2.5 - Part 2

Tuesday, February 18, 2020 10:01 AM

Recall: Given $y = f(x)$ and c is a positive number

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

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

} vertical shifts

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

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

} horizontal shifts

Obj 3: Vertical Shrinking and Stretching.

Given a function $y = f(x)$ and a positive number c.

Stretching: $c > 1$

The graph of

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

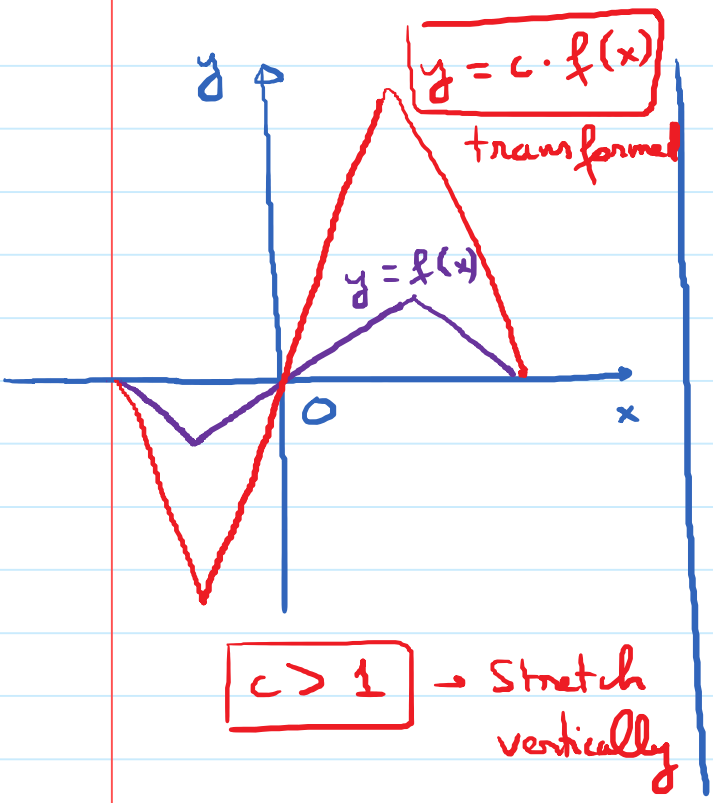
is the graph of $y = f(x)$ vertically stretched by a factor of c

