

Reflecting & Stretching Quadratic Relations

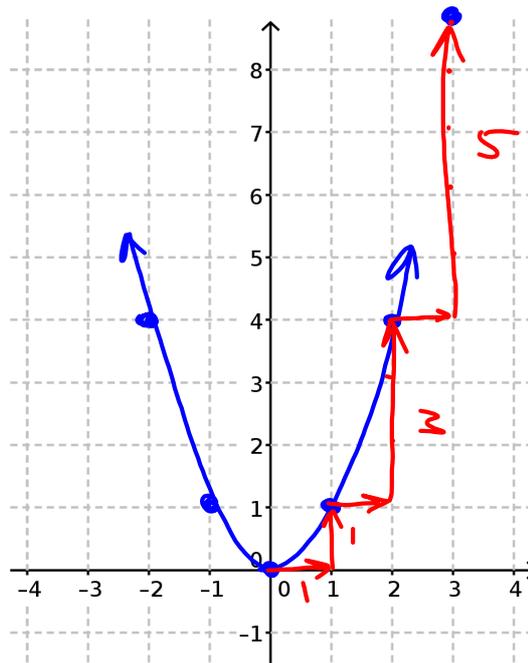
Apr. 13/2016

The simplest quadratic relation is $y = x^2$, called the parent function.

x	$y = x^2$
-2	$(-2)^2 = 4$
-1	$(-1)^2 = 1$
0	$0^2 = 0$
1	$1^2 = 1$
2	$2^2 = 4$
3	$3^2 = 9$

Step Pattern?

1, 3, 5, 7, ...



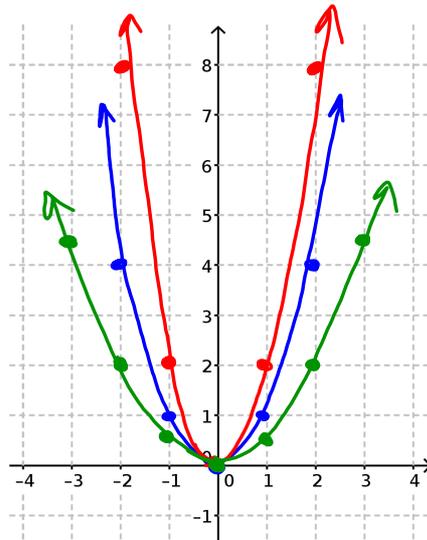
May 2-4:13 PM

Compare the graphs and TOV for $y = x^2$, $y = 2x^2$, and $y = \frac{1}{2}x^2$.
What do you notice?

x	$y = x^2$	$y = 2x^2$	$y = \frac{1}{2}x^2$
-3	$(-3)^2 = 9$	$2(-3)^2 = 18$	$\frac{1}{2}(-3)^2 = \frac{1}{2}(9) = \frac{9}{2} = 4.5$
-2	$(-2)^2 = 4$	$2(-2)^2 = 8$	2
-1	$(-1)^2 = 1$	2	0.5
0	$0^2 = 0$	0	0
1	$1^2 = 1$	2	0.5
2	$2^2 = 4$	8	2
3	$3^2 = 9$	18	4.5

May 2-4:18 PM

Graph $y = x^2$, $y = 2x^2$ and $y = \frac{1}{2}x^2$.



Step Patterns?

1, 3, 5, 7, ...
 $\downarrow \downarrow \downarrow \downarrow$
 2, 6, 10, 14, ...

0.5, 1.5, 2.5, ... } OR
 $\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \dots$

Answer: Each step pattern multiplies the parent pattern by the 'a' coefficient.

May 2-4:29 PM

See Geogebra quadratic translation demo
 (click here for link)

Apr 29-9:10 PM

$y = x^2$ $a = 1$, so $a > 0$, parabola opens up

$y = -x^2$ $a = -1$, so $a < 0$, parabola opens down
vertical reflection

The sign of **a** determines if there is a vertical reflection of the parent function, $y = x^2$.

