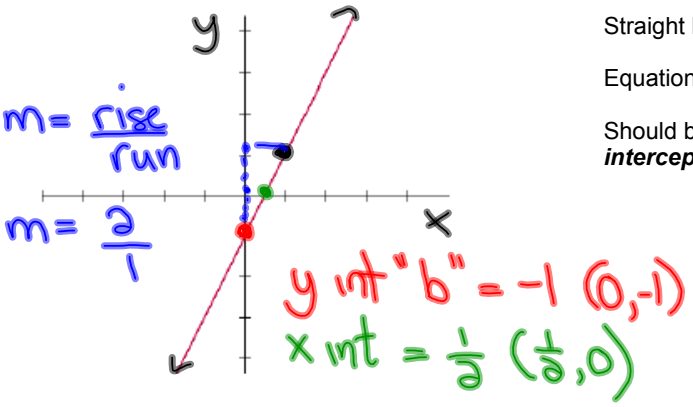
Catalog of Essential Functions

1. Linear



Straight Line

highest exponent

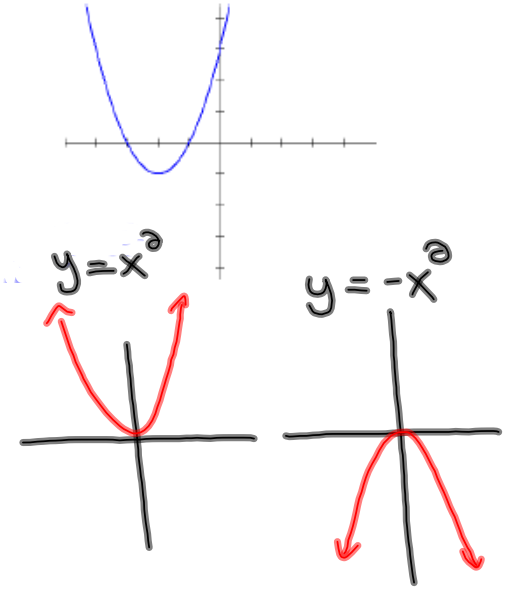
Equation will be degree one

Should be able to identify the ***slope, intercepts, and equation*** from the graph

$y = mx + b$

$y = 2x - 1$

2. Quadratic

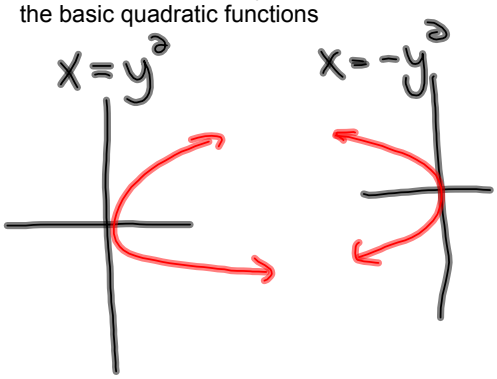


Parabola (U-Shaped) Degree 2

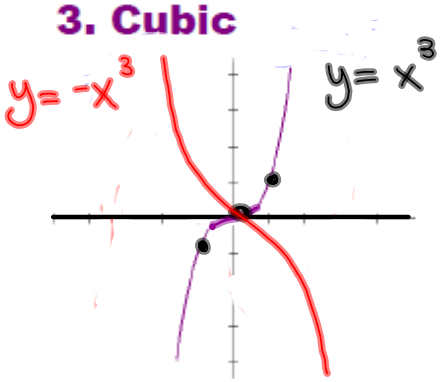
Either *y or x* will be squared (not both!)

