Math Tutoring

REMEMBER there is math tutoring during lunch every day (except for Wednesday), after school tutoring every day (except for Friday), and even Saturday morning tutoring in room 341!!!

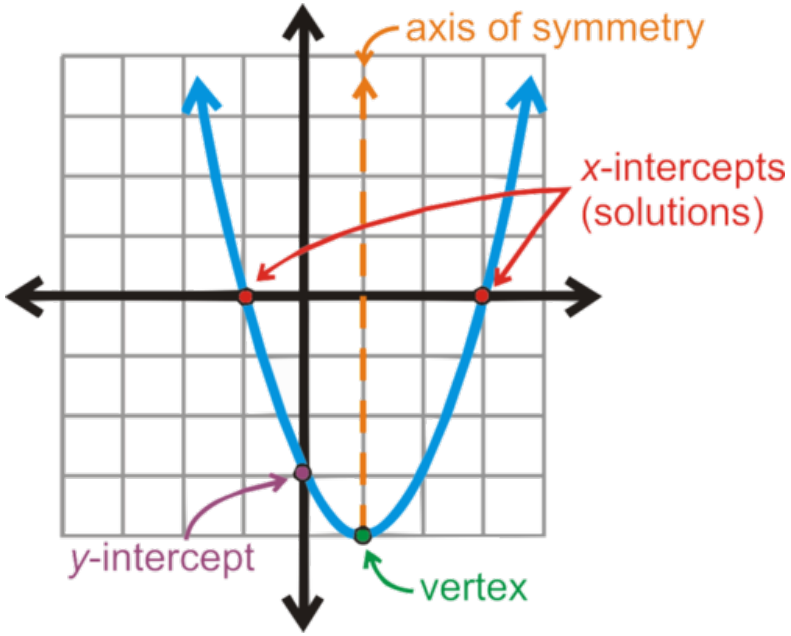
Objective

Students will be able to graph quadratic functions in standard form.

Intro to Quadratics

A quadratic equation in one variable can be written in the form $ax^2 + bx + c = 0$ where $a \neq 0$ (written in standard form). The solutions of a quadratic equation are called the roots, solutions, x-intercepts, and zeros of the equation.

The graph of a quadratic equation is a parabola



A few more details…

$$f(x) = ax^2 + bx + c$$

1) *a* is the coefficient in front of x^2 (the quadratic term)
b is the coefficient in front of x (the linear term)
c is the constant term

2) *a*, *b*, and *c* are real numbers

3) *a* can not be zero

**If a = 0, you no longer have a quadratic equation because you lose the quadratic term. What kind of equation do you have when a = 0?

Identify *a*, *b*, and *c*

1) $f(x) = 3x^2 + 2x - 5$

2) $f(x) = x^2 - 3x$

3) $f(x) = 7 - 3x^2 + x$

4) $f(x) = 3x - 5 + 6x^2$

Find the y-intercept, equation of the axis of symmetry, and the vertex of:

$$f(x) = 3x^2 + 2x - 5$$

y-intercept: -5

axis of symmetry: x = -1/3

vertex: (-1/3, -16/3)

$$f(x) = ax^2 + bx + c$$

What affect do *a*, *b*, and *c* have on the graph of a quadratic function?

http://www.mathopenref.com/quadraticexplorer.html

Graphing a Quadratic Function

When graphing a quadratic function, you should start by finding the equation for the axis of symmetry, then find your vertex so that you can pick which values of *x* to use in your t-table
(and graph at least two or three points on either side of the vertex)

Graph $y = 2x^2 - 8x + 6$

Step 1: Find the axis (line) of symmetry and graph the line

$$x = \frac{-b}{2a} = \frac{-(-8)}{2(2)} = \frac{8}{4} = 2$$

$$x = 2$$

Step 2: Find the vertex and plot this point

We already found that the x-coordinate is x = 2, need to plug in x = 2 into quadratic equation to find y-coordinate of the vertex

