Lesson 6.6: Analyzing Graphs of Quadratic Functions

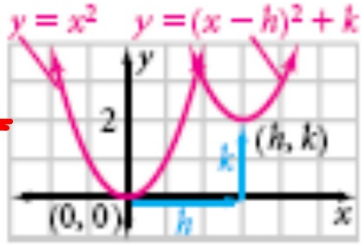
A **family of graphs** is a group of graphs that displays one or more similar characteristics. The graph of $y = x^2$ is called the **parent function** of the family of quadratic functions.

Study the graphs of $y = x^2$, $y = 2x^2$, $y = x^2 + 2$, $y = (x - 3)^2$, etc.

Notice that adding a constant to x^2 moves the graph up. Subtracting a constant from x before squaring moves the graph to the right.

$y = ax^2 + bx + c$

$x = \frac{-b}{2a}$



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

(h, k)

$x = h$

Notice that each function in the activity can be written in the form $y = a(x - h)^2 + k$ where **(h, k)** is the vertex of the parabola and **x = h** is its axis of symmetry.

This is often referred to as the **vertex form** of a quadratic function.

A translation slides a figure on the coordinate plane without changing its shape or size. As the value of h and k change, the graph of $y = a(x - h)^2 + k$ is the graph of $y = x^2$ translated *h* units horizontally and k units vertically.

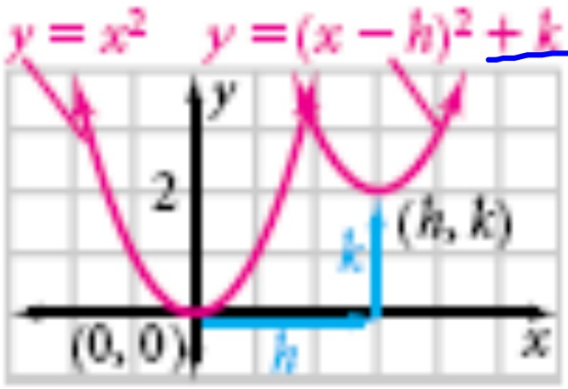
$y = a(x-h)^2 + k$

+k up

-k do

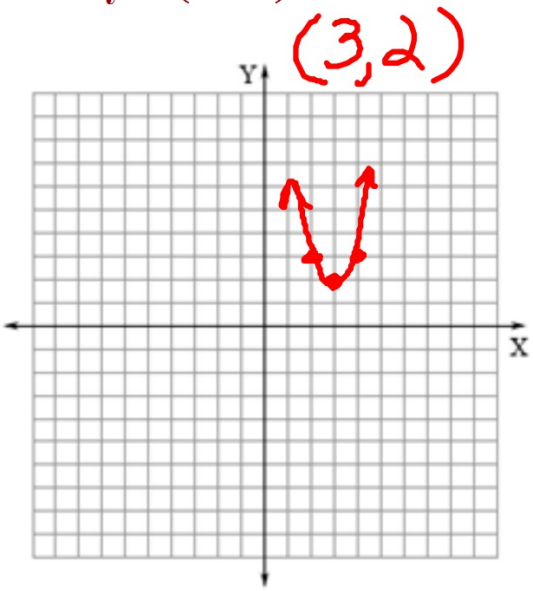
$x-h$ right h units

$x+h$ left h units

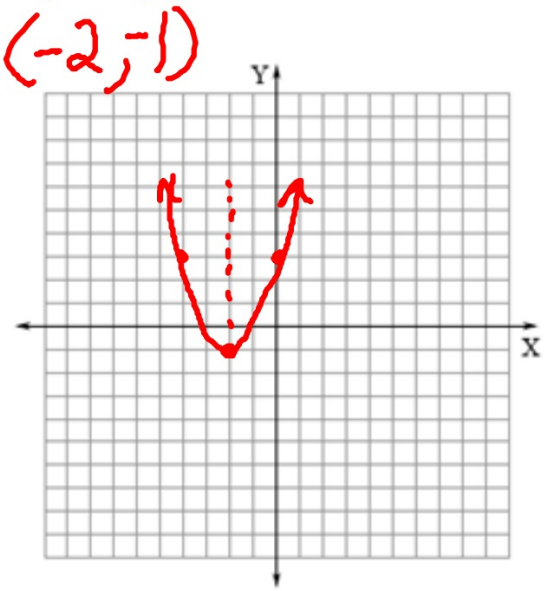


1. Analyze each equation then draw its graph.

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



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



Given a function of the form $y = ax^2 + bx + c$ you can complete the square to write the function in vertex form.

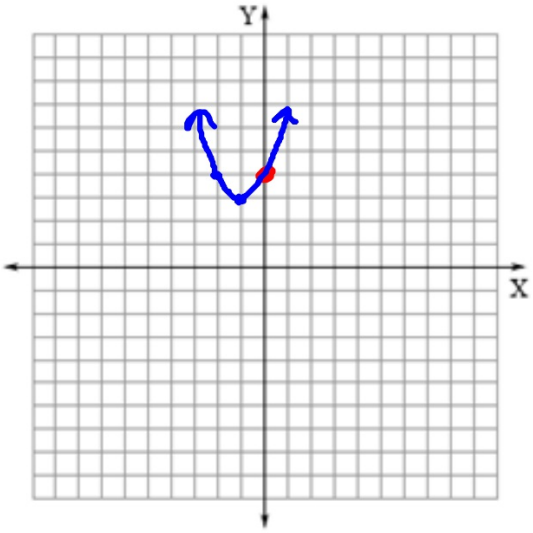
2. Write each equation in vertex form. Then analyze the function.
   a. $y = x^2 + 2x + 4$

