Warm-Up

Solve by completing the square:

1. $x^2 + 12x - 85 = 0$

$+85 \quad +85$

$\left(\frac{12}{2}\right)^2 = 36$

$x^2 + 12x = 85$

$+36 \quad +36$

$x^2 + 12x + 36 = 121$

$\sqrt{(x+6)^2} = \sqrt{121}$

$x + 6 = \pm 11$

$x = 5 \quad x = -17$

Write in Vertex Form

2. $y = x^2 + 4x + 6$

$\left(\frac{b}{2}\right)^2$

$\left(\frac{4}{2}\right)^2$

$(2)^2$

4

$-6 + y = x^2 + 4x + 4$

$+4$

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

$+2$

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

Write in Standard form

3. $f(x) = -2(x-3)^2 - 1$

$-2(x-3)(x-3) - 1$

$-2(x^2 - 6x + 9) - 1$

$-2x^2 + 12x - 18 - 1$

$-2x^2 + 12x - 19$

Objective

Today we will:

- Describe transformations of a quadratic function from its parent graph
- Apply Quadtratic Equations to model real world problems

Agenda:

- Transformations
- Matching Practice
- Quadratic Application Examples
- Independent practice

Transformations: Describe the changes from the parent function to the new function

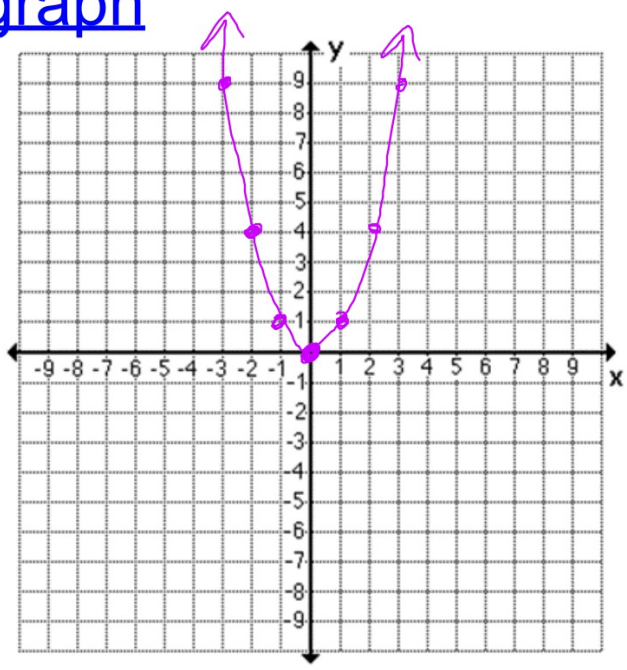
Parent Quadratic Graph: $y = x^2$

$f(x) = x^2$

Parent graph

Equation: $y = x^2$

$\left(\frac{-b}{2a},\right.$



Transformations

Horizontal Shift left or right: Comes from the "h" value (opposite of what you would think)

Vertical Shift up or down: Comes from the "k" value (same as what you would think)

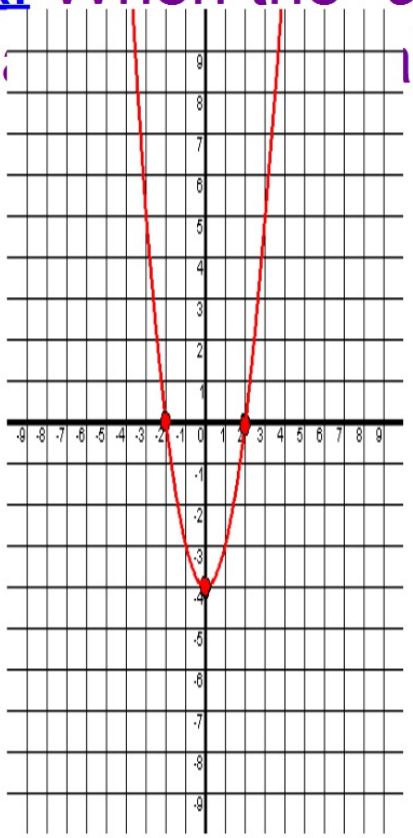
Reflection about the X-Axis: Comes from a negative "a" value, flips the parabola upside down

Transformations

Vertical Stretch: When the "a" value is greater than 1, Makes the parabola "thinner"

Vertical Shrink: When the "a" value is less than 1, m[illegible]bola "wider"

