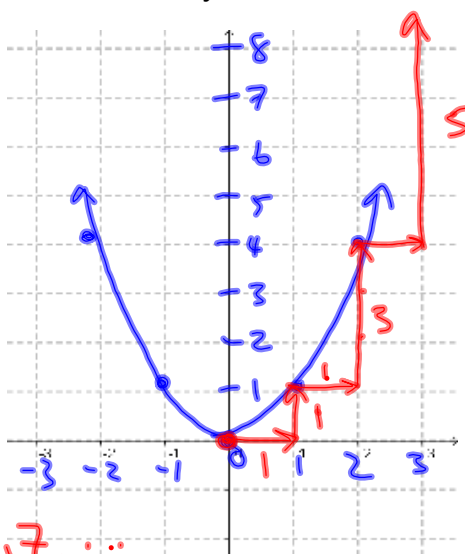


### Reflecting & Stretching Quadratic Relations

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

x	$y = x^2$
-2	4
-1	1
0	0
1	1
2	4



pattern: 1, 3, 5, 7, ...

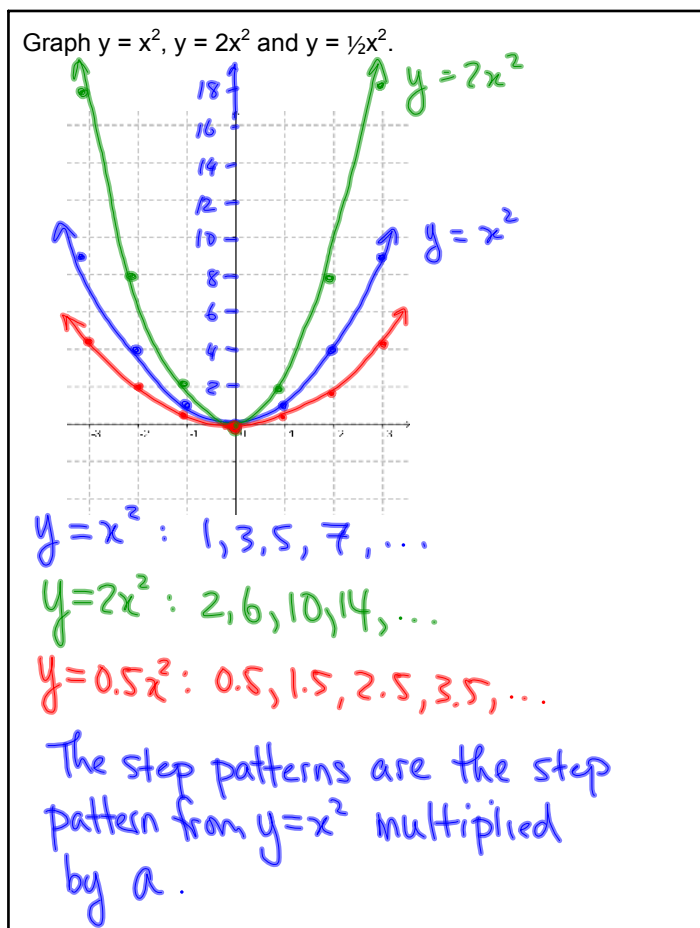
called the "step pattern"

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	9	18	4.5
-2	4	8	2
-1	1	2	0.5
0	0	0	0
1	1	2	0.5
2	4	8	2
3	9	18	4.5

May 2-4:18 PM



May 2-4:29 PM

See Geogebra quadratic translation demo  
(click here for link)

Apr 29-9:10 PM

$$y = x^2 \quad a = 1, \text{ so } a > 0, \text{ parabola opens up}$$

$$y = -x^2 \quad a = -1, \text{ so } a < 0, \text{ parabola opens down}$$

vertical reflection

vertically reflected

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

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.,  $y = 2x^2$ ,  $y = -3x^2$ ,  $y = 1.01x^2$

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

e.g.,  $y = 0.5x^2$ ,  $y = -\frac{1}{4}x^2$ ,  $y = 0.999x^2$

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 a factor of  $\frac{1}{4}$   
or a factor of 4)