(0,4)

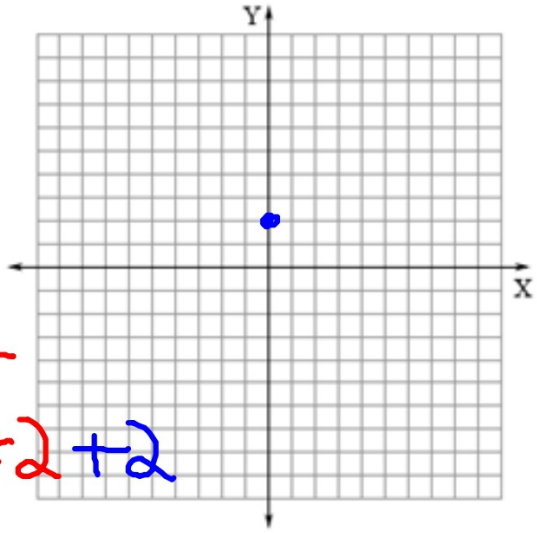
$y = (x^2 + 2x + 1) + 4 - 1$

$y = (x+1)^2 + 3$

up (-1,3)



b. $y = -2x^2 - 4x + 2$



(0, 2)

opens down

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

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

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

(−1, 4)

3. Write each equation in vertex form. Then analyze the function and graph it.

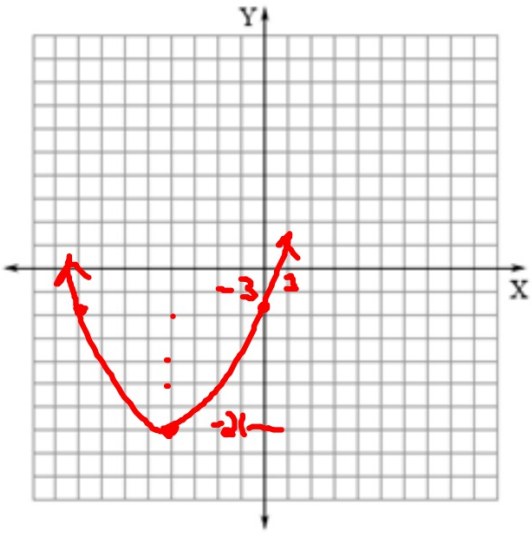
a. $y = x^2 + 8x - 5$

y-int. (0,-5)

opens up

$y=(x+4)^2-21$

(-4,-21)

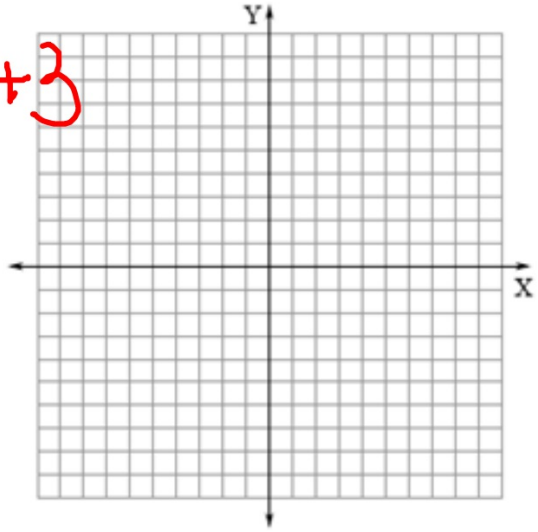


b. $y = -3x^2 + 6x - 1$

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

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

$(1, 2)$



If the vertex and one other point on the graph of a parabola are known, you can write the equation of the parabola in vertex form.

4. Write an equation for the parabola whose vertex is at (-1, 4) and passes through (2, 1).

h, k

x, y

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

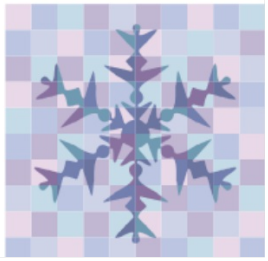
$1 = a(2+1)^2 + 4$

$1 = a(9) + 4$

$-3 = a(9)$

$-\frac{1}{3} = a$

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



5. Write an equation for the parabola whose vertex is at (1, 2) and passes through (3, 4).

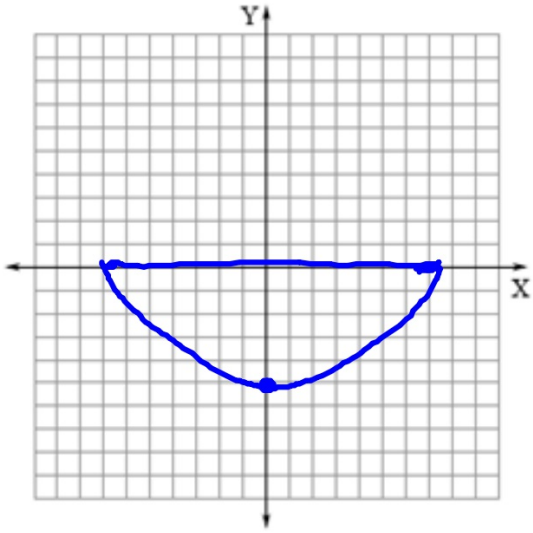
h, k

x, y

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

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

6. You want to make a parabolic solar oven to fit into a frame. Your design is to have a dish 50 cm deep and 150 cm across at the level of the frame. Sketch a graph to show the dimensions of the solar oven on a coordinate plane. (Hint: Place the vertex on the y-axis).



Homework:

Page ~~321 all 1-15~~

Page 326 odds 15-47, all 48-50