$$y = 2(2)^2 - 8(2) + 6 = 2(4) - 16 + 6 = 8 - 16 + 6 = -2$$

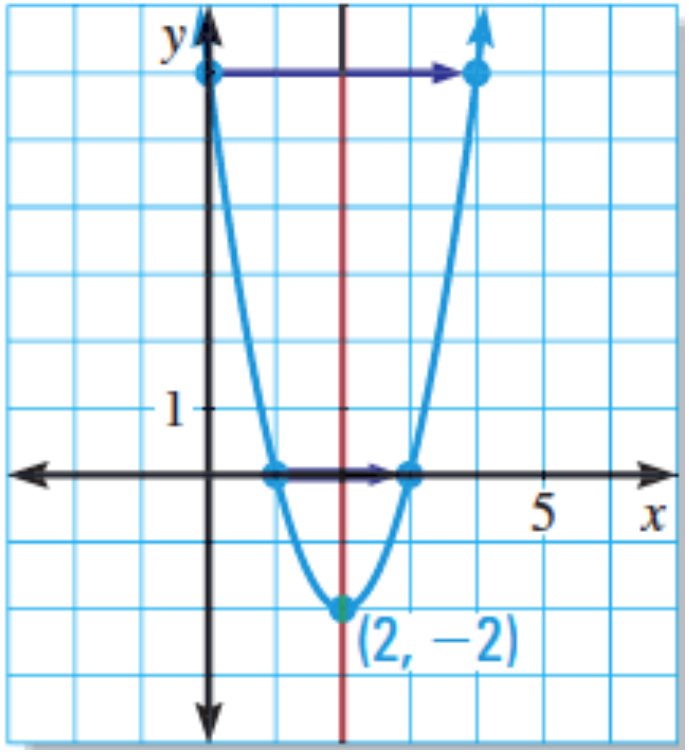
vertex: (2, -2)

Step 3: Pick which values of *x* to use in your t-table (you need to have two or three *x* values to the left and also to the right of your vertex)

***can also use the line of symmetry to find points– use y-intercept and then find point that is reflected

Step 4: Draw a parabola through the points

Graph $y = 2x^2 - 8x + 6$ continued…



Homework

Graphing Quadratic Functions (Day 2) Worksheet

Objective

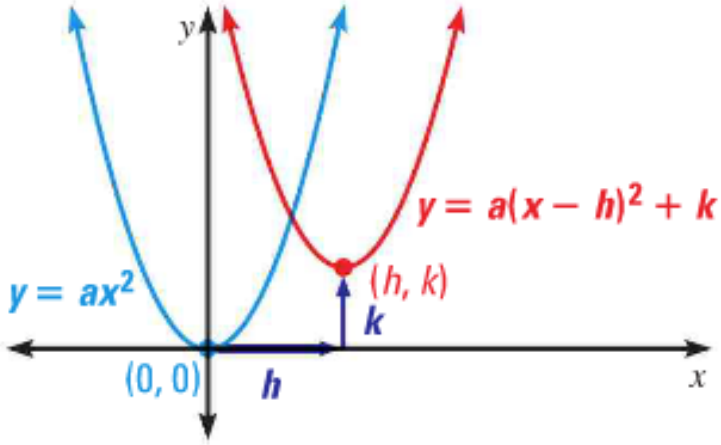
Students will be able to graph quadratic functions in vertex form and intercept form.

Graph of a Quadratic Function in Vertex Form

$$y = a(x-h)^2 + k$$

Vertex: (h, k)

Axis of Symmetry: x = h



The graph opens up if a > 0 and down if a < 0.

**Similar to absolute value equations

Graphing a Quadratic Function in Vertex Form

Graph $y = -\frac{1}{4}(x+2)^2 + 5$

Step 1: Find the axis (line) of symmetry and graph the line

$x = h$ $\qquad$ $x = -2$

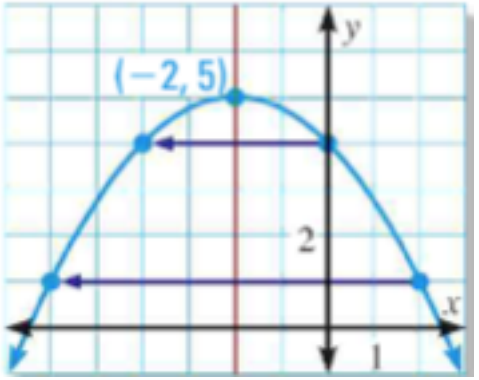
Step 2: Find the vertex and plot this point

vertex: (h, k) $\qquad$ vertex: (-2, 5)