Should know the 4 basic quadratic functions

Should be able to apply transformations to the basic quadratic functions



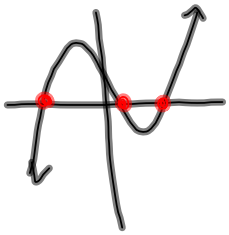
3. Cubic



S-Shaped / N-shaped

We will work with functions that are raised to the third power

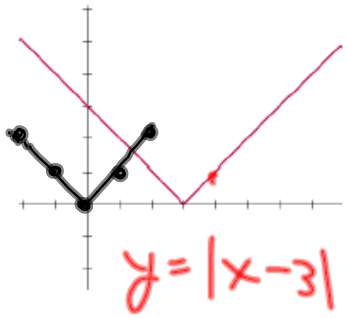
x	y
-2	-8
-1	-1
0	0
2	8



max 3 roots

Catalog of Essential Functions

4. Absolute Value



V-Shaped

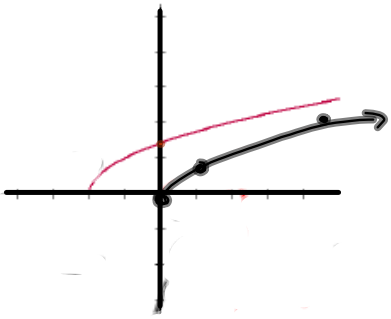
Equation will have a variable within the absolute value bars $y = |x|$

Should be able to apply transformations to the basic absolute value function

$y = |x|$

x	y
-2	2
-1	1
0	0
1	1
2	2

5. Square Root



Half Parabola

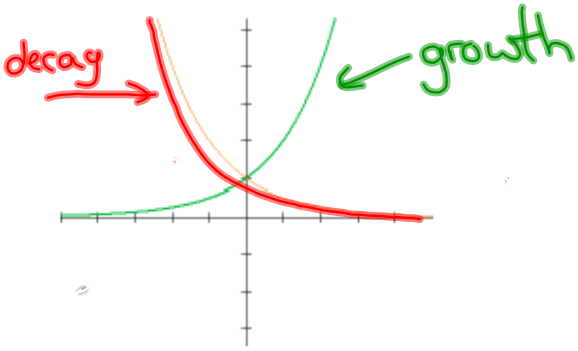
Equation will have a variable under the square root sign

Should be able to apply transformations to the basic square root function

$y = \sqrt{x}$

x	y
0	0
1	1
4	2
9	3

6. Exponential



Steadily increasing or decreasing

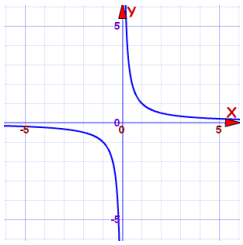
Base will be a number and variable will appear in the exponent

ex: $y = 2^x$

Should be able to identify the ***horizontal asymptote***

Catalog of Essential Functions

7. Reciprocal



Will have two branches

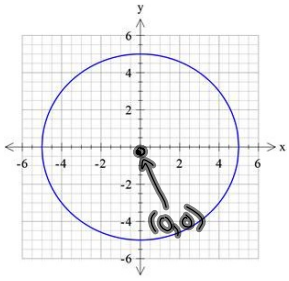
Equation will have a variable within the denominator of a rational expression

Should be able to identify the ***vertical and horizontal asymptotes***

$y = \frac{1}{x}$

x	y
-2	-½
-1	-1
0	undefined
1	1
2	½

8. Circle



- General form: $(x-h)^2 + (y-k)^2 = r^2$

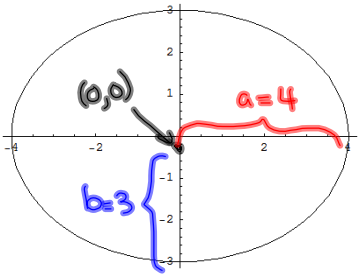
  * center: (h, k) = (0,0)
  * radius = r = 5

- Be able to identify the function that would describe either just the top or bottom of the circle.

$(x-0)^2 + (y-0)^2 = 5^2$

$x^2 + y^2 = 25$

9. Ellipse



- General form: $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

Where…

- Center: (h, k) = (0,0)
- a > b
- If a is the denominator of the "y" term the ellipse will have a vertical major axis.

"Horizontal Major Axis"

$\frac{(x-0)^2}{4^2} + \frac{(y-0)^2}{3^2} = 1$

major axis = 8

minor axis = 6

$\frac{x^2}{16} + \frac{y^2}{9} = 1$

Transformations:

New Functions From Old Functions

Translations

Stretches

Reflections

Translation

- To *translate* or *shift* a graph is to move it up, down, left, or right without changing its shape.
- Translation is summarized by the following table and illustration:

Vertical and Horizontal Shifts Suppose $c > 0$. To obtain the graph of

$y = f(x) + c$, shift the graph of $y = f(x)$ a distance c units upward

$y = f(x) - c$, shift the graph of $y = f(x)$ a distance c units downward

$y = f(x - c)$, shift the graph of $y = f(x)$ a distance c units to the right

$y = f(x + c)$, shift the graph of $y = f(x)$ a distance c units to the left

Translations illustrated...

