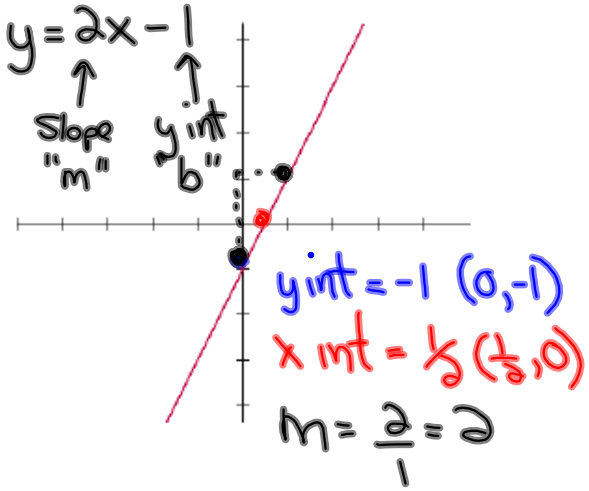
Catalog of Essential Functions

1. Linear



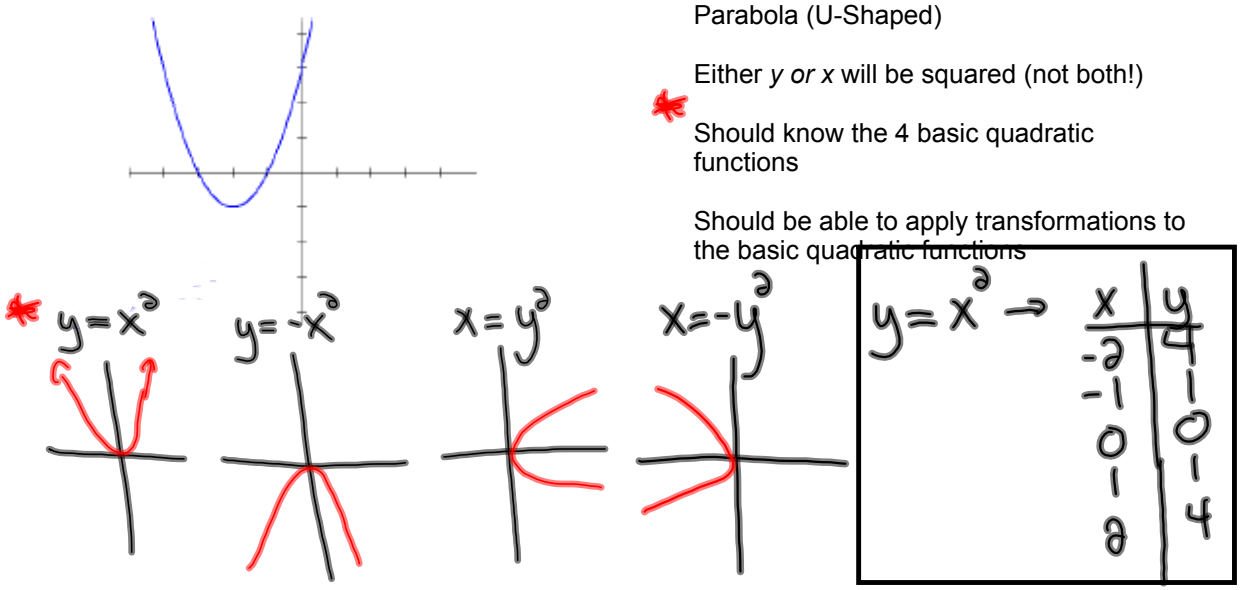
Straight Line

Equation will be degree one

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

$y = x$

2. Quadratic



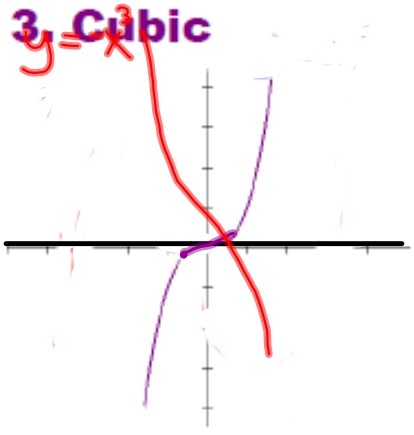
Parabola (U-Shaped)

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

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

$y = x^3$

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

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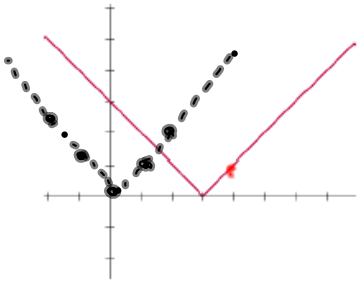
4. Absolute Value