Shrinking: $0 < c < 1$

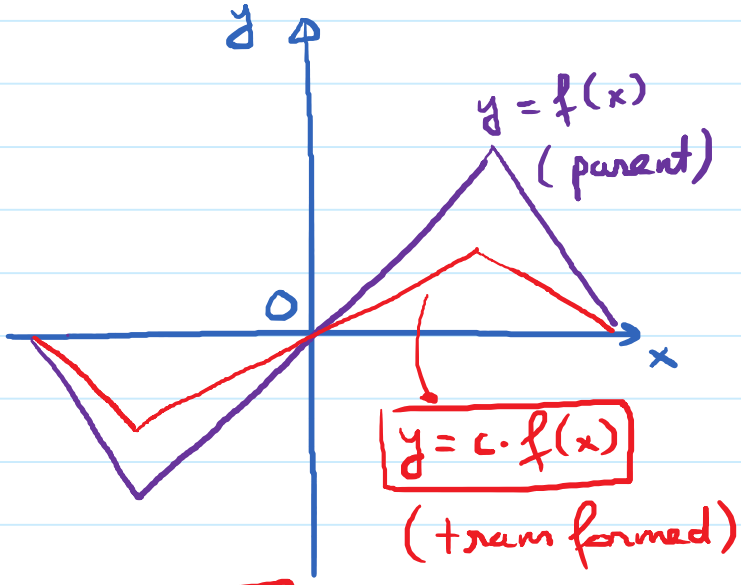
The graph of

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

is the graph of $y = f(x)$ vertically shrunk by a factor of c



$c > 1$ → Stretch vertically



$0 < c < 1$ Shrink vertically

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

$c = 2 > 1$

(a) What is the formula for $y = \boxed{2} f(x)$

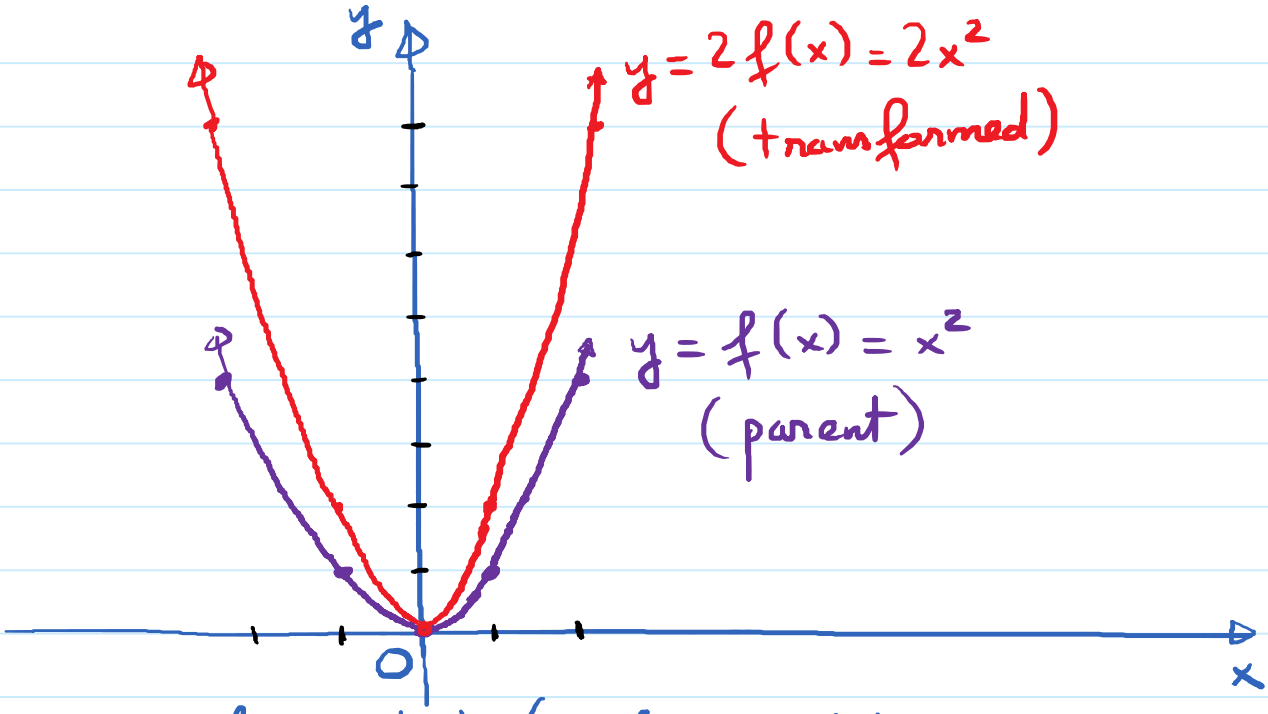
$$y = 2x^2$$

(b) Graph $y = f(x)$ and $y = 2f(x)$. (5 keypoints)

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

x	$y = 2f(x) = 2x^2$
-2	$8 \to (-2, 8)$
-1	$2 \to (-1, 2)$
0	$0 \to (0, 0)$
1	$2 \to (1, 2)$
2	$8 \to (2, 8)$

Each y-coordinate is multiplied by 2

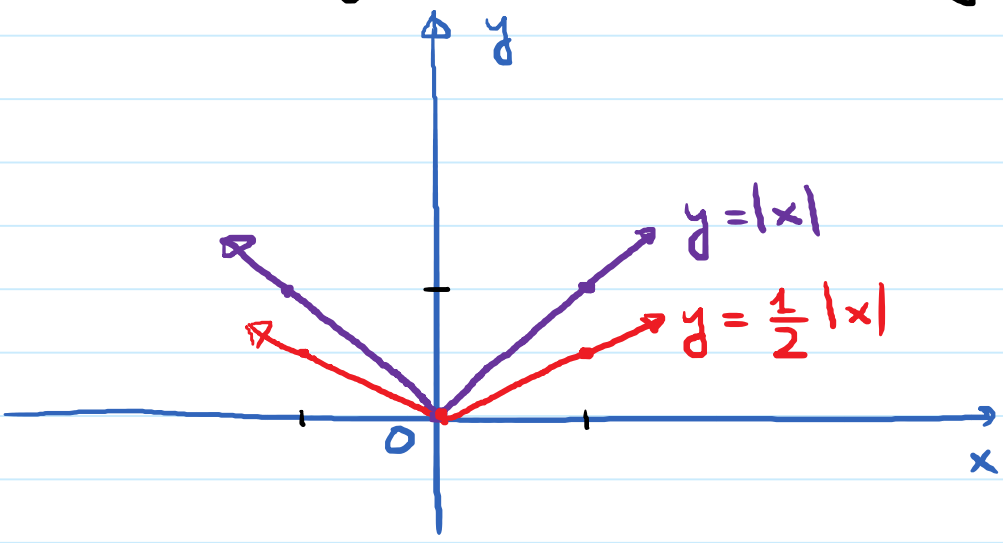


E.g. Graph $y = |x|$ (3 key points)