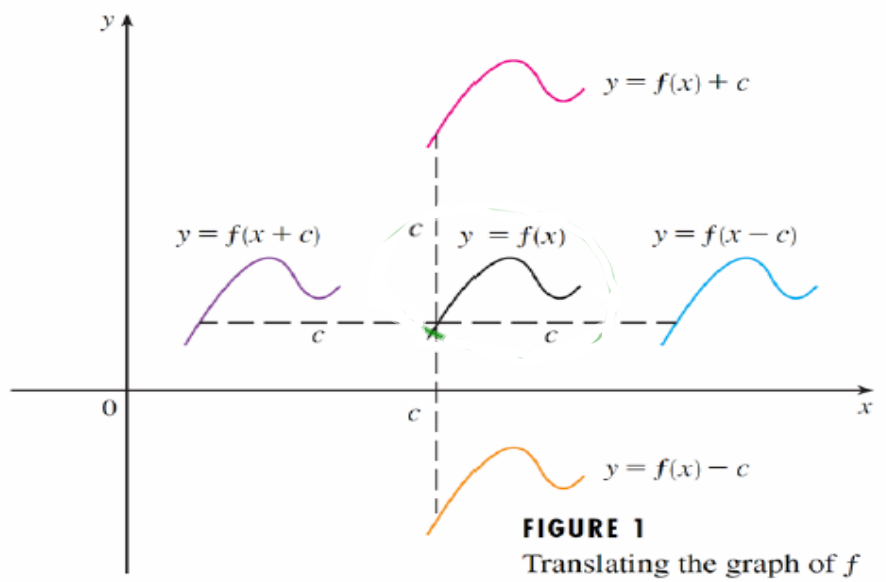


FIGURE 1
Translating the graph of f

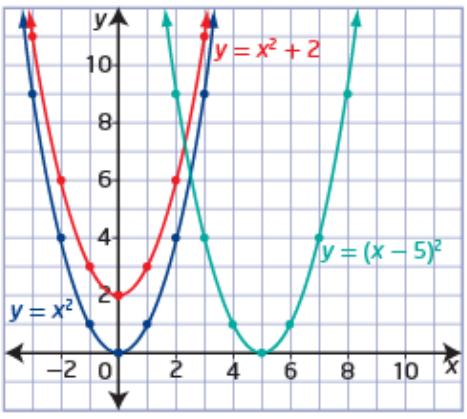
Using Mapping Notation to Describe Transformations:

*Think of this as a set of instructions to follow to transform a graph.

x	$y = x^2$
−3	9
−2	4
−1	1
0	0
1	1
2	4
3	9

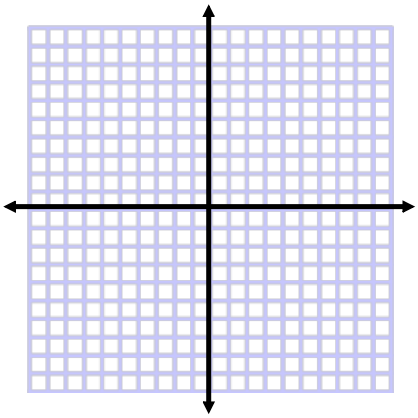
x	$y = x^2 + 2$
−3	11
−2	6
−1	3
0	2
1	3
2	6
3	11

x	$y = (x - 5)^2$
2	9
3	4
4	1
5	0
6	1
7	4
8	9

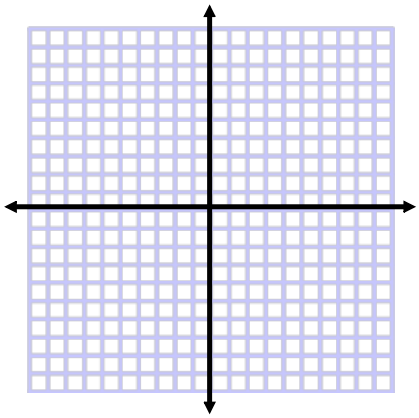


Identify the translations for each of the following...