"Vertically reflected"

Nov 8-1:22 PM

When '**a**' is a number other than 1 or -1, we say that $y = x^2$ has been vertically scaled.

For a vertical scaling, we only care about the size, or magnitude, of '**a**', so we ignore the sign. This is called the "absolute value", and has the symbol **|a|**.

When **|a|** > 1, the graph of $y = x^2$ gets thinner. The parent function undergoes a vertical stretch.

e.g., $y = 2x^2$, $y = -5x^2$, $y = \frac{3}{2}x^2$

When $0 < \mathbf{|a|} < 1$, the graph of $y = x^2$ gets wider. The parent function undergoes a vertical compression.

e.g., $y = \frac{1}{2}x^2$, $y = -0.2x^2$, $y = 0.999x^2$

May 2-4:31 PM

Ex. 1. Describe the transformations to $y = x^2$ that yield the following:

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

Vertical compression

by $\frac{1}{4}$

OR

by 4

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

① Vertical reflection

② Vertical stretch
by 3

May 2-4:35 PM

Ex. 2. Graph using the transformed step pattern.

(a) $y = -0.5x^2$

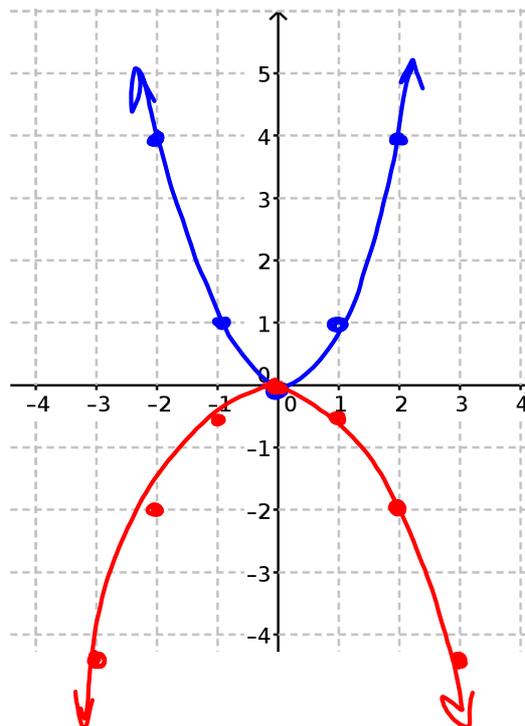
Step patterns:

$y = x^2$: 1, 3, 5, ...

$y = -0.5x^2$

$\{-0.5, -1.5, -2.5$

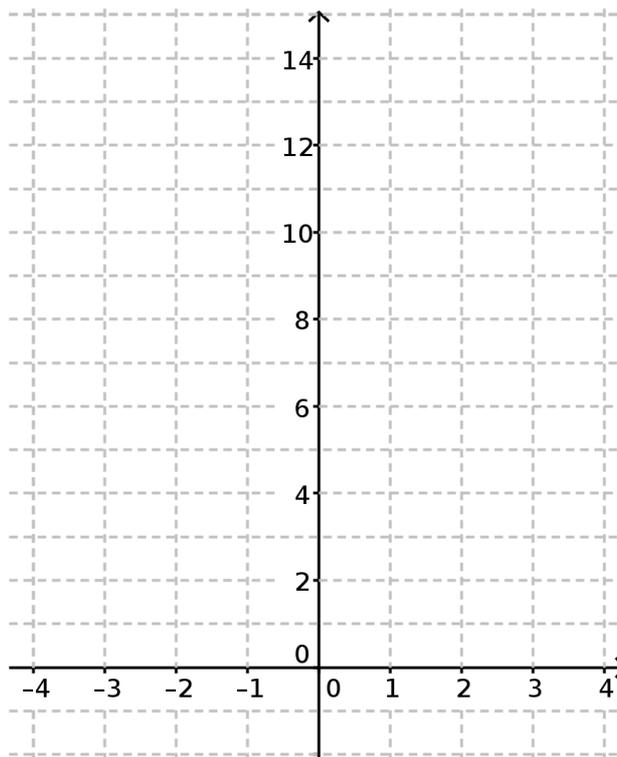
$\{-\frac{1}{2}, -\frac{3}{2}, -\frac{5}{2}$



Apr 11-8:49 PM

Ex. 2. Graph using the transformed step pattern.

