Write as piecewise ...

$$\begin{cases} |8| = 8 \\ |-8| = 8 \end{cases}$$

① $y = -3|x+5| - 4$

③ $y = 4 - |3x+5|$

② $y = |3x-2|$

④ $y = -2|7x-1| + 4$

① BBP

$x+5 \geq 0$

$x \geq -5$

BBN

$x+5 < 0$

$x < -5$

$$f(x) = \begin{cases} -3(x+5) - 4, & x \geq -5 \\ 3(x+5) - 4, & x < -5 \end{cases}$$

② $y = |3x - 2|$

BBP

$3x - 2 \geq 0$

$3x \geq 2$

$x \geq \frac{2}{3}$

BBN

$x < \frac{2}{3}$

$$y = \begin{cases} 3x - 2, & \text{if } x \geq \frac{2}{3} \\ -3x + 2, & \text{if } x < \frac{2}{3} \end{cases}$$

③ $y = 4 - |3x + 5|$

BBP

$3x + 5 \geq 0$

$3x \geq -5$

$x \geq -\frac{5}{3}$

BBN

$x < -\frac{5}{3}$

$$f(x) = \begin{cases} 4 - (3x+5), & \text{if } x \geq -\frac{5}{3} \\ 4 + (3x+5), & \text{if } x < -\frac{5}{3} \end{cases}$$

④ $y = -2|7x-1| + 4$

BBP

$7x - 1 \geq 0$

$7x \geq 1$

$x \geq \frac{1}{7}$

BBN

$x < \frac{1}{7}$

$$f(x) = \begin{cases} -2(7x-1)+4, & \text{if } x \geq \frac{1}{7} \\ 2(7x-1)+4, & \text{if } x < \frac{1}{7} \end{cases}$$

Do I understand????

Sketch the following piecewise function:

$$f(x)=\begin{cases} -2x+3, & \text{if } x\leq -2 \\ (x+1)^2-2, & \text{if } -2<x\leq 1 \\ 3x-1, & \text{if } 1<x<2 \\ 5, & \text{if } x\geq 2 \end{cases}$$

1: Linear

x	y
-2	7
-3	9

2: Quadratic

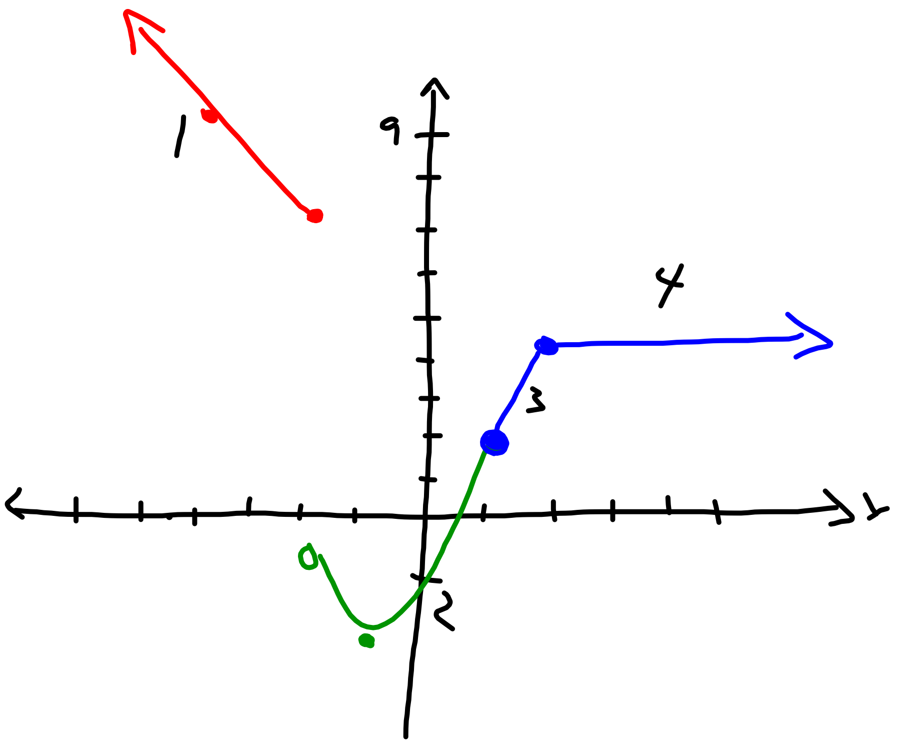
V(-1,-2)

x	y
-2	-1
1	2

3: Linear

x	y
1	2
2	5

4: Linear (Horizontal)



