E.g (a) Graph the square root function $y = f(x) = \sqrt{x}$

(Use 3 key points)

(b) Use the rule of transformation to graph

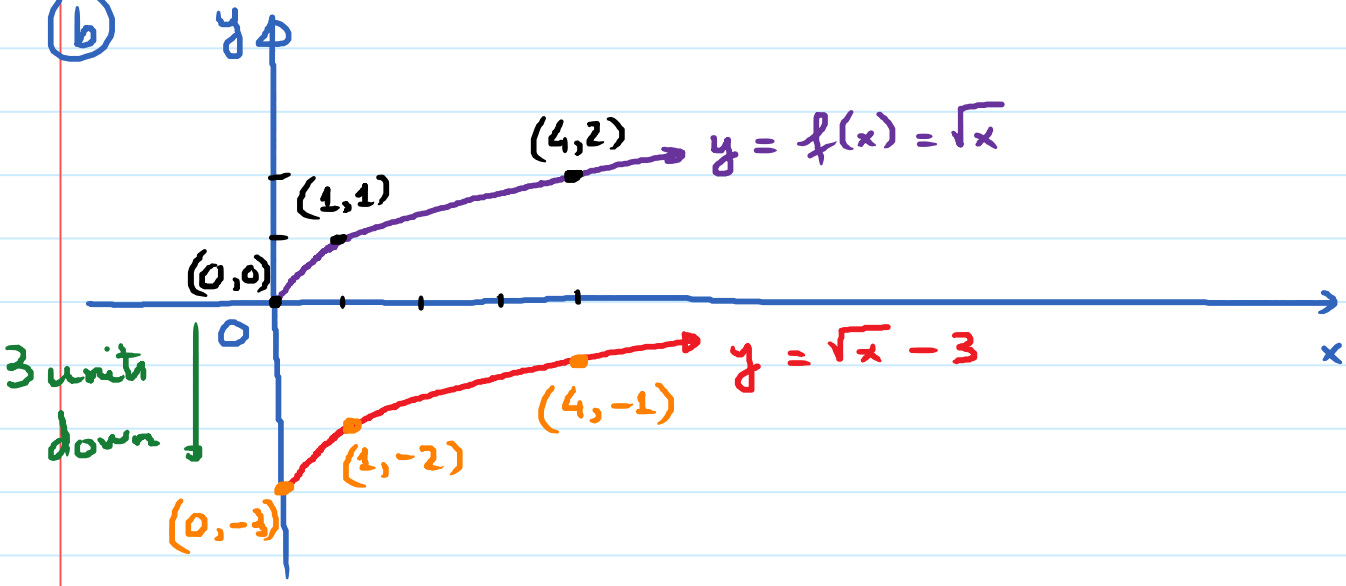
$$y = \sqrt{x} - 3$$

(a)

x	$y = f(x) = \sqrt{x}$		
0	0 → (0,0)	⟶	(0,−3)
1	1 → (1,1)	⟶	(1,−2)
4	2 → (4,2)	⟶	(4,−1)

} transformed points

(b)