Use transformation to graph $y = \frac{1}{2}|x|$

x	$y = \lvert x \rvert$	Shrink
−2	2 → (−2, 2)	→ (−2, 1)
0	0 → (0, 0)	→ (0, 0)
2	2 → (2, 2)	→ (2, 1)

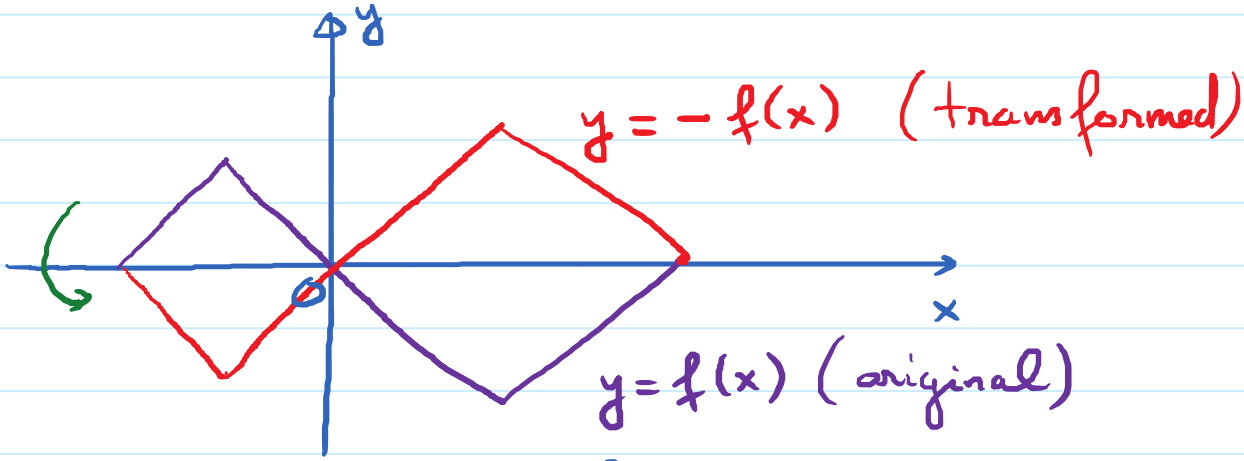
y-values are multiplied by $\frac{1}{2}$.



Obj 4: Reflections of graphs.

Reflection about the x-axis.

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



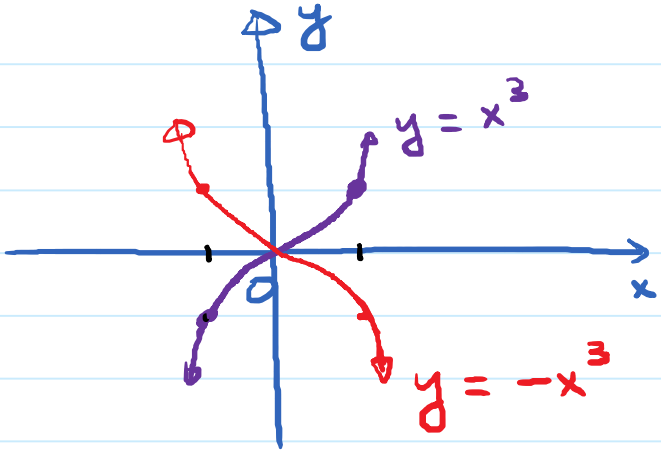
E.g. Given $y = f(x) = x^3$

Graph using 3 key points.

Use transformation to graph $y = -f(x) = -x^3$

x	$y = f(x) = x^3$	Reflect
-1	$(-1)^3 = -1 \rightarrow (-1,-1)$	$\longrightarrow (-1, 1)$
0	$0 \rightarrow (0,0)$	$\longrightarrow (0,0)$
1	$1^3 = 1 \rightarrow (1,1)$	$\longrightarrow (1,-1)$

The sign of each y-coordinate changes.



Obj 5: Sequences of transformations.

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

(a) What is the formula for $y = 2 \cdot f(x+3) - 1$?

