3x^2-12x+16$

$(x-2)(x-2)$

$x(x-2)-2(x-2)$

$x\cdot x+x(-2)-2\cdot x-2(-2)$

$x^2-2x-2x+4$

x^2-4x+4

	x	-2
x	x^2	$-2x$
-2	$-2x$	$+4$

x^2-4x+4

4. What do you notice has remained the same between the vertex form and the standard form?

The "a" is the same

C. Standard form of Quadratics

Any situation that involves jumping/throwing/hitting/kicking/shooting something into the air will create a quadratic equation of the form $f(x) = ax^2 + bx + c$. which is the standard form of a quadratic. This is the most useful form to physics because it is easy to write the equation of an object being sent upward. In these real cases, *a* represents ½ of the gravitational constant (it is always negative because gravity pulls down) and will either be -4.9 if you are in meters per second or -16 if you are in feet per second..*b* represents the initial upward velocity and *c* represents the initial height. You will also see it written as $h(t) = -gt^2 + v_0t + h_0$ Whether it is about an object going up in the air or a non-situational graph, the value of *a* still tells you the same thing it did in vertex and intercept form.

1. If a < 0, the parabola opens down.

If $|a| > 1$ the parabola is skinny (stretch vert). If $0 < |a| < 1$, the parabola is wide (compress vert.)

2. What information does c give you? Explain.

c is the y-intercept (0, c)

$f(0) = a(0)^2 + b(0) + c$

$= 0 + 0 + c$

$= c$

3. Give the *a*, *b*, and *c* values, then give the y-intercept of the following functions.

a) $f(x) = x^2 - 3x + 4$ — $a=1$ $b=-3$ $c=4$ — yint (0, 4)

b) $g(x) = -5x^2 - 3$ — $a=-5$ $b=0$ $c=-3$ — yint (0, -3)

c) $h(x) = 2x^2 + x$ — $a=2$ $b=1$ $c=0$ — yint (0, 0)

d) $j(x) = \frac{1}{4}x^2 + 3x + 8$ — $a=\frac{1}{4}$ $b=3$ $c=8$ — yint (0, 8)

4. Turn each of the following vertex form quadratics into standard form.

Then, give the vertex, a and b values, and y- intercept.

a. $g(x) = -\frac{1}{2}(x-3)^2 + 6$

vertex (3,6)

$= -\frac{1}{2}(x-3)(x-3) + 6$

$= -\frac{1}{2}[x(x-3) - 3(x-3)] + 6$

$= -\frac{1}{2}(x^2 - 3x - 3x + 9) + 6$

$= -\frac{1}{2}(x^2 - 6x + 9) + 6$

$= -\frac{1}{2}x^2 + 3x - \frac{9}{2} + \frac{12}{2}$

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

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

$b = 3$

yint $(0, \frac{3}{2})$

b. $h(x) = -2(x+4)^2 - 1$

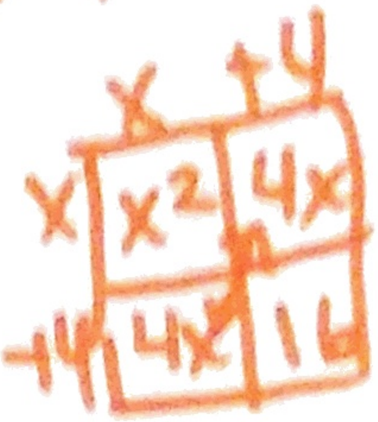
vertex (-4,-1)

$= -2(x+4)(x+4) - 1$

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

$= -2x^2 - 16x - 32 - 1$

$= -2x^2 - 16x - 33$



$x^2 + 8x + 16$

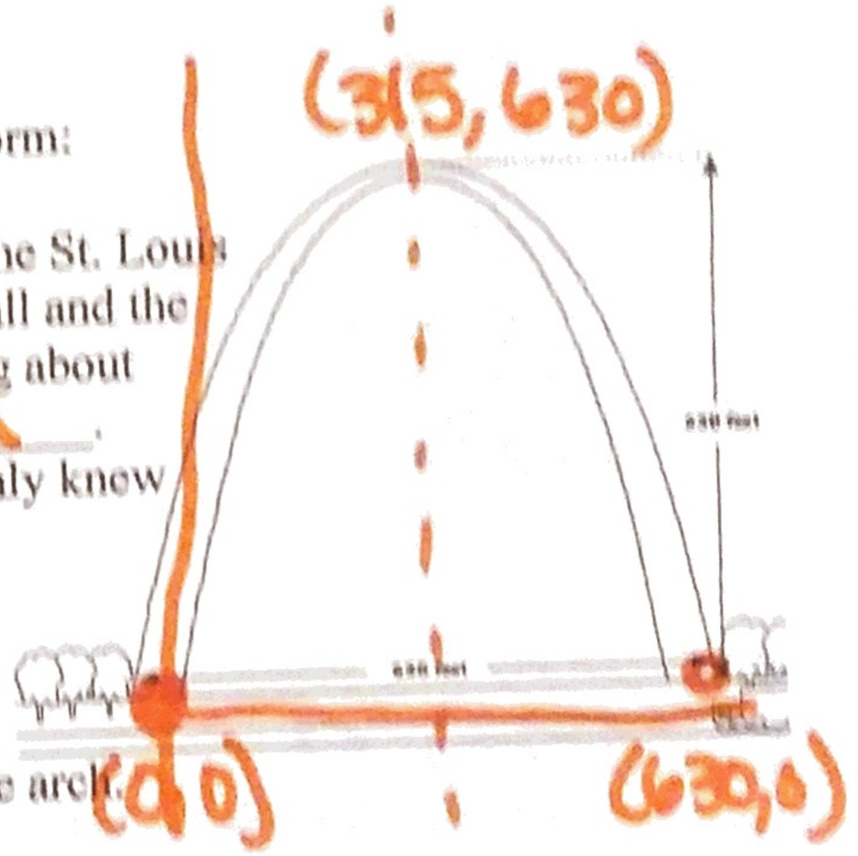
$a = -2$

$b = -16$

yint (0,-33)

5. Besides physics, there is another reason you need to know standard form:

During a spring break trip to St. Louis, Missouri, Melissa paid a visit to the St. Louis Gateway Arch. On the guided tour, she learned that the arch is 630 feet tall and the legs of the arch are 630 feet apart. Being on spring break but still thinking about math, she looked at the arch and immediate saw a parabola. In a fervent effort to analyze this amazing curve, she realize that if she only knew three points, then she could determine the equation of the arch using her graphing calculator.



a. Fill in the blank in the situation above.

b. Draw an x and y axis on the picture. Then give three points on the arch.

c. Use your calculator to do quadratic regression and give the quadratic equation for the St. Louis Arch. What is the equation and what form is it in?

$-0.006349206 3x^2 + 4x$

Standard form

ANY TECHNOLOGY (the calculator, online calculators, excel, go motions, etc) will always give the equation in standard form!