

# PC12 Lesson 1.2 Part II

Monday, September 11, 2017 10:07 AM

## 1.2 Part II: Expansions and Compressions

Vertical

Given  $y = af(x)$ , if

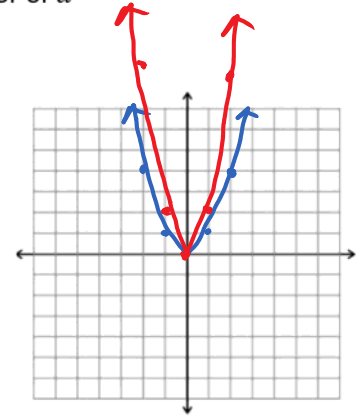
- $a > 1$ , graph is vertically stretched (expanded) by a factor of  $a$
- $0 < a < 1$ , graph is vertically stretched (compressed) by a factor of  $a$

Example 1: Graph  $y = x^2$  and  $y = 2x^2$

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

$x$	$y$
-2	8
-1	2
0	0
1	2
2	8

vertically stretched  
by factor of 2.



Example 2: Graph  $y = |x|$  and  $-4y = |x|$

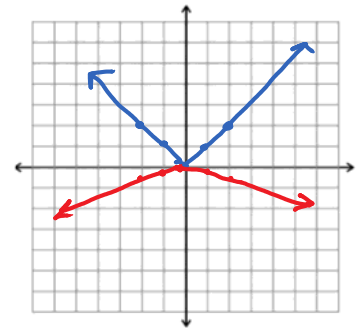
$x$	$y$
-2	2
-1	1
0	0
1	1
2	2

$x$	$y$
-2	-0.5
-1	-0.25
0	0
1	0.25
2	0.5

$$\frac{-4y}{-4} = \frac{|x|}{-4}$$

$$y = -\frac{1}{4}|x|$$

Multiply  
 $y$  values by  $-\frac{1}{4}$



### Horizontal

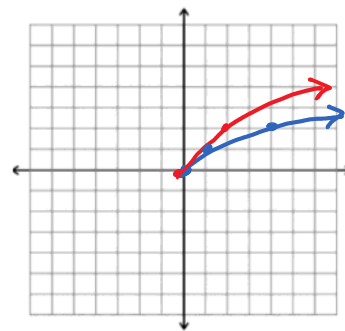
Given  $y = f(bx)$ , if

- $b > 1$ , graph is horizontally stretched (compressed) by a factor of  $\frac{1}{b}$
- $0 < b < 1$ , graph is horizontally stretched (expanded) by a factor of  $\frac{1}{b}$

Example 3: Graph  $y = \sqrt{x}$  and  $y = \sqrt{2x}$

$x$	$y$	$x$	$y$
0	0	0	0
1	1	0.5	1
4	2	2	2
9	3	4.5	3

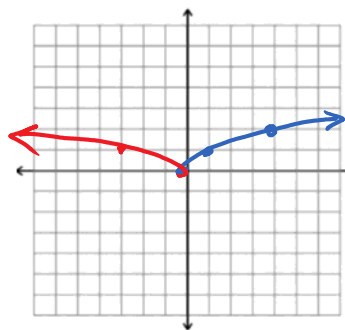
$x$ -values  $\times \frac{1}{2}$



Example 4: Graph  $y = \sqrt{x}$  and  $y = \sqrt{-\frac{1}{3}x}$

$x$	$y$	$x$	$y$
0	0	0	0
1	1	-3	1
4	2	-12	2
9	3	-27	3

horizontal reflection + hor. stretch by 3



$x$ -values  $\times -3$

Example 5: Describe what happens to  $y = f(x)$  when the following changes are made.

- a)  $x$  is replaced with  $-\frac{1}{3}x$       $y = f(-\frac{1}{3}x)$      H.R.  
H.S.  $\times 3$
- b)  $y$  is replaced with  $-4y$

$$\frac{-4y}{-4} = \frac{f(x)}{-4}$$
$$y = -\frac{1}{4}f(x)$$

V.R.  
V.S.  $\times \frac{1}{4}$