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

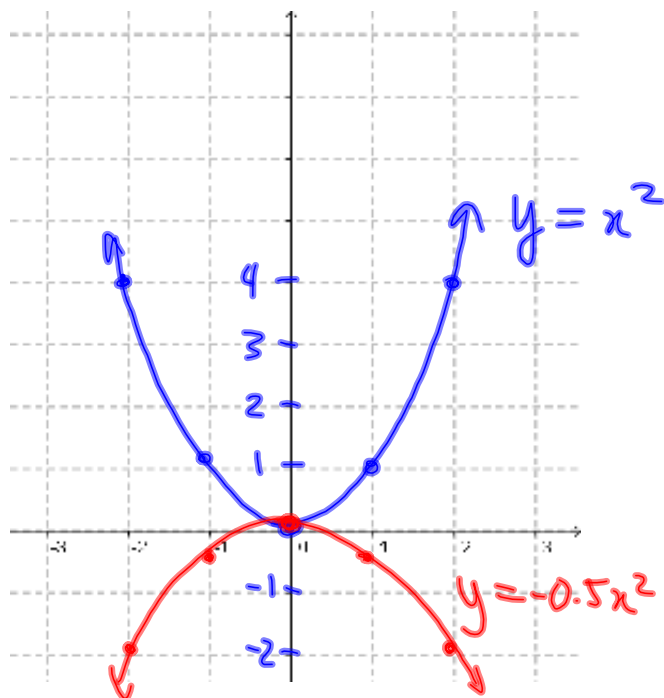
vertical stretch  
by 3  
vertically reflected

May 2-4:35 PM

Ex. 2. Graph (a)  $y = -0.5x^2$

(b)  $y = 3x^2$

$x$	$y=x^2$	$-0.5x^2$
-2	4	-2
-1	1	-0.5
0	0	0
1	1	-0.5
2	4	-2

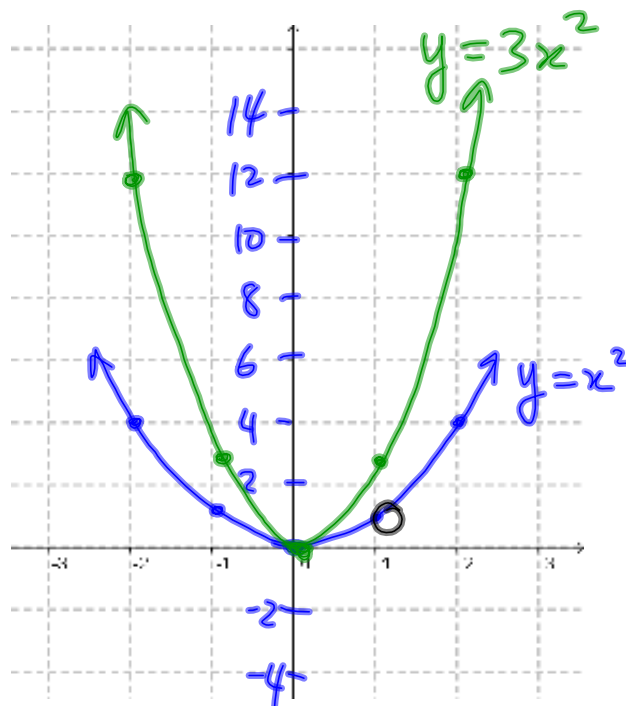


Apr 11-8:49 PM

Ex. 2. Graph (a)  $y = -0.5x^2$ (b)  $y = 3x^2$ 

$x$	$y=x^2$	$3x^2$
-2	4	12
-1	1	3
0	0	0
1	1	3
2	4	12

1, 3, 5, 7, ...  
3, 9, 15, 21, ..

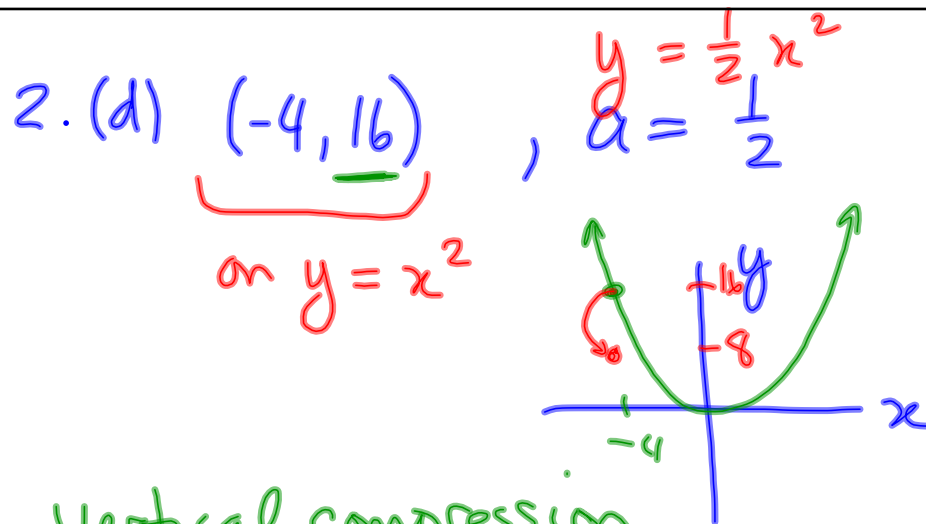


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Assigned Work:

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

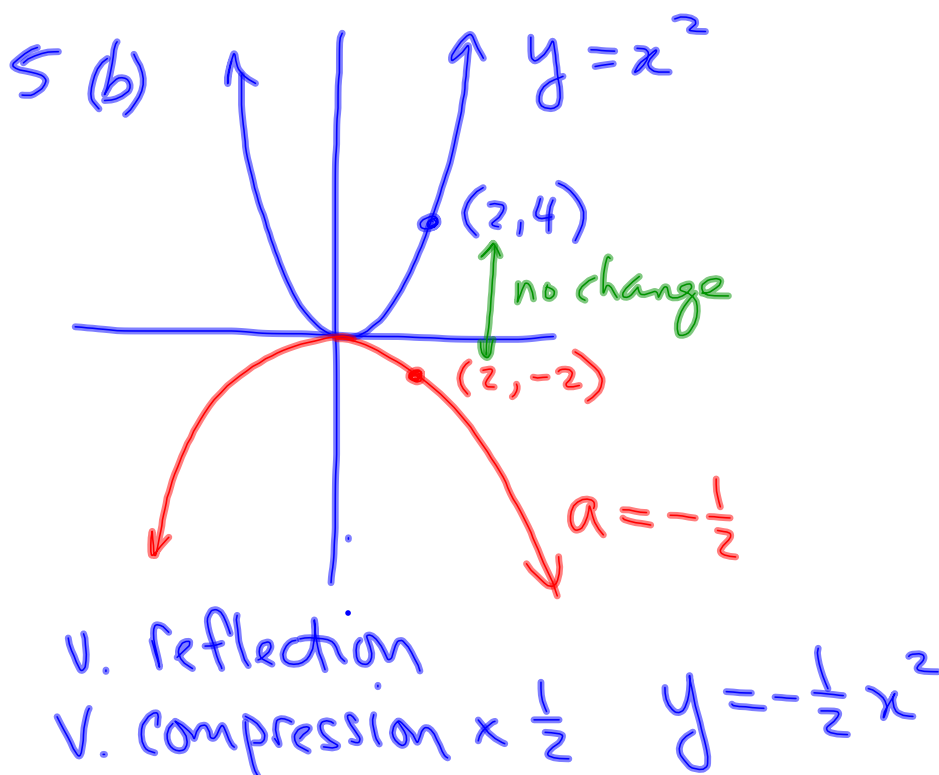
Mar 20 - 4:57 PM



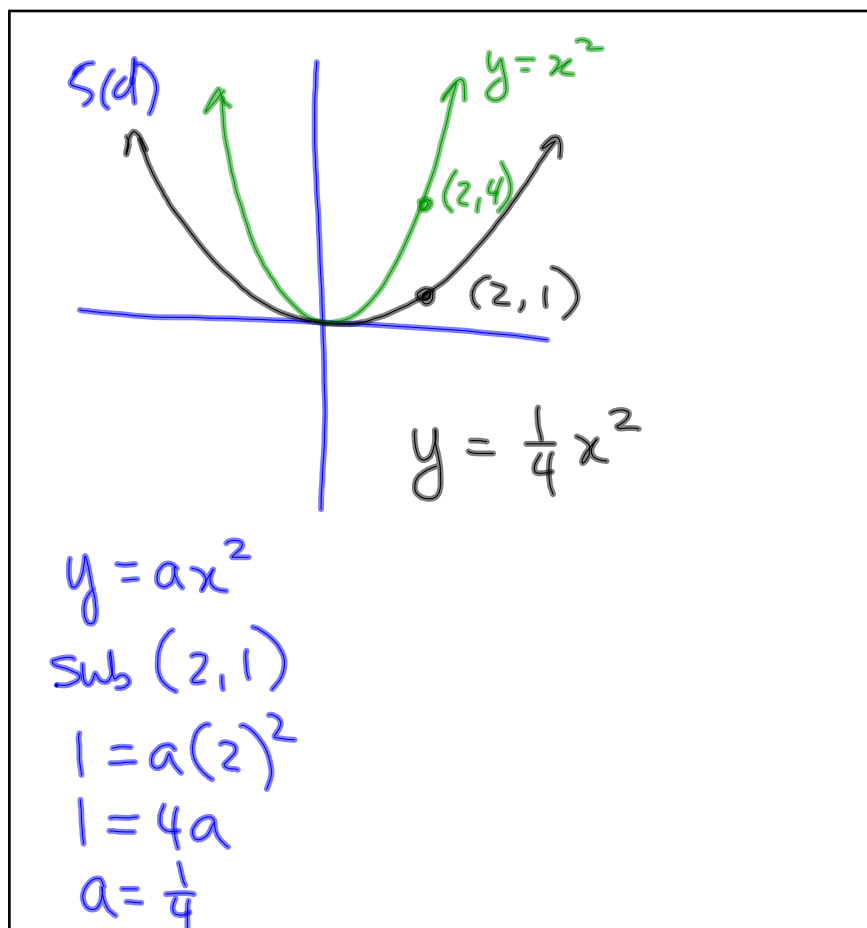
Vertical compression  
 $\rightarrow$  y value smaller