Step 3: Pick which values of *x* to use in your t-table (you need to have two or three *x* values to the left and also to the right of your vertex)

x = 0: $\quad y = -1/4\ ((0) + 2)^2 + 5 \quad = 4$

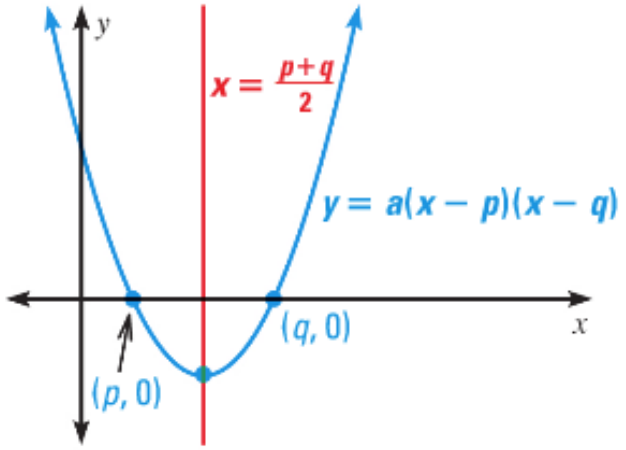
(0, 4) $\qquad$ Reflected point over the axis of symmetry: (-4, 4)



Step 4: Draw a parabola through the points

Graph of a Quadratic Function in Intercept Form

$$y = a(x - p)(x - q)$$



X-intercepts: *p* and *q*

Axis of Symmetry: halfway between (*p*, 0) and (*q*, 0);
equation is $x = \frac{p+q}{2}$

The graph opens up if a > 0 and down if a < 0.

Graphing a Quadratic Function in Intercept Form

Graph $y = 2(x+3)(x-1)$

Step 1: Find the axis (line) of symmetry and graph the line

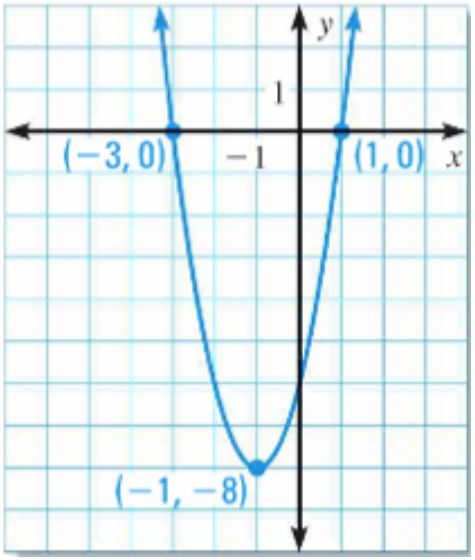
$$x = \frac{p+q}{2} = \frac{-3+1}{2} = \frac{-2}{2} = -1 \qquad x = -1$$

Step 2: Find the vertex and plot this point

x = -1: y = 2((-1) + 3)((-1) – 1) = 2(2)(-2) = -8 vertex: (-1, -8)

Step 3: Pick which values of *x* to use in your t-table (since you already have your x-intercepts, you need to have one more *x* values to the left and also to the right of your vertex)

x-intercepts: (-3, 0) and (1, 0)



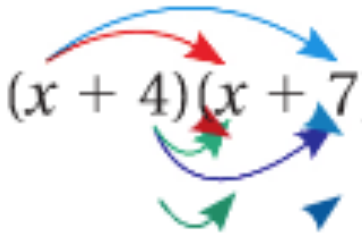
Step 4: Draw a parabola through the points

FOIL METHOD

You can change quadratic functions from intercept form or vertex form to standard form by multiplying algebraic expressions.

F irst O utside I nside L ast

Example



$$(x + 4)(x + 7) = \underset{\text{F}}{x^2} + \underset{\text{O}}{7x} + \underset{\text{I}}{4x} + \underset{\text{L}}{28} = x^2 + 11x + 28$$

The path of a placekicked football can be modeled by the function $y = -0.026x(x - 46)$ where x is the horizontal distance (in yards) and y is the corresponding height (in yards).