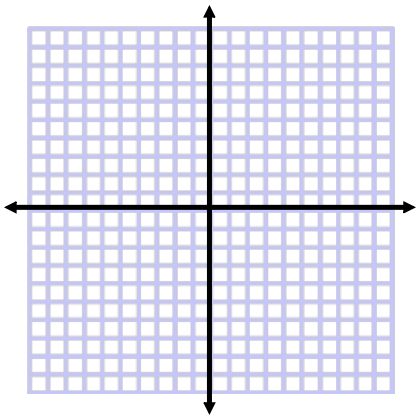
$f(x)=(x+7)^2$



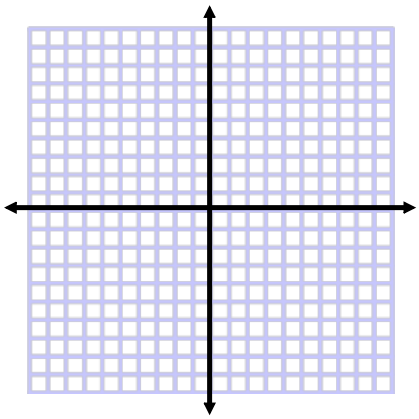
$f(x)=|x|+3$



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

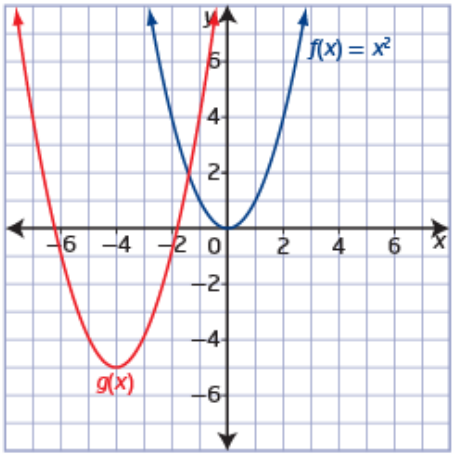


$f(x)=\frac{1}{x-5}+7$

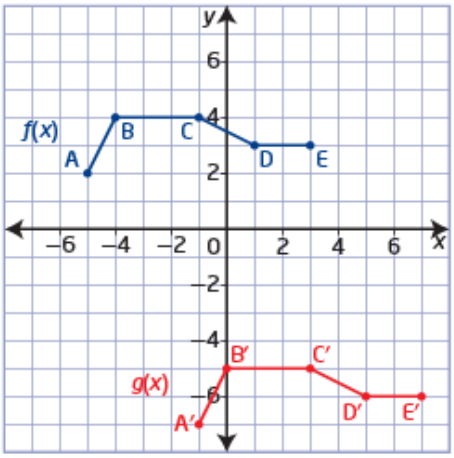


Determine the Equation of a Translated Function:

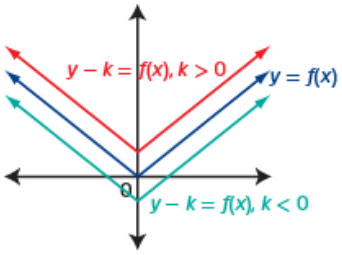
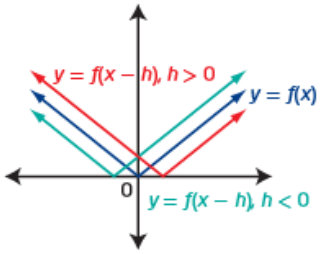
a)



b)



- Translations are transformations that shift all points on the graph of a function up, down, left, and right without changing the shape or orientation of the graph.
- The table summarizes translations of the function $y = f(x)$.

Function	Transformation from $y = f(x)$	Mapping	Example
$y - k = f(x)$ or $y = f(x) + k$	A vertical translation If $k > 0$, the translation is up. If $k < 0$, the translation is down.	$(x, y) \rightarrow (x, y + k)$	
$y = f(x - h)$	A horizontal translation If $h > 0$, the translation is to the right. If $h < 0$, the translation is to the left.	$(x, y) \rightarrow (x + h, y)$	

- A sketch of the graph of $y - k = f(x - h)$, or $y = f(x - h) + k$, can be created by translating key points on the graph of the base function $y = f(x)$.

Homework