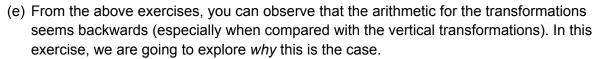
## **Horizontal Transformations**

## https://www.desmos.com/calculator/6lta79xbov

In Desmos (click <u>here</u> or copy the url above), you have a parent graph of  $f(x) = \sqrt{x}$  graphed with a domain of [0,16] and a range of [0, 4]. The sliders on the left help create a transformation graph, g(x) = af(bx - c) + d where in this case a = 1 and d = 0. Move the sliders to answer the following questions.

aph, $g(x) = af(bx - c) + d$ where in this case $a = 1$ and $d = 0$ . Move the sliders to swer the following questions.		
(a)		slider will shift the graph left and right? Which slider will horizontally stretch or ess the graph?
(b)	For ea (i)	ch of the following cases, find the equation for $g(x)$ and the domain for $g(x)$ . Horizontally shift the graph right 3 units.
	(ii)	Horizontally shift the graph left 2 units.
	(iii)	Horizontally stretch the graph by a factor of 2.
	(iv)	Horizontally compress the graph by a factor of 3.
(c)	Suppo	se $c=0$ . What value of <b>b</b> would make the domain of $g(x)$ equal to $[0,32]$ ?

(d) Suppose b = 1. What value of **c** would make the domain of g(x) equal to [-7, 9]?



- (i) Consider g(x) = f(x 5). Write out what g(2) is.
  - i. Notice that 2 is the input of g(x), not f(x). What is the input of f(x) when 2 is the input of g(x)?
    - Note: here, we have transformed backwards (we went from an input of g(x) to an input of f(x)).
  - ii. Now let 2 be an input of f(x). What is the input of g(x) when 2 is the input of f(x)?
    - Note: here, we have transformed in the usual direction (we went from an input of f(x) to an input of g(x)).
  - iii. What is the input of g(x) when 3 is the input of f(x)? What is the input of g(x) when 4 is the input of f(x)? In general, what is the input of g(x) when  $x_0$  is any input of f(x)?

We should now have an idea as to  $\underline{why}$  the arithmetic for the transformations seems backwards. The answer lies in  $\underline{who}$  the x-value being transformed belongs to (i.e. which function's domain is it in?), and who the x-value in the algebraic expression of the function notation belongs to.