$-1 < x < 1$



Describe the Transformations

$y = x^2$

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

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

Horizontal shift left one

Vertical shift up 3

Ex. 2 $y = -(x-3)^2 - 2$

reflection about X-axis

1 Horizontal shift right 3

Vertical shift down 2

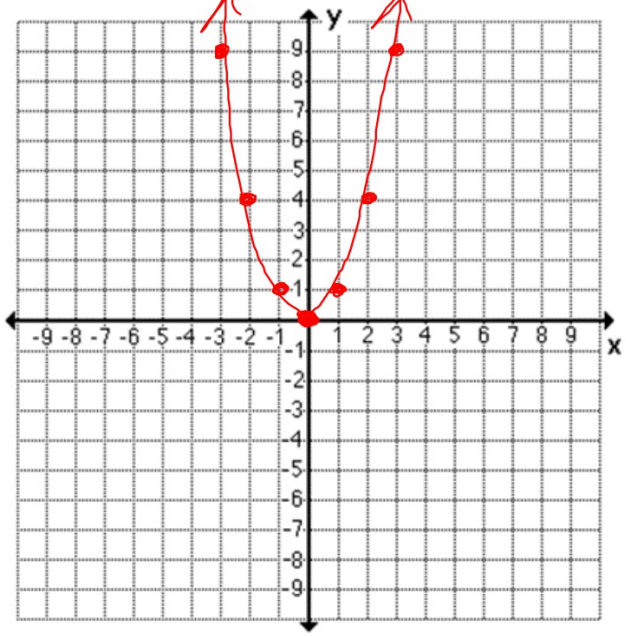
Ex. 3 $y = 2(x+3)^2 + 2$ — Vertical shift up 2

Vertical Stretch by a factor of 2

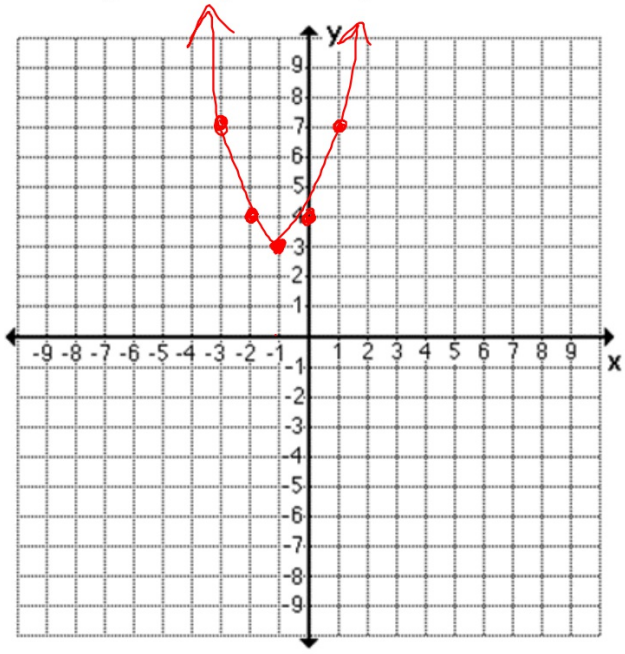
Horizontal Shift left 3

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

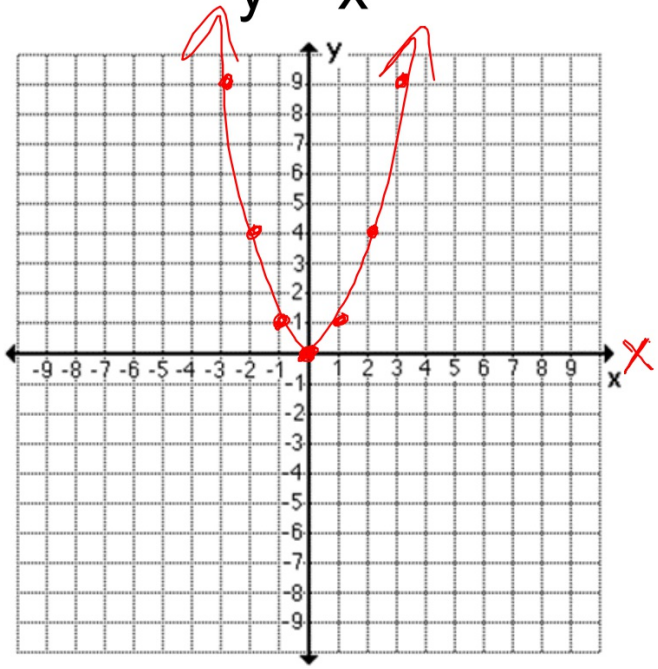
$y = x^2$


y
x
-9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9
-9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9

