8.2 Graph $f(x) = ax^2 + c$

Essential Question:

How does the value of c affect the graph of $f(x) = ax^2 + c$?

What You Will Learn:

- Graph quadratic functions of the form $f(x) = ax^2 + c$
- Solve real-life problems involving functions of the form $f(x) = ax^2 + c$

Core Vocabulary:

zero of a function

Previous:

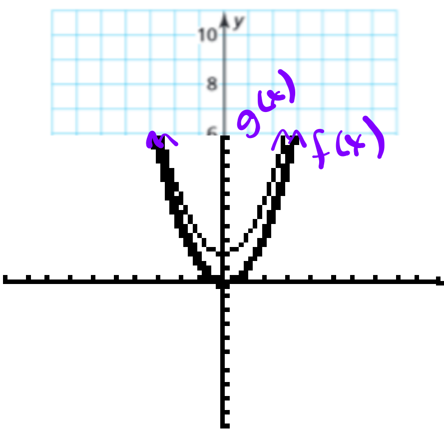
translation
vertex of a parabola
axis of symmetry
vertical stretch
vertical shrink

Feb 22-12:08 PM

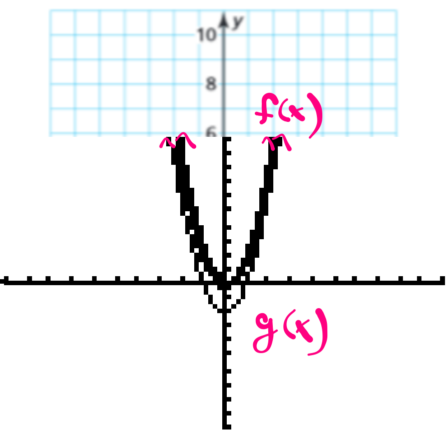
EXPLORATION: *Use a graphing calculator*

Sketch the graphs of the functions in the same coordinate plane. What do you notice? C ↑ or ↓
+ −

a. $f(x) = x^2$ and $g(x) = x^2 + 2$



b. $f(x) = 2x^2$ and $g(x) = 2x^2 - 2$



EXPLORATION 2: Finding x-Intercepts of Graphs

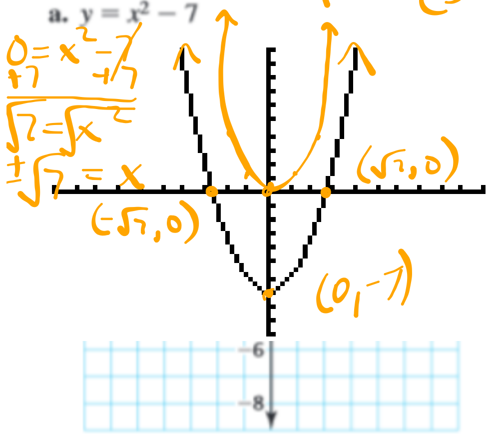
Graph each function. Find the x-intercept of the graph. Explain how you found the x-intercepts.

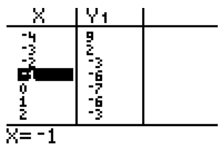
$(\_,0)$ P { zeros, roots, solutions

Use a graphing calculator

a. $y = x^2 - 7$

$0 = x^2 - 7$
$+7 \quad +7$
$\sqrt{7} = \sqrt{x^2}$
$\pm\sqrt{7} = x$





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

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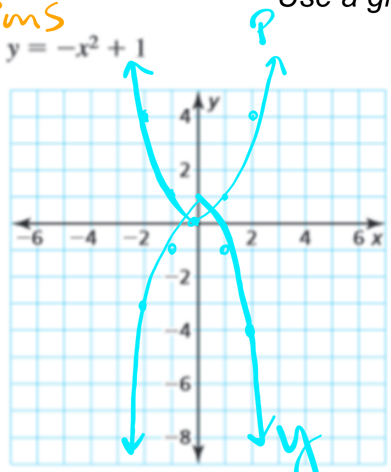
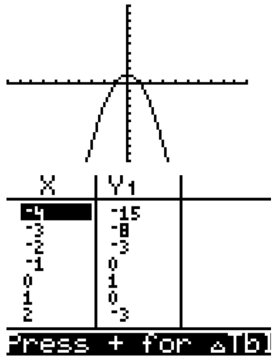




$0 = -x^2 + 1$
$-1 = -x^2$
$\pm\sqrt{1} = \sqrt{x^2}$

$x = \pm 1$

$\boxed{(\pm 1, 0)}$

Feb 22-12:11 PM

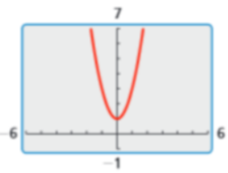
Communicate Your Answer

1) How does the value of c affect the graph of $f(x) = ax^2 + c$?

shifts the parabola up/down.

2) Use a graphing calculator to verify your answers to Question 1.

3) The figure shows the graph of a quadratic function of the form $y = ax^2 + c$. Describe possible values of a and c. Explain your reasoning.