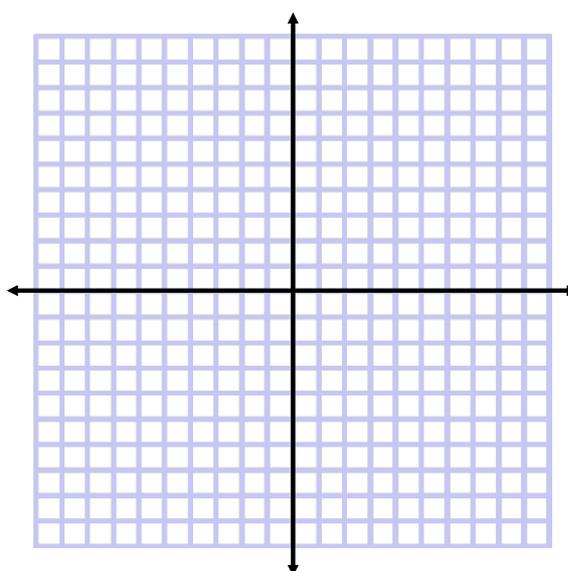
(b) $y = 3x^2$



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Ex. 2. Graph (b) $y = 3x^2$

x	$y=x^2$



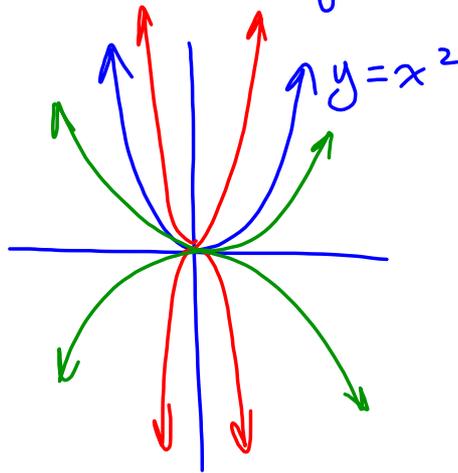
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Assigned Work:

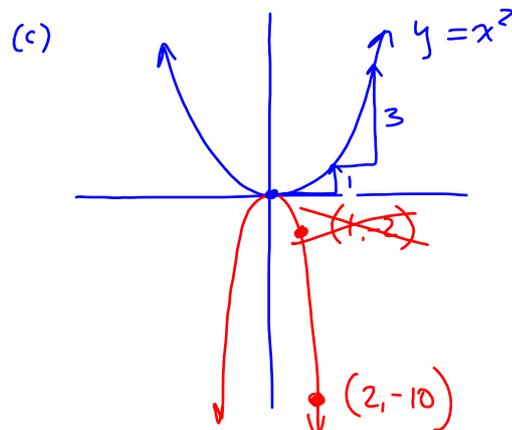
p. 256 # 1, 2, 4, 5, 8
c

1. (a) $y = 4x^2$ (b) $y = -3x^2$

(c) $y = \frac{2}{3}x^2$ (d) $y = -0.4x^2$



Mar 20 - 4:57 PM



$$y = ax^2$$

$$-10 = a(2)^2$$

$$-10 = 4a$$

$$a = \frac{-10}{4}$$

$$a = -\frac{5}{2}$$

OR

$$a = -2.5$$

$$y = -\frac{5}{2}x^2$$

OR

$$y = -2.5x^2$$

Apr 14-12:38 PM

$$8(c) \quad y = 0.25x^2$$

① v. compression by $\begin{matrix} \nearrow 4 \\ \searrow 0.25 \end{matrix}$

$P(2,4) \xrightarrow{y \times 0.25} (2,1)$

x	$y = x^2$	$y = 0.25x^2$
2	4	$0.25(4) = 1$

Apr 14-12:44 PM