V-Shaped

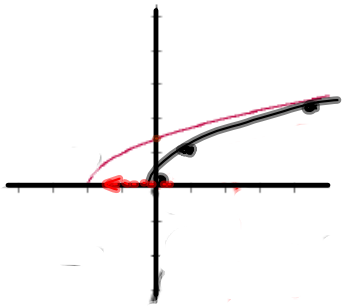
Equation will have a variable within the absolute value bars

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

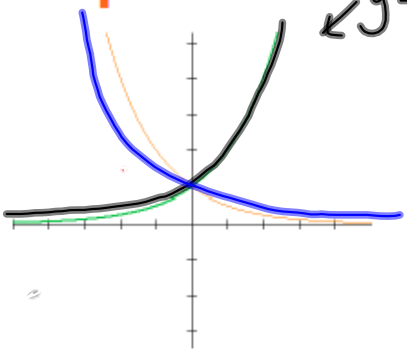
Equation will have a variable under the square root sign

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***

$y = 2^x$

x	y
-2	1/4
-1	1/2
0	1
1	2
2	4

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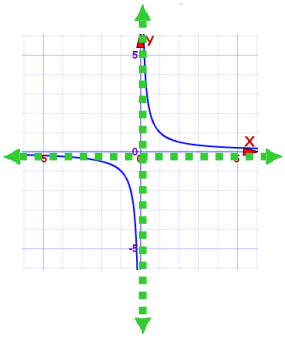
7. Reciprocal



Will have two branches

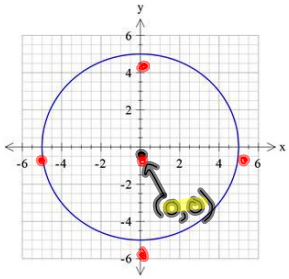
Equation will have a variable within the denominator of a rational expression

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

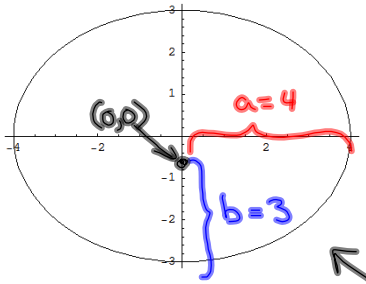
8. Circle



- 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.

$x^2+y^2=r^2$
$x^2+y^2=5^2$
$x^2+y^2=25$

9. Ellipse



major axis = 8
minor axis = 6

- 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.

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

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

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...

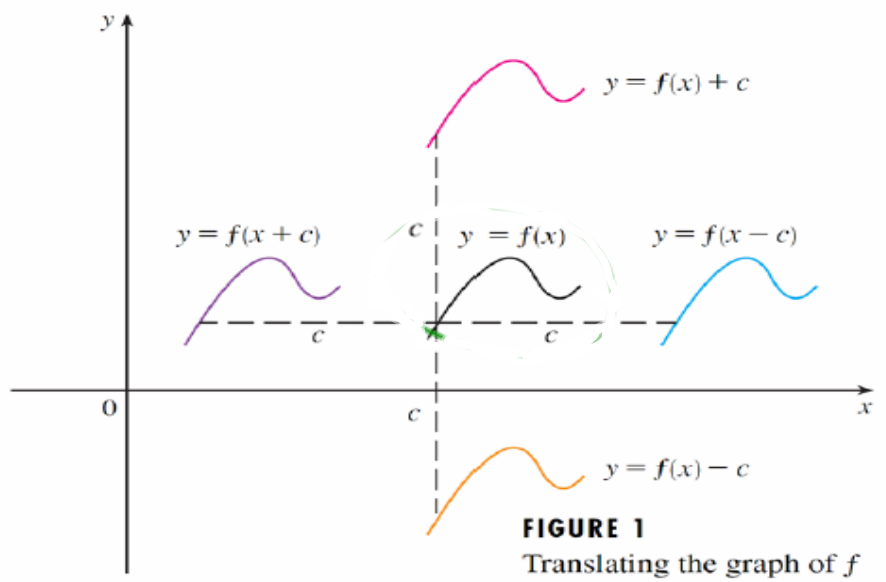


FIGURE 1
Translating the graph of f

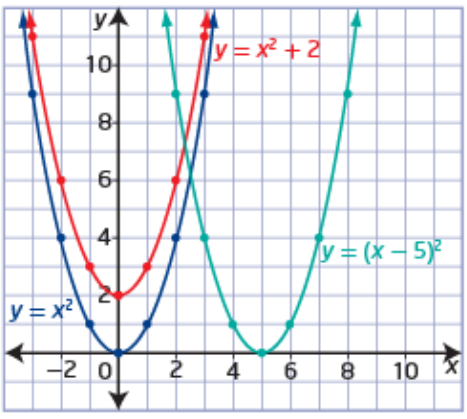
Using Mapping Notation to Describe Transformations:

