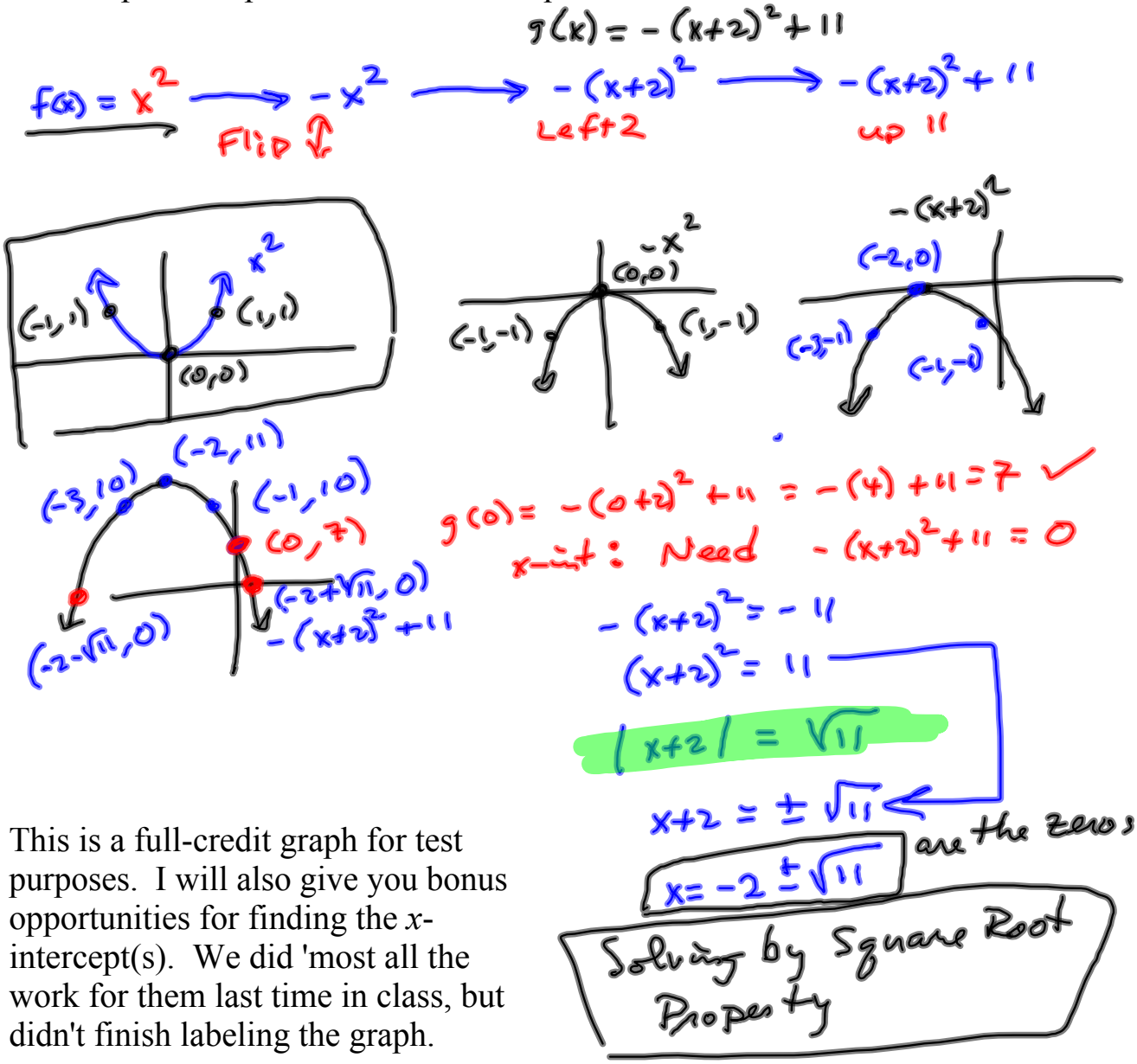
Bonus part of a problem that I didn't quite finish from last time...



This is a full-credit graph for test purposes. I will also give you bonus opportunities for finding the *x*-intercept(s). We did 'most all the work for them last time in class, but didn't finish labeling the graph.

