

4-1: Quadratic Functions and Transformations

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Algebra 2

Parent Functions of Quadratic Functions

- Parent Function: $y = x^2$
 - Basic function you started with.

$-a$: Reflection

$a > 1$: Narrower

$0 < a < 1$: Wider

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

Right or Left

Wider or Narrower

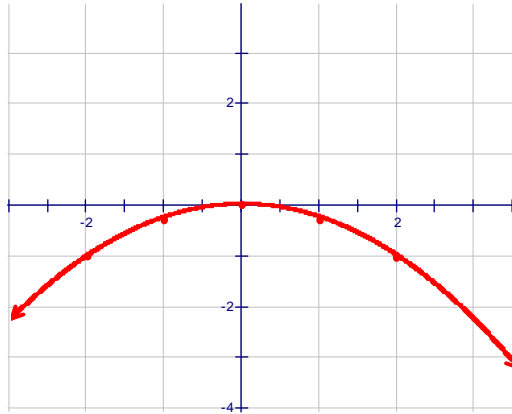
Up or Down

This is the ***Vertex Form of a Parabola.***

What is the graph of $f(x) = -\frac{1}{4}x^2$?

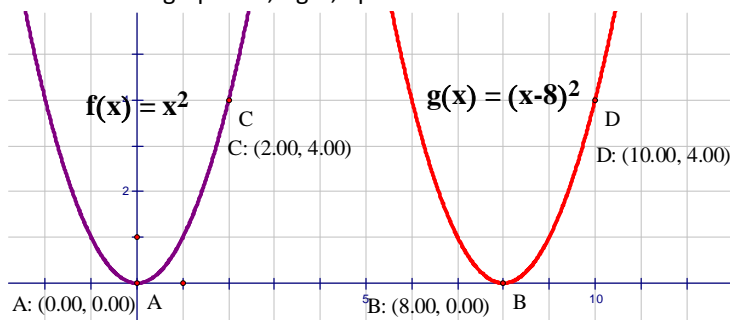
1. What is the vertex?
2. Plot points on either side of the vertex.

x	$f(x) = -\frac{1}{4}x^2$	$(x, f(x))$
-2	$-\frac{1}{4}(-2)^2$	$(-2, -1)$
-1	$-\frac{1}{4}(-1)^2$	$(-1, -0.25)$
0		$(0, 0)$
1	$-\frac{1}{4}(1)^2$	$(1, -0.25)$
2	$-\frac{1}{4}(2)^2$	$(2, -1)$



Graph-Translations

- Graph-Translation (Transformation):
 - Translates a graph left, right, up or down.



How did all the points move?

8 units to the right.

What is the new vertex?

$(8, 0)$

What is the axis of symmetry?

$x = 8$

Stretches and Compressions

- Stretch
 - Makes the graph narrower
- Compression
 - Makes the graph wider

How did the points move?

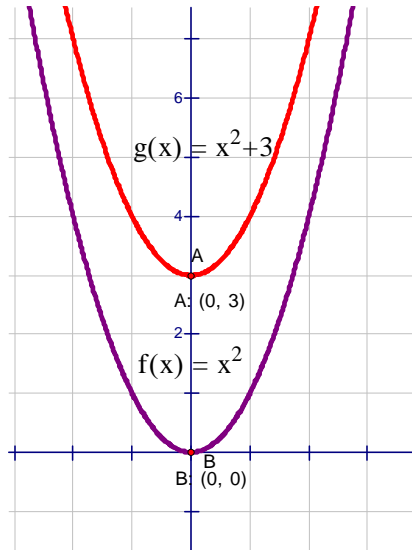
3 units up.

What is the new vertex?

$(0, 3)$

What is the axis of symmetry?

$x = 0$



Find the vertex and axis of symmetry of the following equations:

Equation	Vertex	Axis of Symmetry
$y = x^2$	$(0, 0)$	$x = 0$
$y = (x - 3)^2$	$(3, 0)$	$x = 3$
$y = x^2 + 3$	$(0, 3)$	$x = 0$
$y = (x - 5)^2 + 4$	$(5, 4)$	$x = 5$

For $y = \frac{1}{2}(x-2)^2 + 1$ what is the vertex, axis of symmetry, the min or max value, the domain and the range?

