Pre-Calculus 30 **2.1 Radical Functions and Transformations**

Question: What falls faster… a feather or a hammer?

http://www.youtube.com/watch?feature=endscreen&NR=1&v=4mTsrRZEMwA (50 seconds)

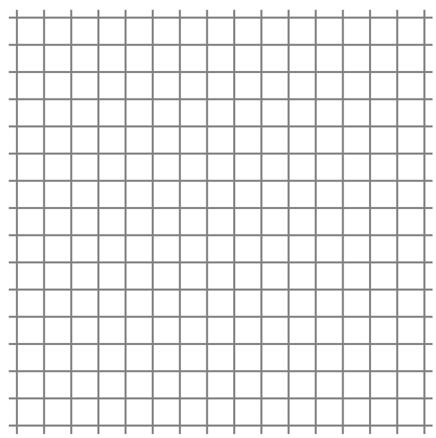
Investigate – page 62

Radical Function – a function containing a radical with a variable in the radicand.

Example 1 – page 63

a) $y=\sqrt{x}$ Restrictions?

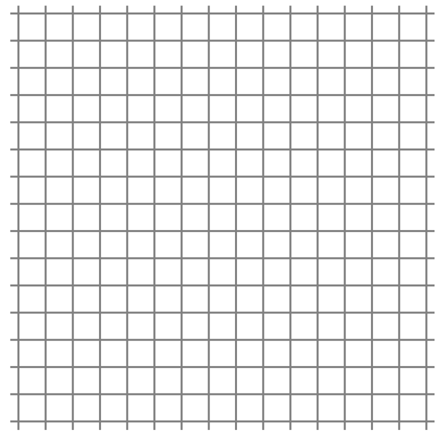
Table of value – choose "nice" values



Domain:

Range:

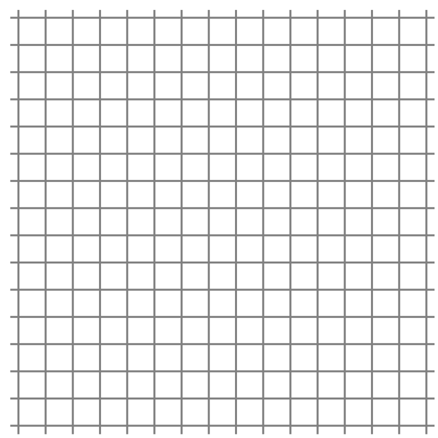
b) $y=\sqrt{x-2}$ Restrictions?



Domain:

Range:

c) $y = -3\sqrt{x}$ Restrictions?



Domain:

Range:

What do you notice about these 3 graphs?

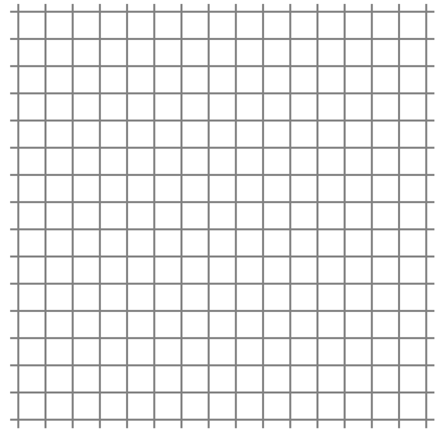
Graphing Radical Functions Using Transformations

- Recall $y = f(x)$ transforms into $y = af\left(b(x-h)\right)+k$)
- Transform the base function of $y = \sqrt{x}$ to become $y = a\sqrt{b(x-h)}+k$
- a, b, h, and k values are like last chapter

Example 2 – page 65

a) $y = 3\sqrt{-(x-1)}$

Restrictions?

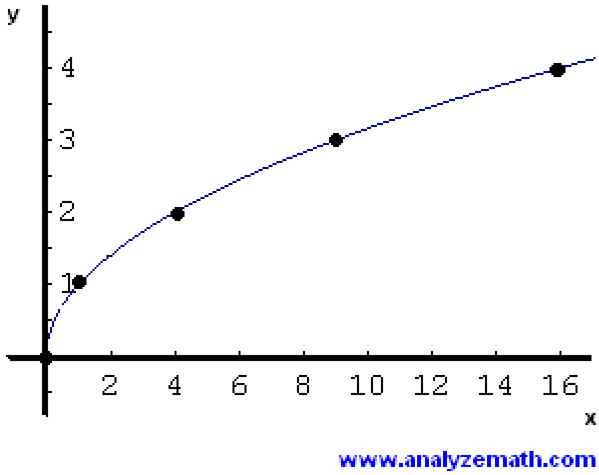


Assignment: Page 72 #1ac, 2ab, 3, 5acd, 9a

2.1 con't

The graph of $y = \sqrt{x}$ has the following characteristics:

- Left point at (0, 0)
- No right endpoint
- Shape of half a parabola
- Domain: $\{x : x \geq 0, x \in \Re\}$
- Range: $\{y : y \geq 0, y \in \Re\}$
- You can graph $y = a\sqrt{b(x-h)} + k$ by transforming $y = \sqrt{x}$



A radical function that involves a stretch can be obtained from either a ***vertical*** or a ***horizontal*** stretch.