Square Root Property is ONE of THREE ways to solve a quadratic equation. In a few weeks, you'll be expected to be able to use all three methods, if you can't already.

1.5 Part II - Adding shrinks and stretches (horizontal and vertical).

Test has been postponed until Friday, September 18th. This puts us a day behind schedule, which is actually one-and-a-third full lectures. Wednesday, there will be a *SENSE* survey performed on our class for a half-hour or so. We will review some more after that for Friday's test on the 18th.

In Problems 27–30, find the function that is finally graphed after the following transformations are applied to the graph of $y = \sqrt{x}$. $= f(x)$

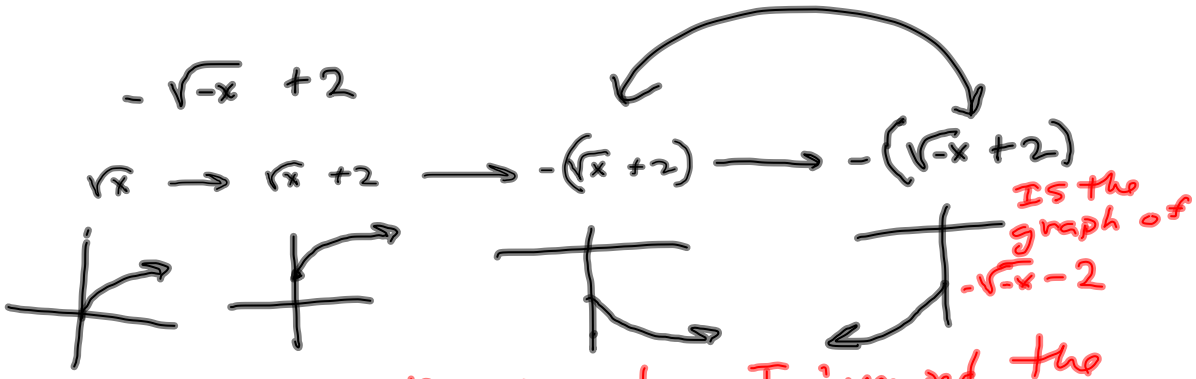
27. (1) Shift up 2 units — $\sqrt{x} + 2$
(2) Reflect about the x-axis — $-(\sqrt{x} + 2) = -\sqrt{x} - 2$
(3) Reflect about the y-axis — $-\sqrt{-x} - 2 = -f(-x) - 2$

Compare and contrast with switch of (1) and (2). This is why I recommend doing your vertical reflections before your vertical shifts, because the sign (direction) of the vertical shift can be messed-up.

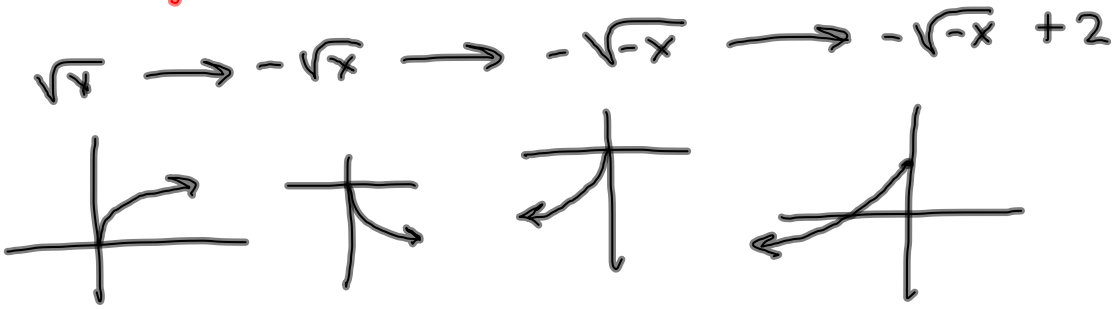
27. (1) Shift up 2 units
(2) Reflect about the x-axis
(3) Reflect about the y-axis