1. Compare: $y = a(x-h)^2 + k$
 $y = \frac{1}{2}(x-2)^2 + 1$

2. The vertex is $(h, k) = (2, 1)$

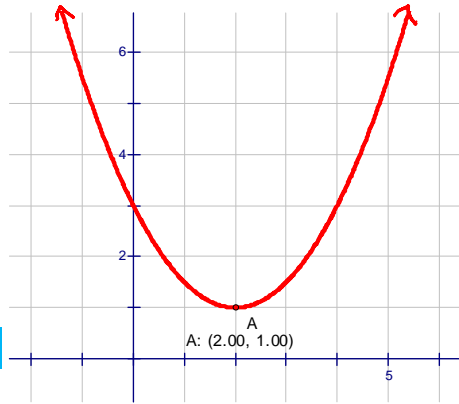
3. The axis of symmetry is $x = 2$

4. $a > 0$ so the parabola opens: Upward

5. Is the vertex a max or min? Min

6. The domain is: All real numbers

The range is: $\{y : y \geq 1\}$



The arch of the Sidney Harbor Bridge is approximately 500 meters long and 85 meters high. What quadratic function models the curve of the arch? Assume the arch starts at $(0,0)$. $f(x) = a(x-h)^2 + k$

What is the vertex? $(250, 85)$

Solve for a . $0 = a(0-250)^2 + 85$

Choose another point from the path and substitute in the vertex form.

$(0,0)$ $f(x) = a(x-h)^2 + k$

$0 = a(0-250)^2 + 85$

$-85 = a(-250)^2$

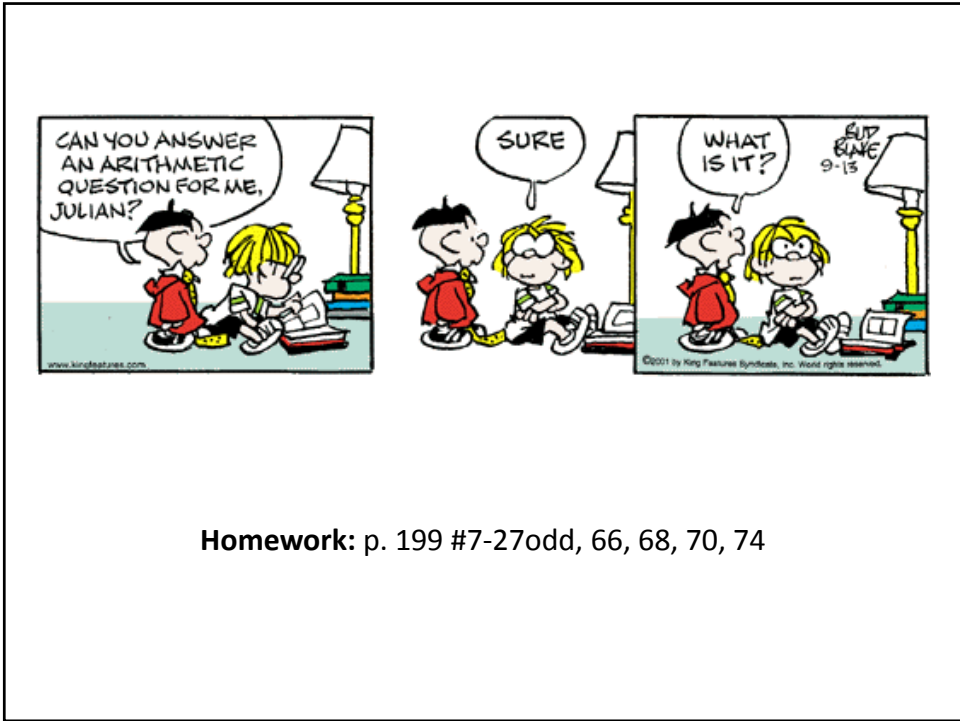
$-85 = 62,500a$

$-\frac{85}{62,500} = a$

$-\frac{17}{12,500} = a$

Substitute in the vertex form.

$f(x) = -\frac{17}{12,500}(x-250)^2 + 85$



Homework: p. 199 #7-27odd, 66, 68, 70, 74