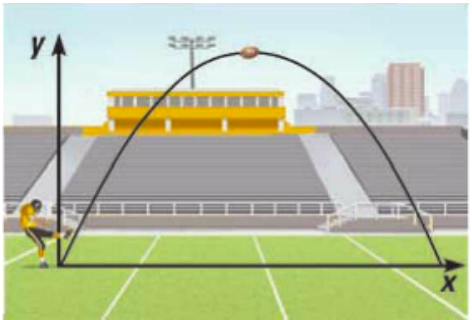
a) How far is the football kicked?

y = -0.026(x – 0)(x – 46) because $p = 0$ and $q = 46$, so the football is kicked a distance of 46 yards

b) What is the football's maximum height?

$$x = \frac{p+q}{2} = \frac{0+46}{2} = 23 \qquad y = -0.026(23)(23-46) \approx 13.8$$

about 13.8 yards



Homework p.249: 8, 10, 16, 18, 34, 36, 51

GRAPHING WITH VERTEX FORM **Graph the function. Label the vertex and axis of symmetry.**

8. $y = 2(x + 1)^2 - 3$

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

GRAPHING WITH INTERCEPT FORM **Graph the function. Label the vertex, axis of symmetry, and x-intercepts.**

16. $f(x) = 2(x - 5)(x - 1)$

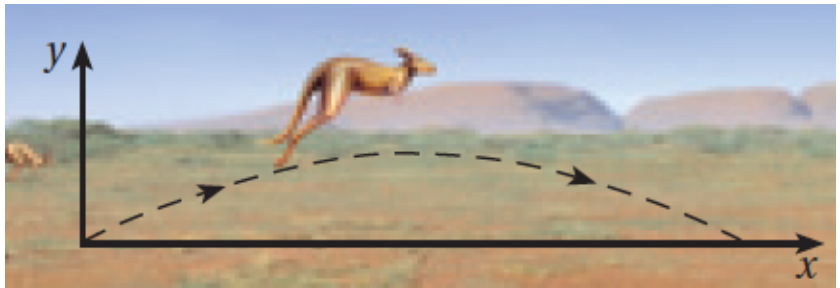
18. $g(x) = -4(x + 3)(x + 7)$

MINIMUM OR MAXIMUM VALUES **Find the minimum value or the maximum value of the function.**

34. $g(x) = -4(x + 6)^2 - 12$

36. $f(x) = 3(x + 10)(x - 8)$

51. BIOLOGY The function $y = -0.03(x - 14)^2 + 6$ models the jump of a red kangaroo where x is the horizontal distance (in feet) and y is the corresponding height (in feet). What is the kangaroo's maximum height? How long is the kangaroo's jump?



Objective

Students will be able to write quadratic functions.

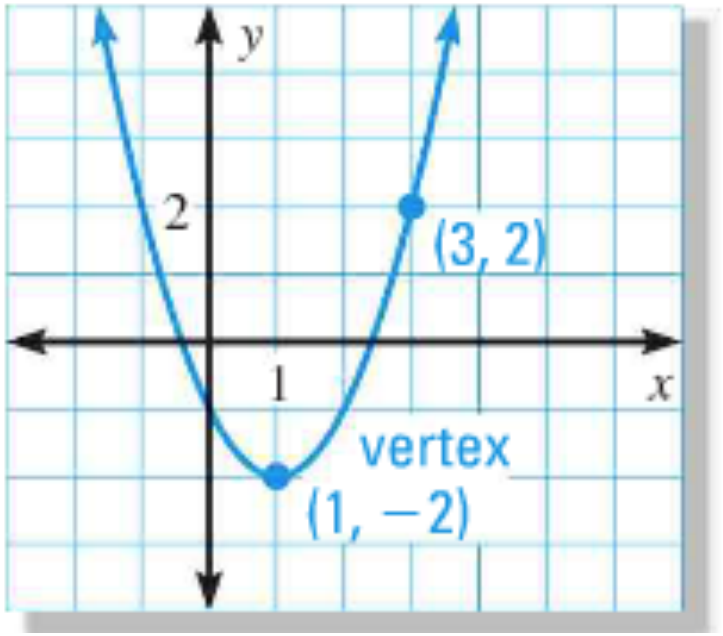
Graphing Quadratic Functions Test on <u>Monday</u>!
No Graphing Calculator!

Summer Packet Review and Tutoring: October 17th (Monday- room 341), October 19th (Wednesday- room 303), October 24th (Monday- room 341) after school

Writing Quadratic Functions

Write a quadratic function for the parabola shown:

1)



Using the given information, which is the best quadratic form to use?