Swap these

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

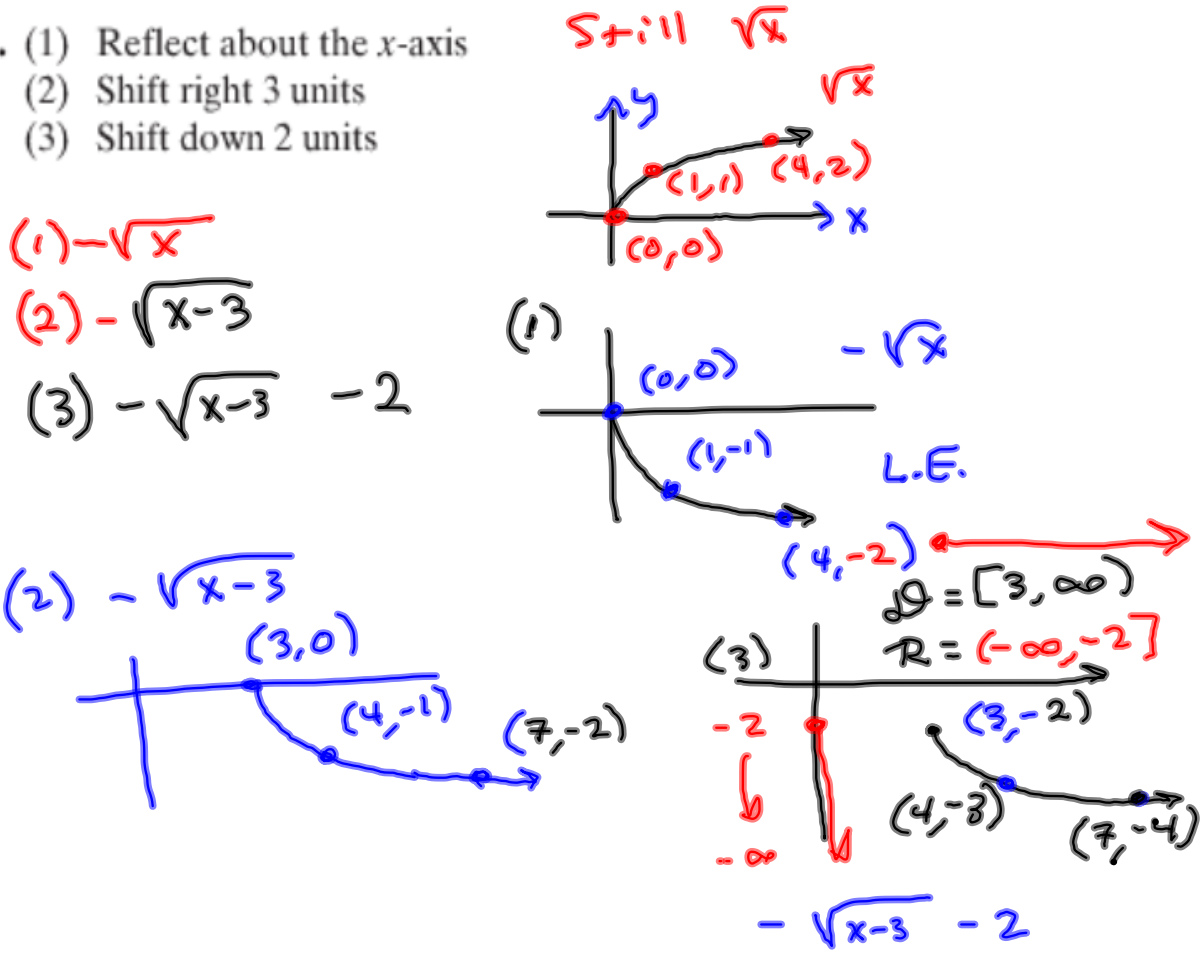


This is the pic when I jumped the gun with vertical shift



IS CORRECT

28. (1) Reflect about the x-axis
(2) Shift right 3 units
(3) Shift down 2 units



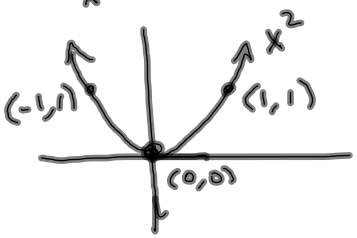
$y = af(x), \quad a > 0$	Multiply each y-coordinate of $y = f(x)$ by a. Stretch the graph of f vertically if $a > 1$. Compress the graph of f vertically if $0 < a < 1$.	Multiply $f(x)$ by a.