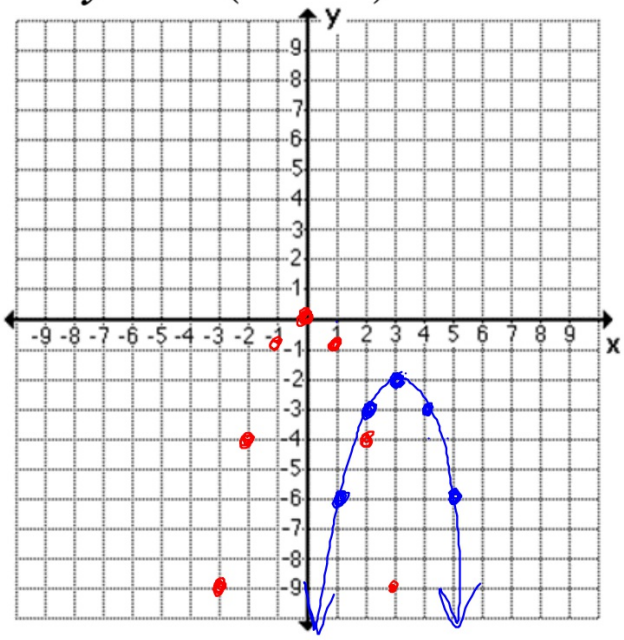
$y = (x + 1)^2 + 3$


y
x
-9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9
-9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9