Use $y = a\sqrt{x}$ or $y = \sqrt{bx}$.

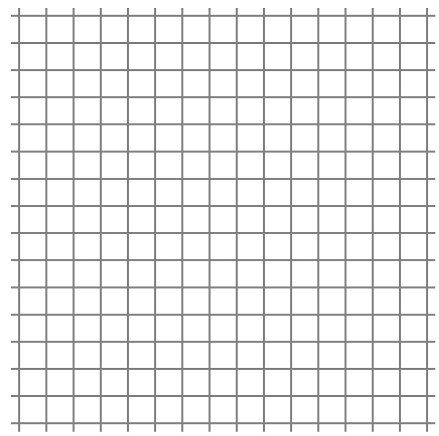
Example 3 – page 68

2.2 Square Root of a Function

Given $f(x) = 2x + 1$, graph the functions $y = f(x)$ and $y = \sqrt{f(x)}$.

x	$y = f(x)$	x	$y = \sqrt{f(x)}$
-2		-2	
-1		-1	
$-\frac{1}{2}$		$-\frac{1}{2}$	
0		0	
$\frac{1}{2}$		$\frac{1}{2}$	
1		1	
2		2	

Use a large scale (each square=1/4) so that you can see the details of each function and the relationship between them.



- Where do the graphs of $f(x) = 2x + 1$ and $y = \sqrt{2x + 1}$ intersect?

These are called **invariant** points because they don't change from one function to the other. Note the *y*- values in these invariant points. Written as generic coordinates $(x_1, 0)$ and $(x_2, 1)$.

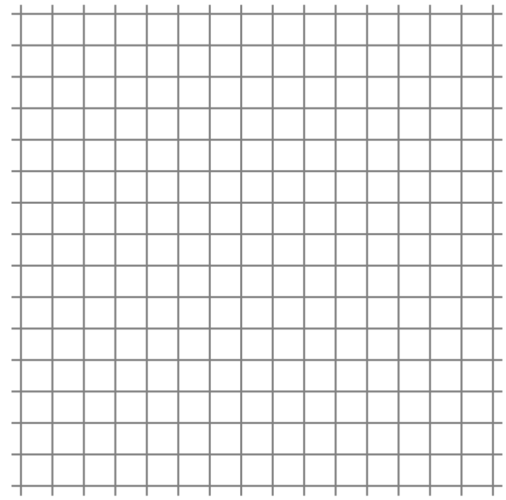
- What is the domain of $f(x) = 2x + 1$? What is the range of $f(x) = 2x + 1$?

- What is the domain of $y = \sqrt{2x + 1}$? What is the range of $y = \sqrt{2x + 1}$?

- The domain of $y=\sqrt{f(x)}$ is determined by the restrictions on the radicand.
- The range of $y=\sqrt{f(x)}$ consists of the **square roots of the values that are in the range of** $y=f(x)$, for which $y=\sqrt{f(x)}$ is defined.
- The graph of $y=\sqrt{f(x)}$ exists only where $f(x)\geq 0$. The following table allows us to predict the location of the graph of $y=\sqrt{f(x)}$ relative to $y=f(x)$, using the values of $f(x)$.

Value of $f(x)$	$f(x)<0$	$f(x)=0$	$0<f(x)<1$	$f(x)=1$	$f(x)>1$
Relative location of Graph of $y=\sqrt{f(x)}$	The graph of $y=\sqrt{f(x)}$ is **undefined**.	The graphs of $y=\sqrt{f(x)}$ and $y=f(x)$ **intersect** on the *x*-axis.	The graph of $y=\sqrt{f(x)}$ is **above** the graph of $y=f(x)$.	The graph of $y=\sqrt{f(x)}$ **intersects** the graph of $y=f(x)$.	The graph of $y=\sqrt{f(x)}$ is **below** the graph of $y=f(x)$.

