

2.5. (Continue)

Monday, September 30, 2019

12:53 PM

Recall: $y = f(x)$; $c > 0$

$y = f(x) + c$: up c units

$y = f(x) - c$: down c units

$y = f(x + c)$: left c units

$y = f(x - c)$: right c units

Obj 1: Vertical Stretching and Shrinking.

Vertical Stretching and Shrinking of Graphs

Given the graph of $y = f(x)$ and a positive number

c .

Vertical Stretching
 $c > 1$

The graph of

$$y = c \cdot f(x)$$

is the graph of

$$y = f(x)$$

vertically stretched

by multiplying each of
its y -coordinates by

c

Vertically Shrinking:
 $0 < c < 1$

The graph of

$$y = c \cdot f(x)$$

is the graph of

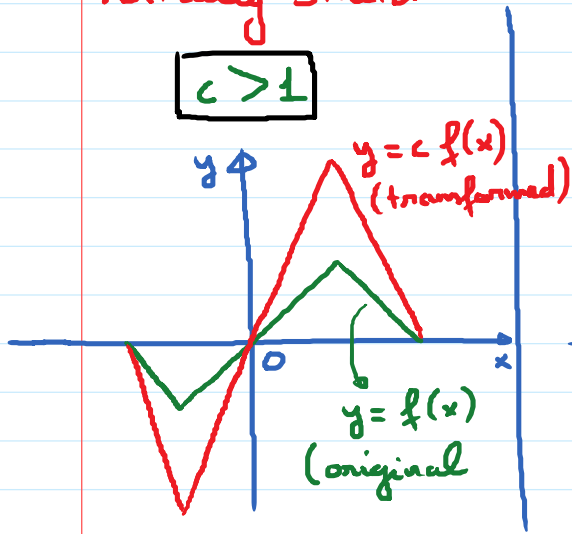
$$y = f(x)$$

vertically shrunk by

multiplying each of its
 y -coordinates by c

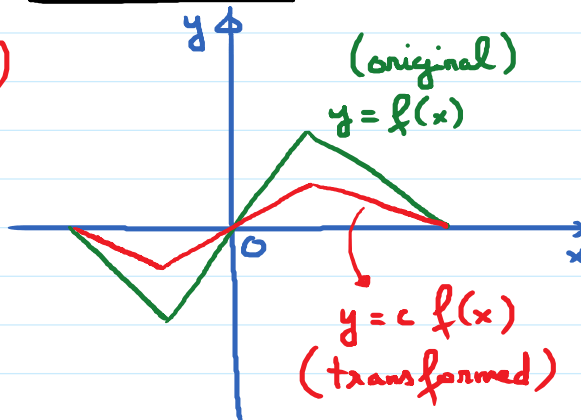
Vertically Stretch

$$c > 1$$



Vertically Shrinking

$$0 < c < 1$$



E.g. Given $y = f(x) = x^2$

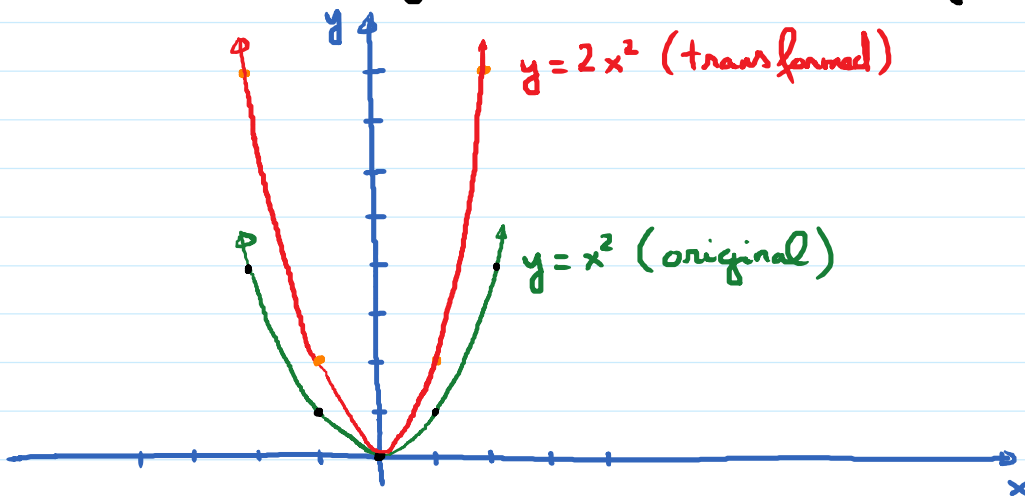
(a) Graph $y = f(x) = x^2$ (5 key points)