(b) Graph the original function using 3 key points. Use transformation to graph the transformed function.

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

(b) Left 3 units, Vertically stretch by a factor of 2

Down 1 unit.

Parent function is $y = f(x) = x^2$.

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

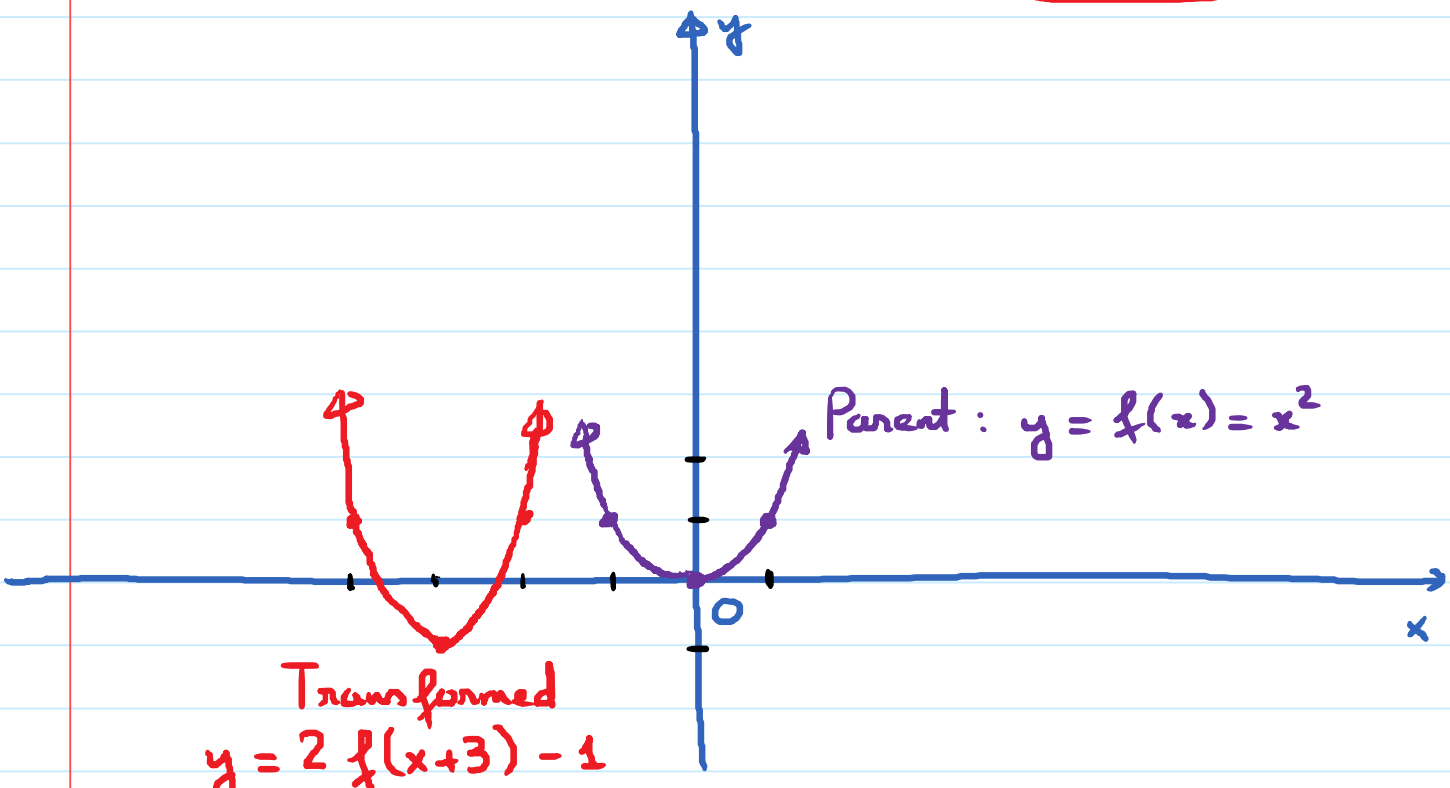
(Subtract x-coord by 3)

Left 3 units → $(-4, 1)$

Stretch Vertically by 2 (multiply y-coord by 2)

$(-4, 1)$ ← Down by 1 — $(-4, 2)$

(Subtract y-coord by 1)

$(0,0) \to (-3,0) \to (-3,0) \to \boxed{(-3,-1)}$

$(1,1) \to (-2,1) \to (-2,2) \to \boxed{(-2,1)}$