Given the function: $f(x) = -3|4-3x| + 2$

(a) Evaluate $f(2)$

(b) Express $f(x)$ as a piecewise function

(a) $f(\underline{2}) = -3|4-3(2)| + 2$

$f(2) = -3|-2| + 2$

$= -3(2)+2$

$= -4$

b)

BBP

$4-3x \geq 0$

$\frac{-3x}{-3} \geq \frac{-4}{-3}$

$x \leq \frac{4}{3}$

BBN

$x > \frac{4}{3}$

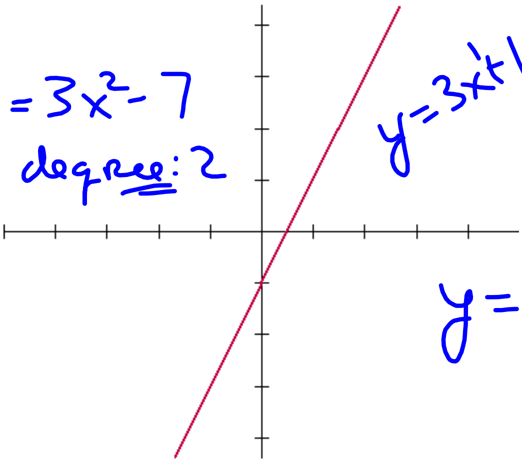
$$f(x) = \begin{cases} -3(4-3x)+2, & \text{if } x \leq \frac{4}{3} \\ 3(4-3x)+2, & \text{if } x > \frac{4}{3} \end{cases}$$

Catalog of Essential Functions

1. Linear

$y = 3x^2 - 7$

degree: 2



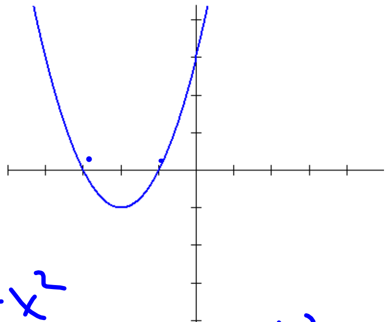
$y = 3x^1 + 1$

- Straight line
- Equation will be degree one
- Should be able to identify ***slope***, ***intercepts***, and ***equation*** from the graph

$y = x^2 - 3x^4y + 7x^3y^4 - x^8y^7$

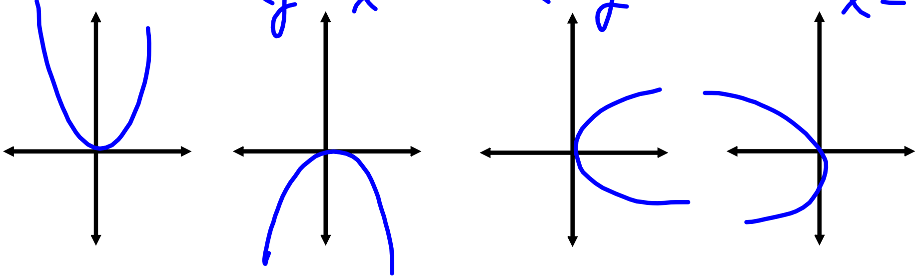
Degree: 15

2. Quadratic



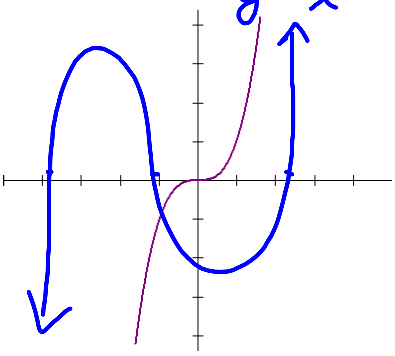
- Parabola (U-Shaped)
- Either x or y will be squared (Not both!)
- Should know the 4 basic quadratic ~~functions~~ Relations
- Should be able to apply transformations to the basic quadratic functions