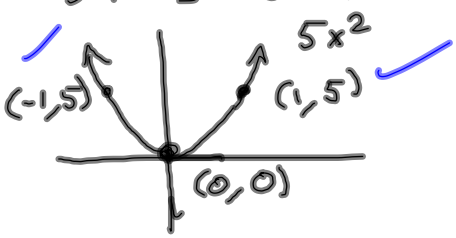
$y = f(ax), \quad a > 0$	Multiply each x-coordinate of $y = f(x)$ by $\frac{1}{a}$. Stretch the graph of f horizontally if $0 < a < 1$. Compress the graph of f horizontally if $a > 1$.	Replace x by ax.

There is very little (nothing!?) in the exercises related to this last technique. #s 65 – 68, part *g* is about all I see. This skill will be important for those going on to Trigonometry and Calculus, so it's worthwhile to cover this, briefly, at least.

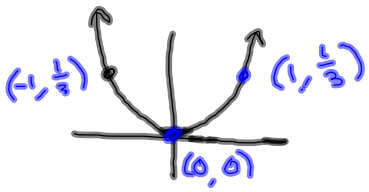
Vert. Stretch $af(x)$

$x^2 \rightarrow 5x^2$ 5 times taller





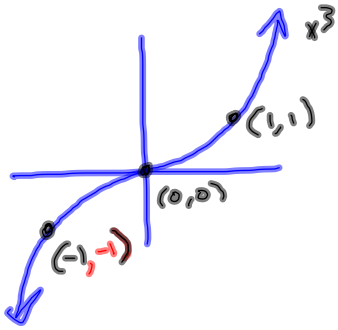
$g(x) = \frac{1}{3}x^2$ Vertical Shrink

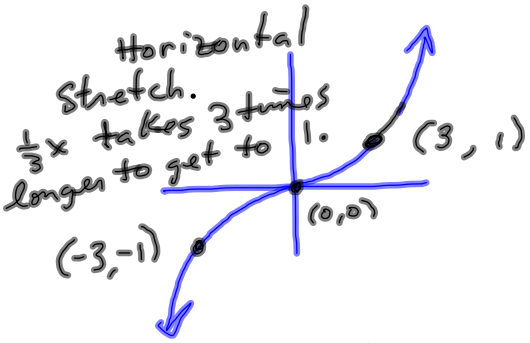


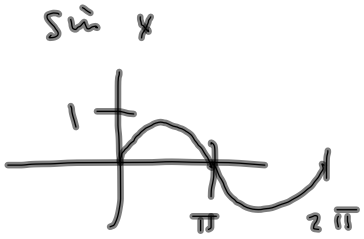
Horizontal Stretch $f(\frac{1}{3}x)$

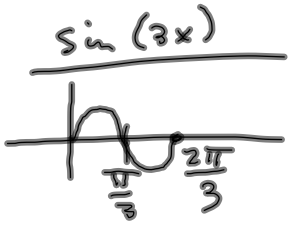
.. Shrink $f(4x)$

$x^3 = f(x)$ $(\frac{1}{3}x)^3 = g(x) = f(\frac{1}{3}x)$







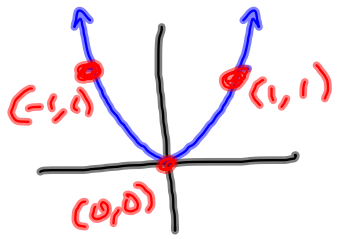


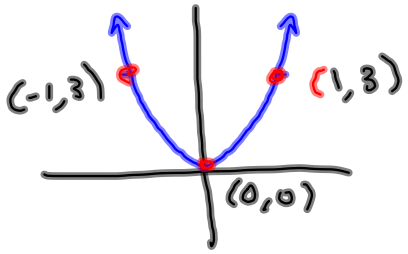
In Problems 35–64, graph each function using the techniques of shifting, compressing, stretching, and/or reflecting. Start with the graph of the basic function (for example, $y = x^2$) and show all stages.

