

## TRANSFORMATIONS WITH B

$$y = af(bx - h) + k$$

There are two ways to work with a b (horizontal shrink/stretch/reflection).

**METHOD 1:** Use the order of transformations to place each point from the parent function on the graph (my preferred method because it will serve you better in PC and Calc!).

1. horizontal shift (h)

2. divide x-value by b (the x-value where you are after the horizontal shift) → go to that x-value (point)

By dividing the x-values by b, you have taken care of any shrink/stretch/reflection. It's like a two-for-one deal!

Note: if you have an a, you would need to multiply the y-values by a at this step in the problem too and then go to the point with the "new" x and y-value.

3. vertical shift (k)

4. Connect the points with a smooth curve.

**METHOD 2:** Factor out the b and use a table of values (much more time consuming, but it will work). This method does NOT follow the order of transformations.

1. Factor the b from (bx-h)

2. Identify the horizontal and vertical shifts in writing (left h, right h, up k, down k)

3. Use a table appropriate for the parent function of the given function and divide the x-values by b creating new x-values. Note: the y-values do not change unless you have an a. If you have an a, change the y-values in the table too by multiplying each y-value by a.

4. Using the NEW points on the table, graph the point and then apply the shifts you identified in step two to move each point to its final resting place on the graph. Connect the points with a smooth curve.

**EXAMPLE:**

$$g(x) = f(-2x - 6) + 1$$

Let's use the square root function

$$f(x) = \sqrt{x}$$

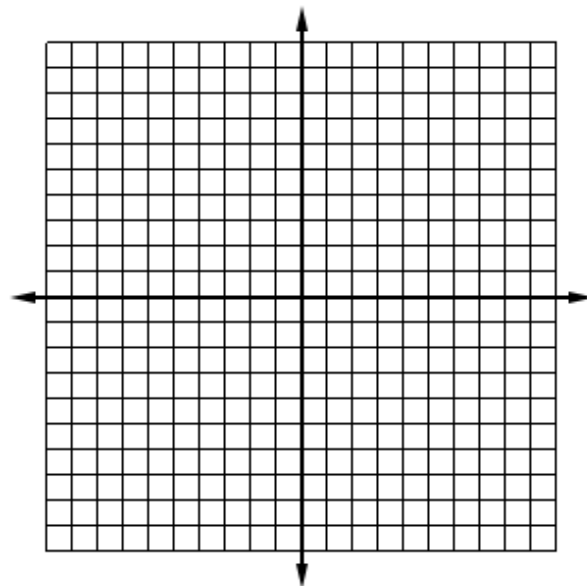
REWRITE the square root function to show the transformation given by g(x) above:

**METHOD 1:** Use the points from the parent function to:

1. horizontal shift:

2. use your brain to divide the current x-value by:  
(this will take care of the shrink and the reflection for this function)

3. vertical shift:



METHOD 2:

$$f(x) = \sqrt{-2x - 6} + 1$$

1. Factor the b from  $(bx - h)$ :

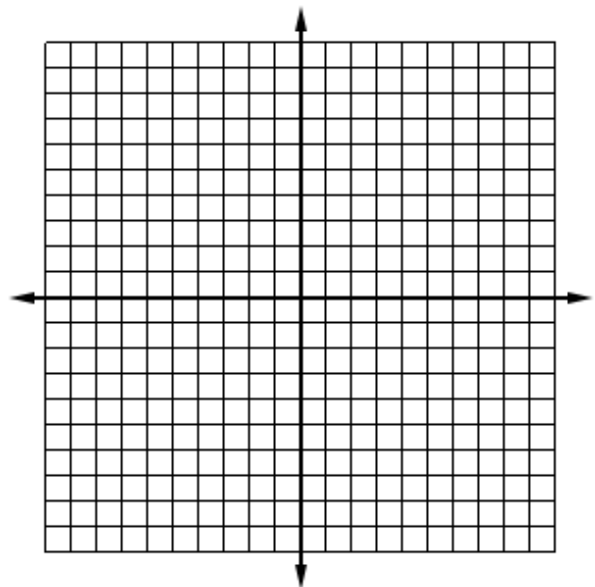
2. Identify the horizontal and vertical shifts from the rewritten function in 1 (hold these shifts for step 3).

3. Make a table for the PARENT function and DIVIDE the x-values by b.

x	$y = \sqrt{x}$

Show the new x-value by slashing the old value and writing the new value in its place. (Do this with the y-values too if you have an a, but remember that we MULTIPLY y-values by a.)

4. Using the new points in the table from step 3, apply the shifts from step 2 and place each point on the graph. Connect with a smooth curve.



So, you're thinking this way isn't that bad, but what if you started with  $(\frac{1}{3}x - 2)$ ? You want to factor that? How would you factor that???. And remember, time is important! Learn to use the most efficient method.