$a =$ pos ; $a \approx 1$

$c =$ $c > 0$ b/c ↑

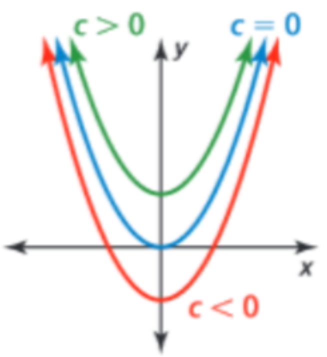
Core Concept

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

c is pos. ↑ "c" units

- When $c > 0$, the graph of $f(x) = ax^2 + c$ is a vertical translation c units up of the graph of $f(x) = ax^2$.
- When $c < 0$, the graph of $f(x) = ax^2 + c$ is a vertical translation $|c|$ units down of the graph of $f(x) = ax^2$.

The vertex of the graph of $f(x) = ax^2 + c$ is $(0, c)$, and the axis of symmetry is $x = 0$.



c is neg. ↓ "c" units

c is your y-int.

Feb 22-12:14 PM

Solving Real-Life Problems

solution, root, & x-int.

A zero of a function f is an x-value for which $\boxed{f(x) = 0.}$ A zero of a function is an x-intercept of the graph of the function.

$(x, 0)$

Example:

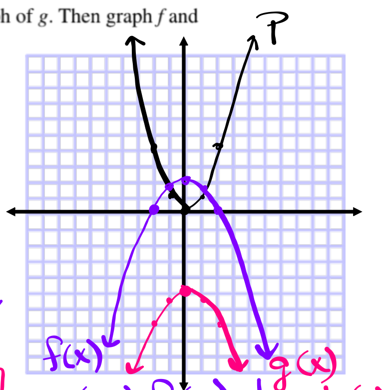
Let $f(x) = -0.5x^2 + 2$ and $g(x) = f(x) - 7$.

a. Describe the transformation from the graph of f to the graph of g. Then graph f and g in the same coordinate plane.

b. Write an equation that represents g in terms of x.

a) $f(x) = -0.5x^2 + 2$

R_x VC $\frac{1}{2}$ ↑2u



$g(x) = -0.5x^2 + 2 - 7$

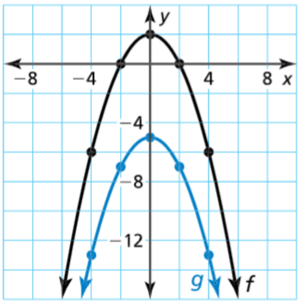
b) $\boxed{g(x) = -0.5x^2 - 5}$

R_x VC $\frac{1}{2}$ ↓5u

x	f(x)		g(x)
-2	$-\frac{1}{2}(-2)^2+2$	0	-7
-1	$-\frac{1}{2}(-1)^2+2$	$\frac{3}{2}$	$-\frac{11}{2}$
0	$-\frac{1}{2}(0)^2+2$	2	-5
1		$\frac{3}{2}$	$-\frac{11}{2}$
2		0	-7

Feb 22-12:14 PM

8.2 Graph ax2 + c with work



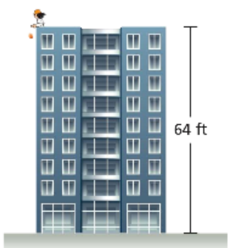
SOLUTION

a. The function g is of the form $y = f(x) + k$, where $k = -7$. So, the graph of g is a vertical translation 7 units down of the graph of f.

x	-4	-2	0	2	4
$f(x)$	-6	0	2	0	-6
$g(x)$	-13	-7	-5	-7	-13

$-0.5x^2 + 2$

$f(x) - 7$



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The function $f(t) = -16t^2 + s_0$ represents the approximate height (in feet) of a falling object t seconds after it is dropped from an initial height s_0 (in feet). An egg is dropped from a height of 64 feet.

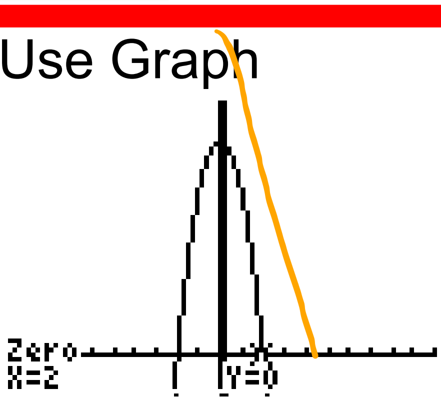
a. After how many seconds does the egg hit the ground? 2 secs.

b. Suppose the initial height is adjusted by k feet. How will this affect part (a)? longer time

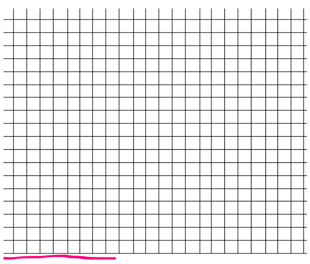
$f(t) = -16t^2 + 64$

Example:

1. Use Graph



2. Use ZPP



$0 = -16t^2 + 64$

$0 = -16(t^2 - 4)$

$(t+2)(t-2) = 0$

$t+2=0 \quad t-2=0$

$t = \pm 2$

8.2 Graph $f(x) = ax^2 + c$

Assign:

p 429

A: 6, 10, 12, 16, 18, 24 - 34(e), 38, 44

B: 1, 2 - 14(e), 20 - 28 (e), 30, 32, 42

C: 2, 4, 6, 10, 14, 18, 20, 22, 28, 42

Feb 22-12:20 PM