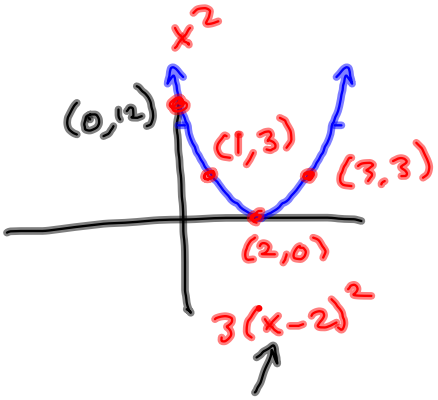
54. $f(x) = 3(x - 2)^2 + 1$

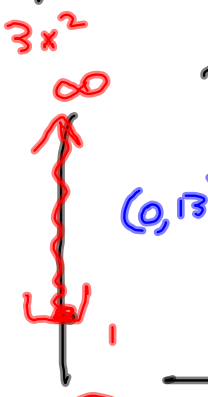
$x^2 \longrightarrow 3x^2 \longrightarrow 3(x-2)^2 \longrightarrow 3(x-2)^2 + 1$

$x^2 \longrightarrow (x-2)^2 \longrightarrow 3(x-2)^2 \longrightarrow 3(x-2)^2 + 1$



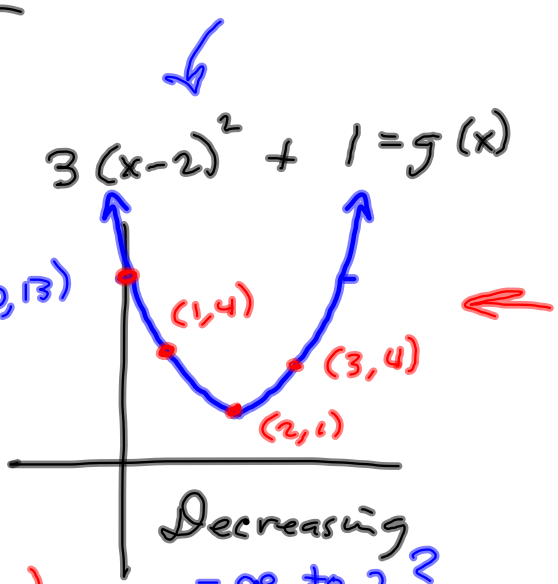






$D = \mathbb{R}$

$R = [1, \infty)$



Decreasing

$-\infty$ to 2 ?

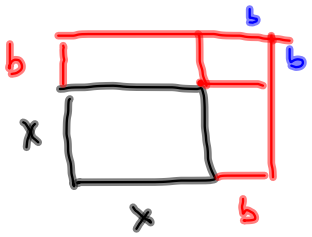
$(-\infty, 2)$

Increasing

62. $g(x) = 4\sqrt{2 - x}$

In Problems 75–84, complete the square of each quadratic expression. Then graph each function using the technique of shifting. (If necessary, refer to the Appendix, Section A.4, to review completing the square.)

This is pretty much the whole 9 yards on "seeing" any quadratic function's graph.



By Foil.

$(x+b)^2 = x^2 + 2bx + b^2$

Add each piece

$x^2 + bx + bx + b^2$

$(x+3)^2 = x^2+6x+9$

$\frac{6}{2} = 3 \rightsquigarrow 3^2$

$(x-5)^2 = x^2 - 10x + 25$

$\frac{10}{2} = 5 \rightsquigarrow 5^2$

Complete This one:

$x^2 + 6x \pm ?$

$x^2+6x+3^2 = x^2+6x+9$

$(x-2)^2 - 3 = x^2-4x+4-3 = x^2-4x+1$

Let $f(x) = x^2-4x+1$. Complete the square & graph it.

$f(x) = x^2-4x+1 = x^2-4x \pm 2^2 + 1 - 4$

$\frac{4}{2} = 2 \rightsquigarrow 2^2$

$= (x-2)^2 + 1 - 4$

$= (x-2)^2 - 3$

84. $f(x) = -2x^2 - 12x - 13$

$= -2(x^2 + 6x) - 13$

$= -2(x^2 + 6x + 3^2) - 13 + 2(3^2)$

$\frac{6}{2} = 3 \rightarrow 3^2$

$-13 + 18 = 5$

$= -2(x+3)^2 + 5$

Left 3, flip vert., stretch by factor of 2 (vert.), up

What can go wrong if you shift vertically BEFORE your vertical flip...

59. $f(x) = -(x + 1)^3 - 1$