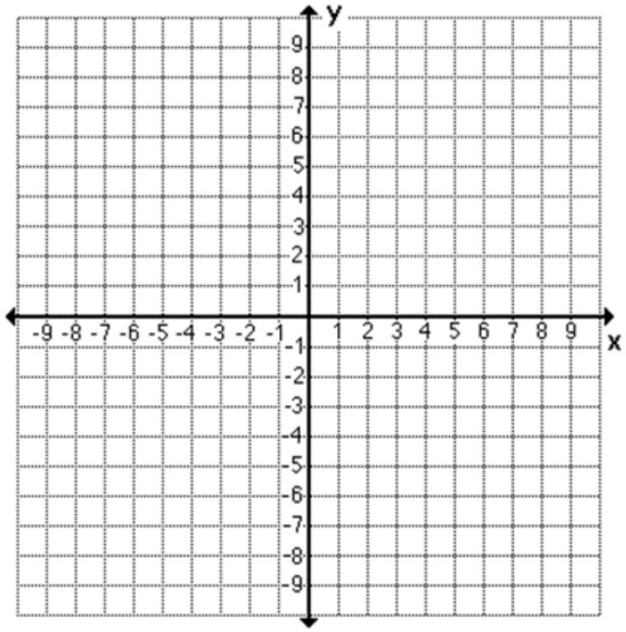
$y = x^2$



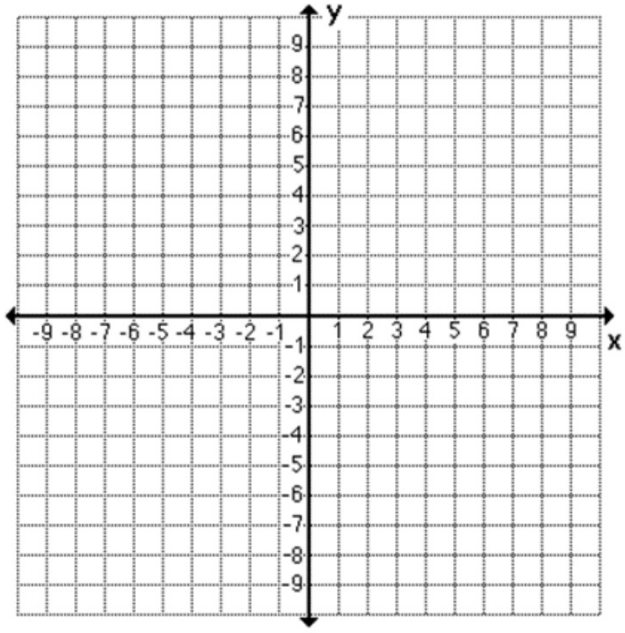
$y = -(x-3)^2 - 2$



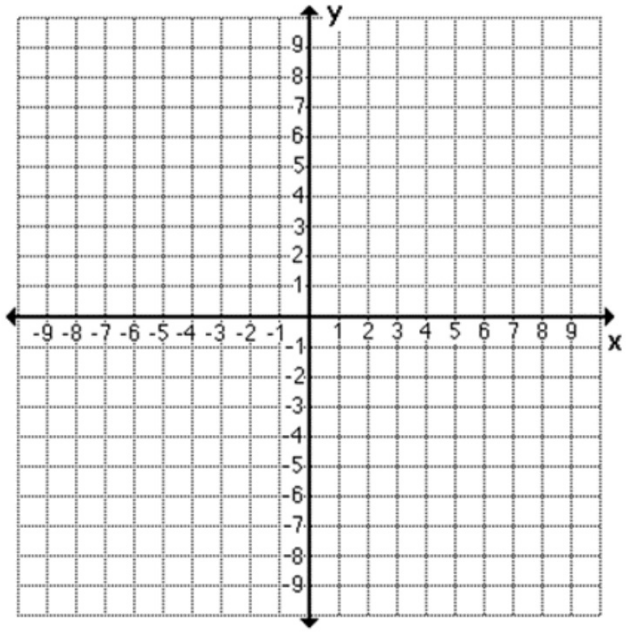
$y = x^2$



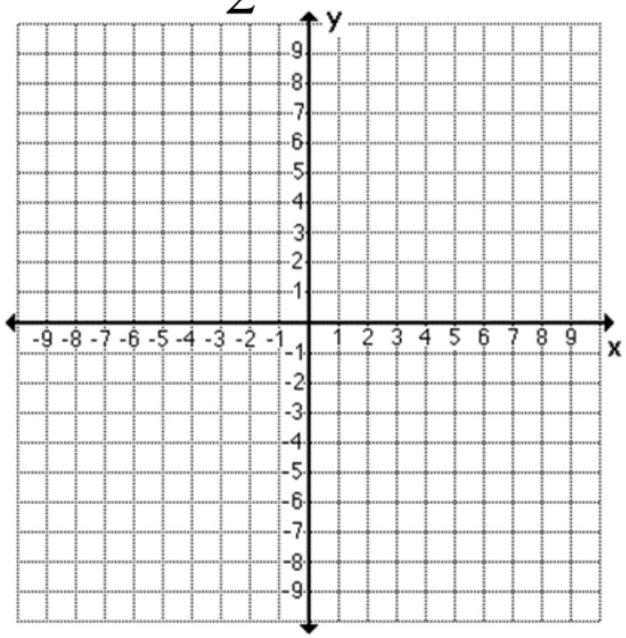
$y = 2(x + 3)^2 + 2$



$y = x^2$



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



The height y (in feet) of a ball thrown by a child is given by ~~$y = -x^2 + 8x + 4$~~ $-x^2+2x+8$ where x is the time (in seconds).

a) At what height was the ball thrown?

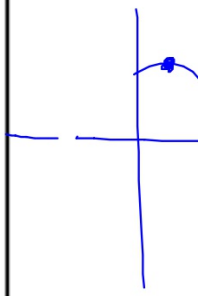
8 feet

b) What is the ball's maximum height?

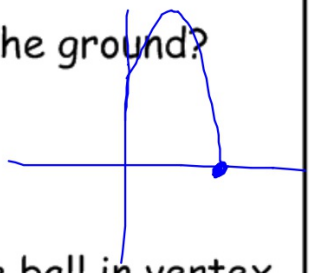
$\frac{-b}{2a}$ $\frac{-2}{-2}$ (1, 9) 9 feet

c) How long did it take the ball to reach the maximum height?

1 sec



d) How long does it take the ball to reach the ground?



e) Rewrite the equation for the path of the ball in vertex form.

f) ***SKETCH*** the graph, be sure to label your axes!
Describe any transformations to the parent graph of $y=x^2$.

A textile manufactorer has daily production costs of $C=0.045x^2-110x+100,000$ where C is the cost (in dollars) and x is the number of units produced.

a) How many units should be produced each day to yield a minimum cost?

b)What will the minimum cost be?