(b) Graph $y = 2f(x) = 2x^2$

x	$y = x^2$ (original)
-2	4 $\rightarrow (-2, 4)$
-1	1 $\rightarrow (-1, 1)$
0	0 $\rightarrow (0, 0)$
1	1 $\rightarrow (1, 1)$
2	4 $\rightarrow (2, 4)$

x	$y = 2x^2$ (transformed)
-2	8 $\rightarrow (-2, 8)$
-1	2 $\rightarrow (-1, 2)$
0	0 $\rightarrow (0, 0)$
1	2 $\rightarrow (1, 2)$
2	8 $\rightarrow (2, 8)$

Every y -coordinate is multiplied by 2.

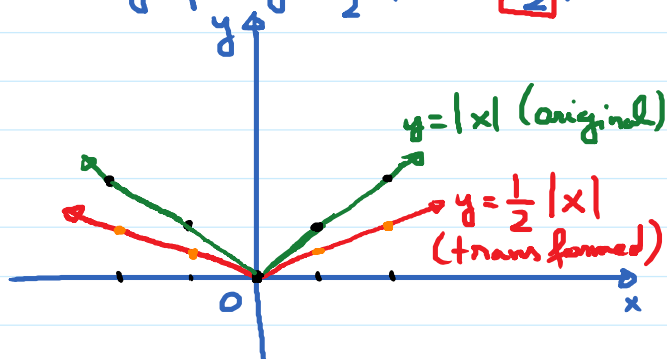


E.g. Given $y = f(x) = |x|$

(a) Graph this function (5 key points)

(b) Use transformation to graph $y = \frac{1}{2}f(x) = \frac{1}{2}|x|$.

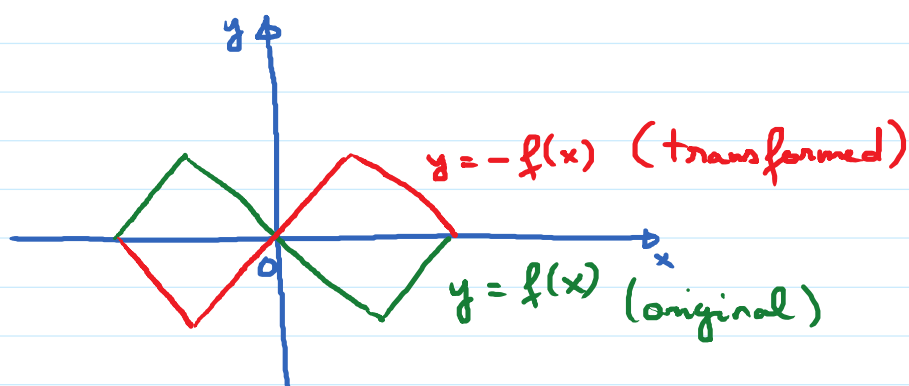
x	$y = x $
-2	2 $\rightarrow (-2, 2)$
-1	1 $\rightarrow (-1, 1)$
0	0 $\rightarrow (0, 0)$
1	1 $\rightarrow (1, 1)$
2	2 $\rightarrow (2, 2)$



Objective 2: Reflection across x-axis.

Reflection across x-axis:

The graph of $y = -f(x)$ is the graph of $y = f(x)$ reflected about the x-axis.