Vertex Form

$$y = a(x-h)^2 + k$$

Plug in given vertex into the equation

$$y = a(x-1)^2 - 2$$

Now we need to solve for *a*, by plugging in the other point given

$2 = a(3-1)^2 - 2$ $\quad 2 = a(4) - 2$

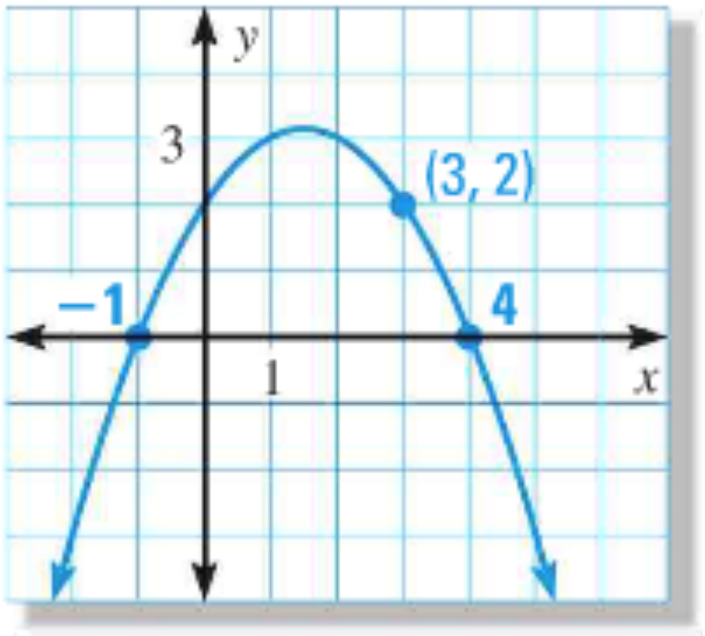
$2 = a(2)^2 - 2$ $\quad 4 = a(4)$ $\quad 1 = a$

$$y = (x-1)^2 - 2$$

Writing Quadratic Functions

Write a quadratic function for the parabola shown:

2)



Using the given information, which is the best quadratic form to use?

Intercept Form

$$y = a(x - p)(x - q)$$

Plug in given intercepts into the equation

$$y = a(x + 1)(x - 4)$$

Now we need to solve for *a*, by plugging in the other point given

$2 = a(3+1)(3-4)$

$2 = a(4)(-1)$

$2 = a(-4)$

$-\frac{2}{4} = a$

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

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

Write a quadratic function in standard form that passes through the points (-1, -3), (0, 4), and (2, 6).

$$y = ax^2 + bx + c$$

With the given points, what can you plug into the equation right away?

$$y = ax^2 + bx + 4$$

Plug in points into the equation:

(-1, -3): $-3 = a(-1)^2 + b(-1) + 4$

$-3 = a(1) - b + 4$

$-3 = a - b + 4$

$-7 = a - b$

(2, 6): $6 = a(2)^2 + b(2) + 4$

$6 = a(4) + 2b + 4$

$6 = 4a + 2b + 4$

$2 = 4a + 2b$

Write a quadratic function in standard form that passes through the points (-1, -3), (0, 4), and (2, 6).

$$y = ax^2 + bx + 4$$

How can we solve for *a* and *b* in these two equations?

$$-7 = a - b \qquad 2 = 4a + 2b$$

System of equations through elimination or substitution!

$$-7 = a - b \quad \rightarrow -7 + b = a$$

$$2 = 4a + 2b$$

$$2 = 4(-7 + b) + 2b \quad 2 = -28 + 4b + 2b \quad 30 = 6b \quad 5 = b$$

$$a = -7 + b \quad a = -7 + 5 \quad a = -2$$

Plug in *a* and *b* into the equation:

$$y = -2x^2 + 5x + 4$$

Homework

p. 312: 7, 12, 15, 21, 24, 30

WRITING IN VERTEX FORM **Write a quadratic function in vertex form whose graph has the given vertex and passes through the given point.**

7. vertex: (1, 6)
point: (−1, 2)

12. vertex: (2, 1)
point: (4, −2)

15. ★ **MULTIPLE CHOICE** The vertex of a parabola is (5, −3) and another point on the parabola is (1, 5). Which point is also on the parabola?

Ⓐ (0, 3) Ⓑ (−1, 9) Ⓒ (−1, 15) Ⓓ (7, 7)

WRITING IN INTERCEPT FORM **Write a quadratic function in intercept form whose graph has the given *x*-intercepts and passes through the given point.**

21. *x*-intercepts: −3, 0
point: (2, 10)

24. *x*-intercepts: −5, −1
point: (−7, −24)

WRITING IN STANDARD FORM **Write a quadratic function in standard form for the parabola shown.**

30.