*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

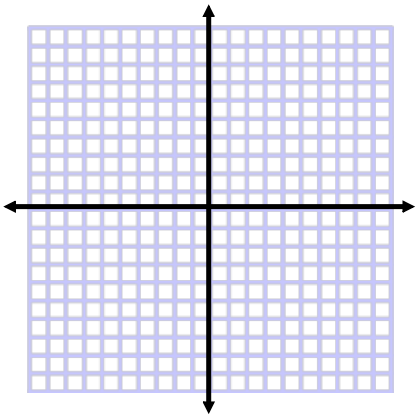
x	$y = x^2 + 2$
−3	11
−2	6
−1	3
0	2
1	3
2	6
3	11

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

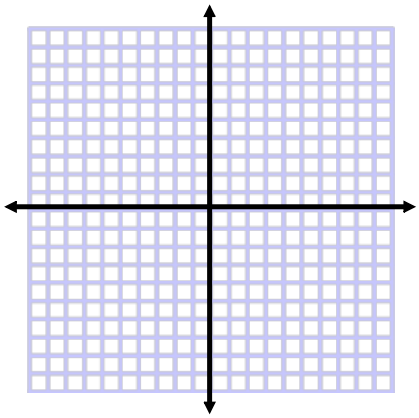


Identify the translations for each of the following...

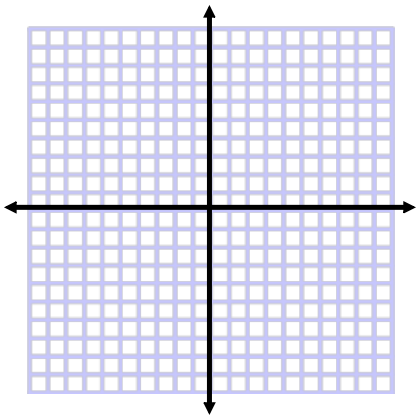
$f(x)=(x+7)^2$



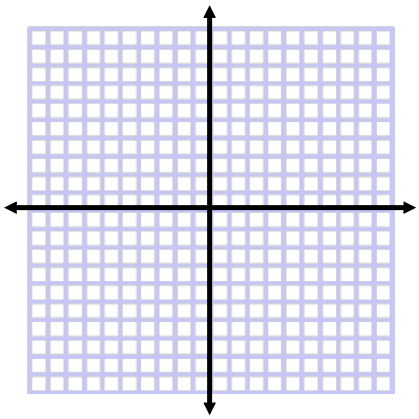
$f(x)=|x|+3$



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

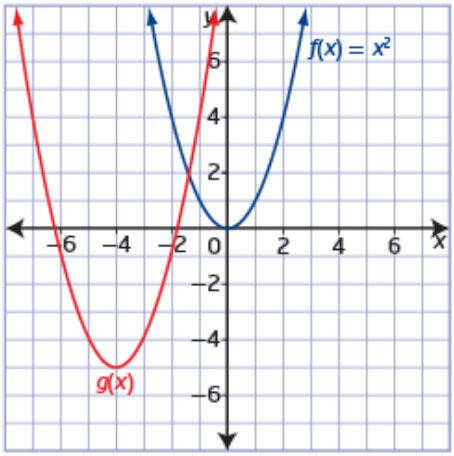


$f(x)=\frac{1}{x-5}+7$

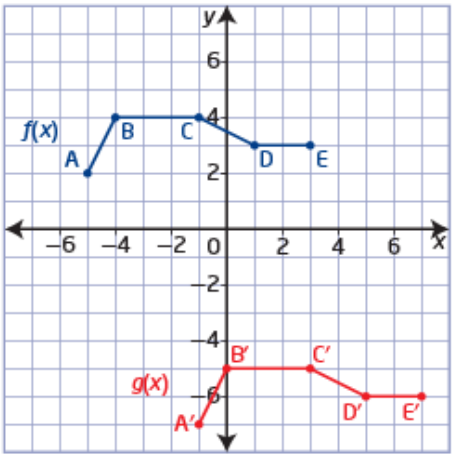


Determine the Equation of a Translated Function:

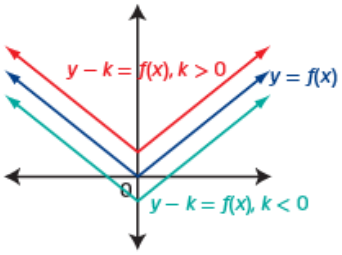
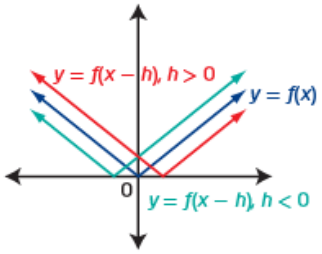
a)



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