<u>Your Turn</u> Given $g(x)=3x+4$, graph the functions $y=g(x)$ and $y=\sqrt{g(x)}$. Note any invariant points and the domain and range of each function. Use the information in the table to assist you in drawing the graph of $y = \sqrt{g(x)}$.



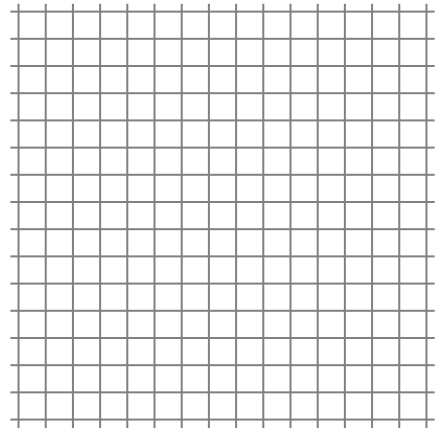
Assignment: Page 86 #1, 2, 4ac, 5, 8ab

2.2 Square Root of a Function (con't)

Ex. Identify and compare the domains and ranges of $y = 2 - 0.5x^2$ and $y = \sqrt{2 - 0.5x^2}$.

- Think about what $y = 2 - 0.5x^2$ looks like.
- Rewrite in the form $y = -0.5x^2 + 2$ or $y = -0.5(x - 0)^2 + 2$

- It's a parabola facing downwards, vertex at (   )
- Find the invariant points and join them with a slight curve that flows **above** the original function.
  y =   y =



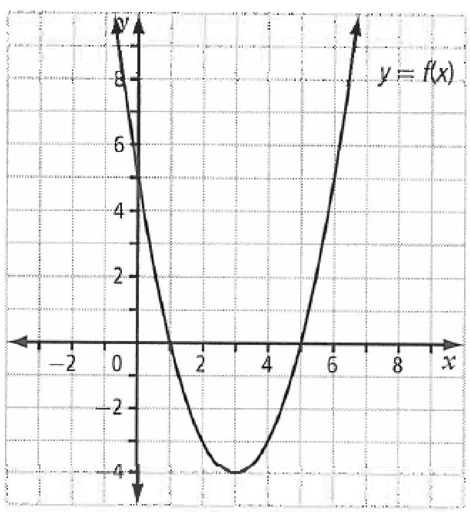
- Locate other *y*-values

- Should there be arrow heads on your graph?

For $y = 2 - 0.5x^2$,   D: and R:

For $y = \sqrt{2 - 0.5x^2}$,   D: and R:

<u>Example</u>: Draw $y = \sqrt{f(x)}$



When is y = 0?

When is y = 1?

If *f(x)= 4*, then $\sqrt{f(x)} =$

<u>Assignment:</u>   Page 86 #3, 6abc, 11ab

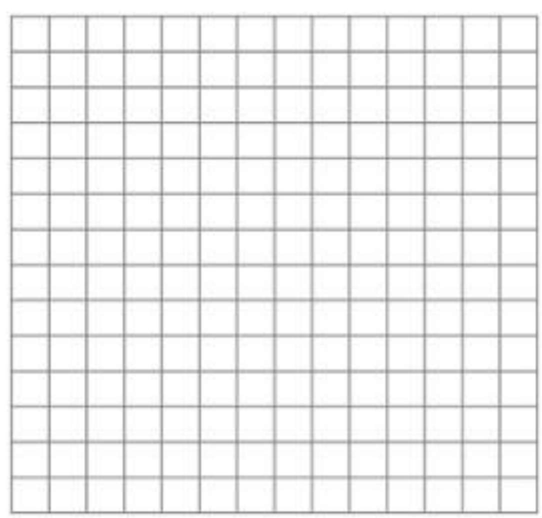
Pre-Calculus 30 **2.3 Solving Radical Equations**

Example 1 Determine the roots(s) of $\sqrt{x+5}-3=0$. (Roots/solutions/x-intercepts). Note restrictions.

a) Algebraically

- Any roots that are discovered algebraically that are not in the domain are called ***extraneous roots.***

b) Graphically Determine the x-intercepts of $\sqrt{x+5}-3=y$.



<u>Example 2</u> Solve the equation $\sqrt{x+5} = x+3$ algebraically. Be sure to check for extraneous roots!

To solve this equation graphically, graph each side of the equation separately. One equation is $y = \sqrt{x+5}$ (the left-hand side) and the other equation is $y = x+3$ (the right-hand side). Find the point where these two functions **intersect. Note that the final answer is ONLY the *x*-value…NOT the ordered pair!**

Assignment: Page 96 #2a, 6 (no restr.), 9 (no graph)