E.g. Given $y = f(x) = x^2$.

(a) What is the formula of $y = -f(x)$?

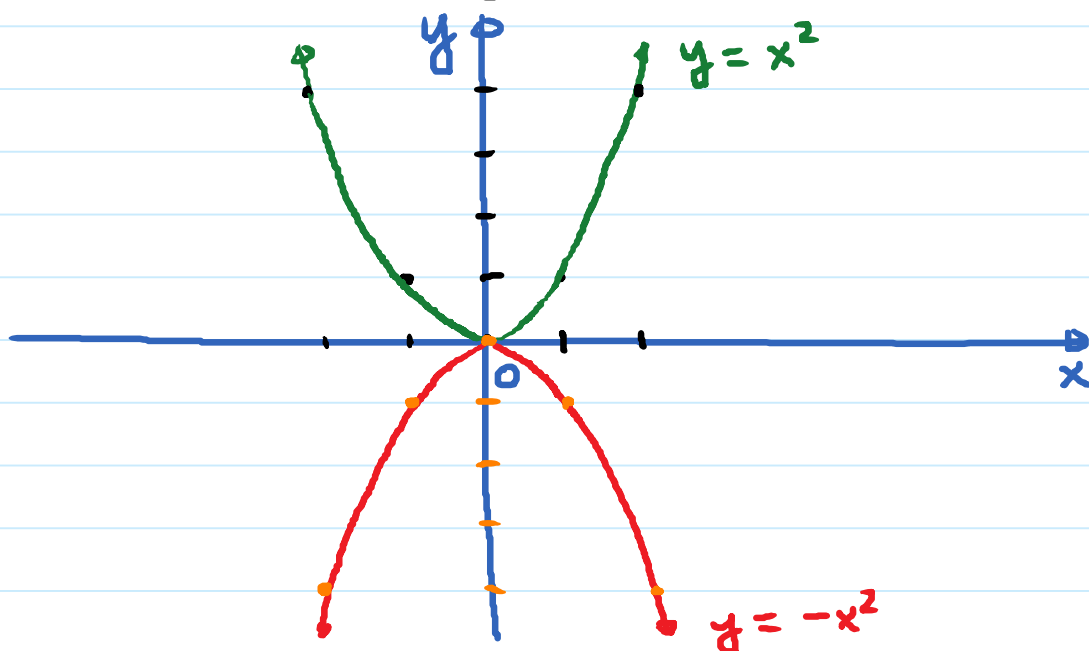
$$y = -x^2$$

(b) Graph $y = f(x)$ and $y = -f(x)$ (5 key points)

x	$y = f(x) = x^2$
-2	4 $\rightarrow (-2, 4)$
-1	1 $\rightarrow (-1, 1)$
0	0 $\rightarrow (0, 0)$
1	1 $\rightarrow (1, 1)$
2	4 $\rightarrow (2, 4)$

x	$y = -f(x) = -x^2$
-2	-4 $\rightarrow (-2, -4)$
-1	-1 $\rightarrow (-1, -1)$
0	0 $\rightarrow (0, 0)$
1	-1 $\rightarrow (1, -1)$
2	-4 $\rightarrow (2, -4)$

sign of y -coordinate is changed



Obj 3: Sequence of Transformation:

$y = f(x)$ (Original) ; $c > 0$

$y = f(x) + c \rightarrow$ up by c

$y = f(x) - c \rightarrow$ Down by c

$y = f(x+c) \rightarrow$ left by c

$y = f(x-c) \rightarrow$ Right by c

$y = c f(x)$ ($c > 1$) $\rightarrow$ v. Stretch by c

$y = c f(x)$ ($0 < c < 1$) $\rightarrow$ v. Shrink by c

$y = -f(x) \rightarrow$ Reflect across x -axis

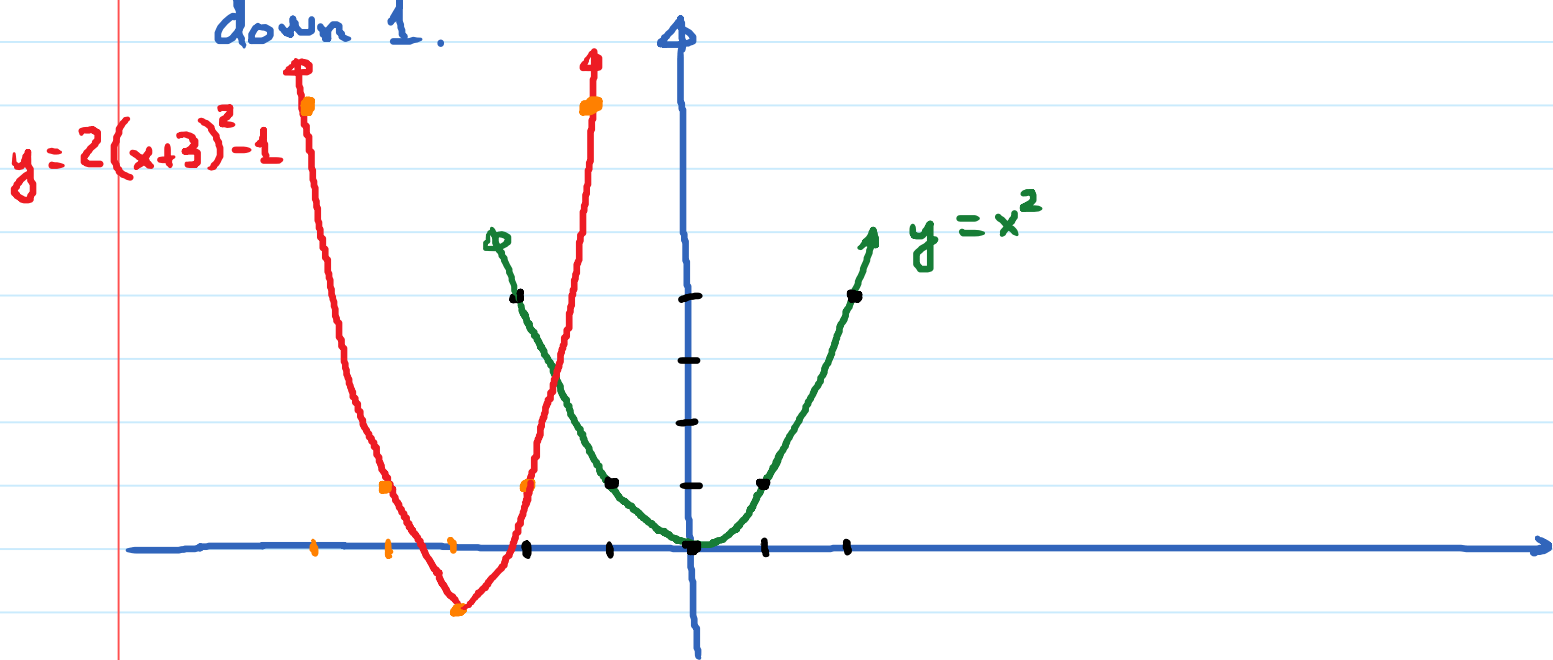
E.g. Given $y = f(x) = x^2$.

Describe the sequence of transformations to graph

$$y = 2f(x+3) - 1.$$

$$y = 2 \cdot (x+3)^2 - 1$$

Sequence of transformations: left 3, v-stretch 2;
down 1.



Ex. Given $y = f(x) = |x|$

(a) Graph $y = f(x) = |x|$ (3 key points)

(b) What is the formula for $y = -\frac{1}{2}f(x-1) + 3$

(c) Use transformations to graph

$$y = -\frac{1}{2}f(x-1) + 3.$$

(a)

x	y = x
-2	2
0	0
2	2

(b) $y = -\frac{1}{2}|x-1| + 3$

* Right 1 * v-Shrink by $\frac{1}{2}$

* Reflect across x * up 3.