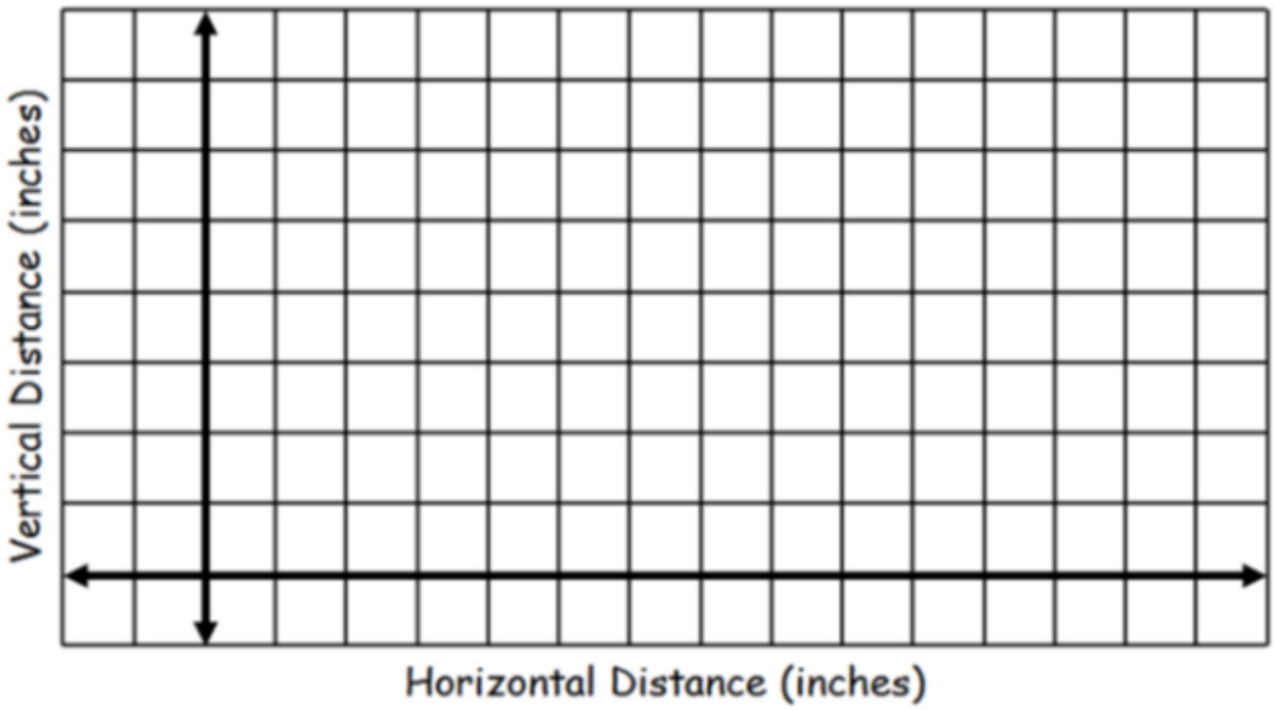
Although a football field appears to be flat, its surface is actually shaped like a parabola so that rain runs off to either side. The cross section of a field with synthetic turf can be modeled by: $y=-0.000234(x-80)^2+1.5$ where x and y are measured in feet.

a) What is the fields width?

b) What is the maximum height of the field's surface?

A flea can jump very long distances. The path of the jump of a flea can be modeled by the graph of the function, $y=-(1/6)x^2+(13/6)x$ where x and y are measured in inches. x represents the horizontal distance and y represents the vertical height of the flea. Round all values to the nearest tenth.

a) Graph the path of the flea.


Vertical Distance (inches)
Horizontal Distance (inches)

Wrap-Up

What is the parent functions? What are its characteristics?

What are ways we can describe Transformations?

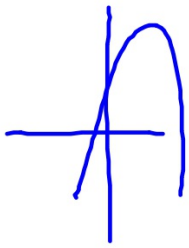
What part of the graph is the highest/lowest point?

Warm-Up

1. What is the vertex of $-x^2 + 6x - 2$?

$-9 \quad +18 \quad -2$

$\left(\frac{-b}{2a}, f(x)\right) \quad \frac{-6}{2(-1)} = (3, 7)$



2. Write the above equation in vertex form.

3. Describe any transformations of this equation from $y = x^2$

Right 3
Up 7
reflected about x-Axis

Tomorrow's Test

Main Topics

Solve:

- Factoring
- Quadratic Formula
- Taking Square Roots
- Completing the Square

Graph:

- In Standard Form
- In Vertex Form

Other Topics

- Standard to vertex
- Transformations
- Discriminant