$$(-4, 16) \rightarrow (-4, 8)$$

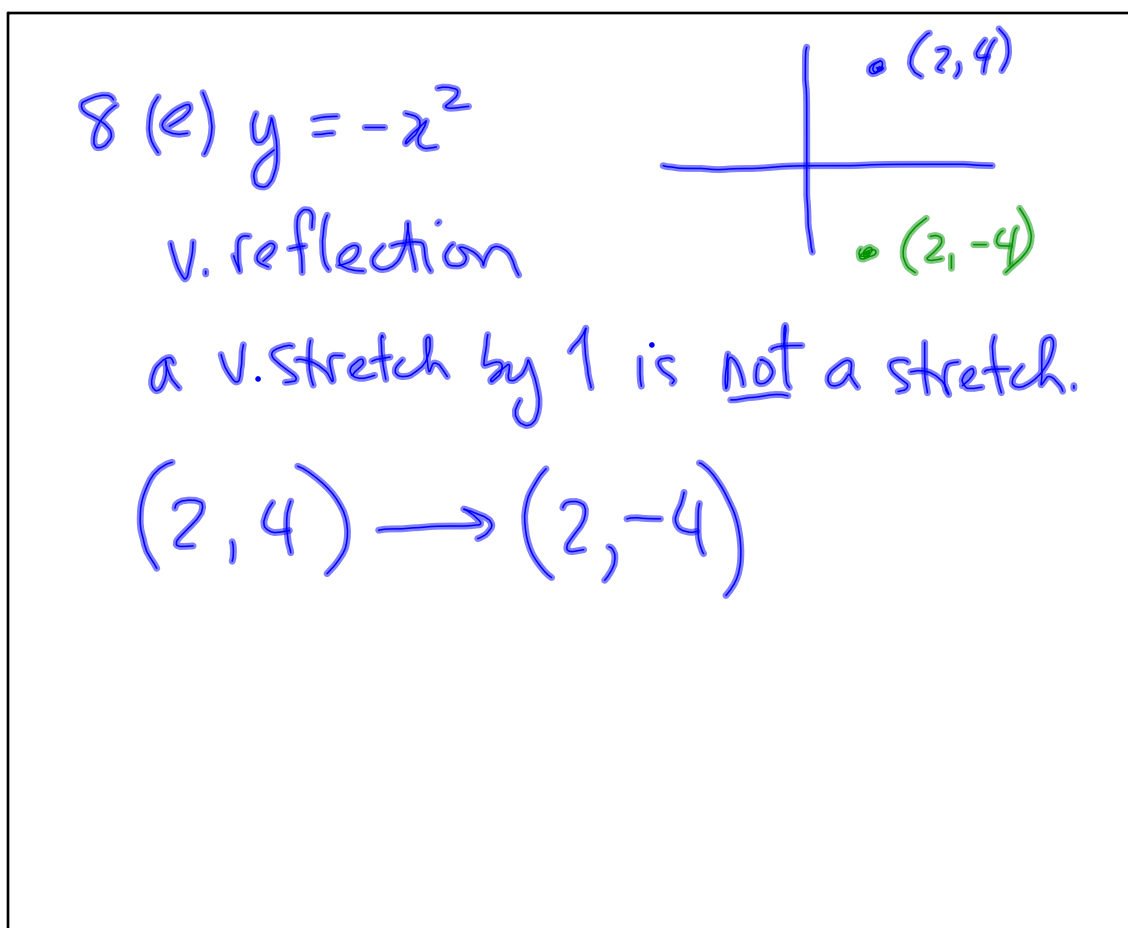
Nov 11-9:14 AM



Nov 11-9:19 AM



Nov 11-9:24 AM



Nov 11-9:28 AM

$$8(b) \quad y = -\frac{2}{3}x^2$$

v. reflection

v. compression (y-value smaller)

$$(2, 4) \rightarrow (2, -\frac{2}{3}(4))$$
$$\rightarrow (2, -\frac{8}{3})$$

$$(5, -8) \rightarrow (5, -8(-\frac{2}{3}))$$
$$\rightarrow (5, \frac{16}{3})$$

Nov 11-9:30 AM