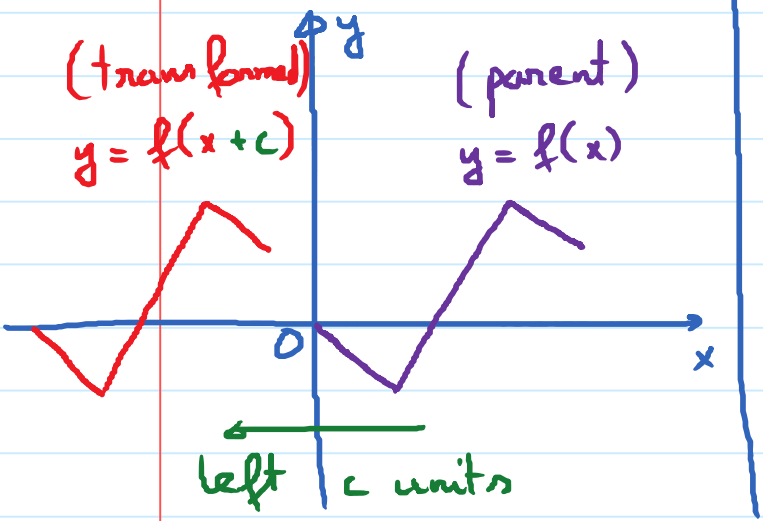
Objective 3: Horizontal Shifts

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

The graph of: $y = f(x + c)$

is the graph of $y = f(x)$

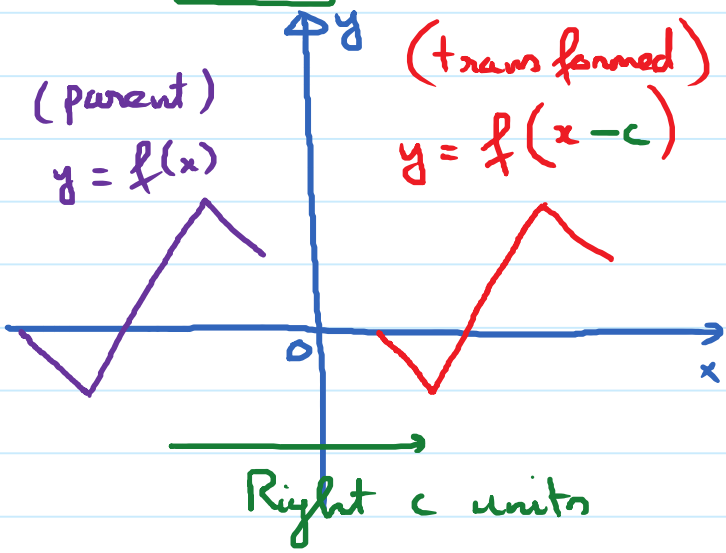
shifted **left** by c units



The graph of $y = f(x - c)$

is the graph of $y = f(x)$

shifted **right** c units



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

(a) What is the formula for $y = f(x+2)$?

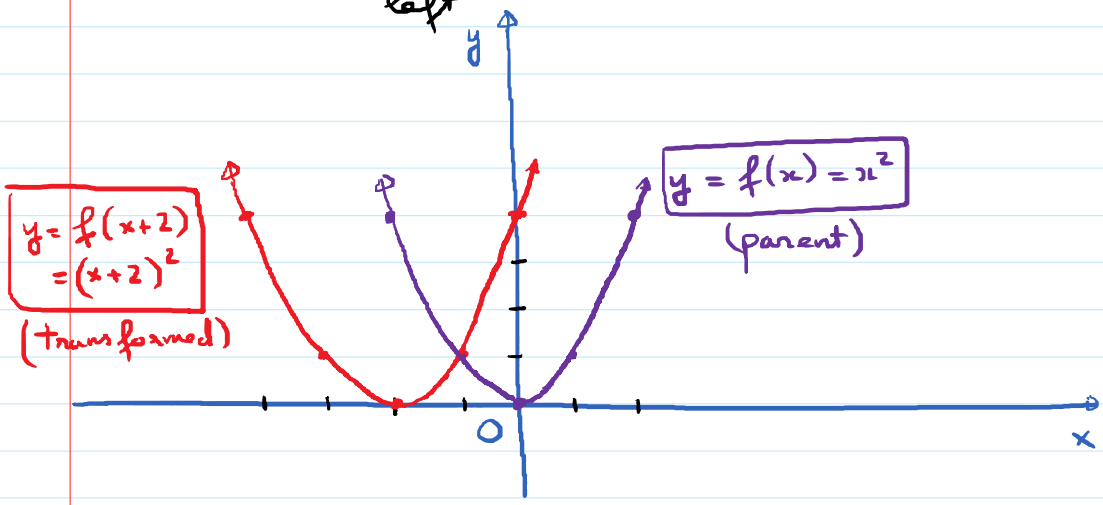
$$y = f(x+2) = (x+2)^2$$

(b) Graph both $y = f(x) = x^2$ and $y = f(x+2) = (x+2)^2$ using table of values.

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	$y = f(x+2) = (x+2)^2$
-4	$(-4+2)^2 = (-2)^2 = 4 \rightarrow (-4, 4)$
-3	$(-3+2)^2 = (-1)^2 = 1 \rightarrow (-3, 1)$
-2	$(-2+2)^2 = 0^2 = 0 \rightarrow (-2, 0)$
-1	$(-1+2)^2 = 1^2 = 1 \rightarrow (-1, 1)$
0	$(0+2)^2 = 2^2 = 4 \rightarrow (0, 4)$

x-values are changed. 2 units to the left



E.g. (a) Graph the function $y = f(x) = |x|$ (3 key points)

(b) Use transformation to graph $y = f(x-4) = |x-4|$

Sol.

(a)

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

4 units to the right

$(-1, 1) \rightarrow (3, 1)$

$(0, 0) \rightarrow (4, 0)$

$(1, 1) \rightarrow (5, 1)$