$y = x^2$ $y = -x^2$ $x = y^2$ $x = -y^2$



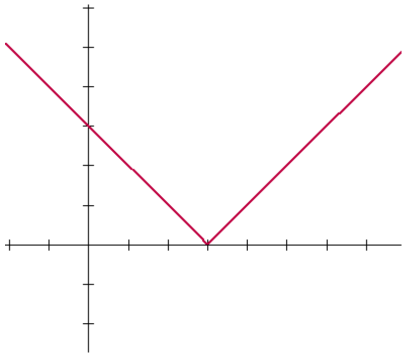
3. Cubic

$y = x^3$



- S-Shaped
- Will work with functions having x raised to the third power
- Should be able to apply transformations to the basic quadratic functions

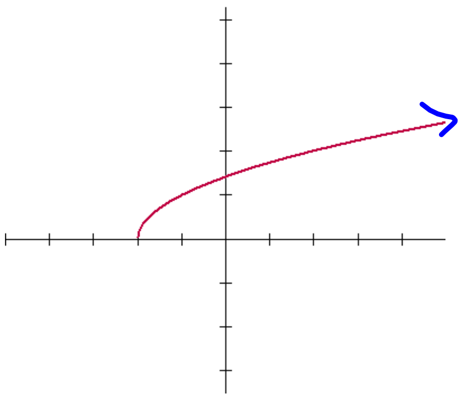
4. Absolute Value



- V-Shaped
- Equation will have a variable within the absolute value bars
- Should be able to apply transformations to the basic absolute value functions

5. Square Root

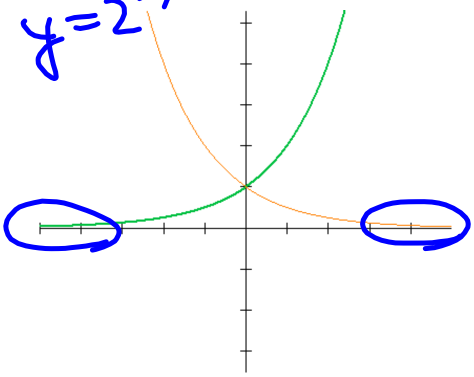
$y = \sqrt{x}$



- Half parabola
- Equation will have a variable under the square root sign
- Should be able to apply transformations to the basic square root function

6. Exponential

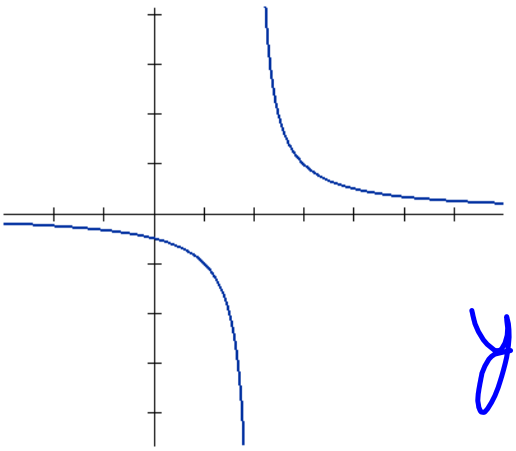
$y=2^{-x}$



- Steadily increasing or decreasing
- Base will be a number and variable will appear in the exponent
- Should be able to identify the horizontal asymptote

$y=2^{x}$

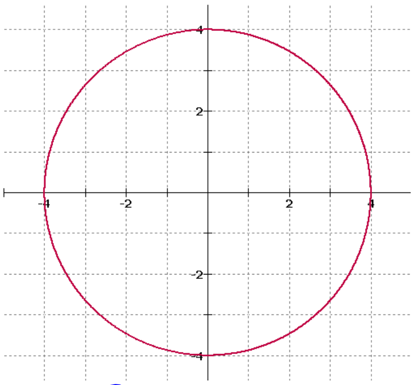
7. Reciprocal



- Will have two branches
- Equation will have a variable within denominator of a rational expression
- Be able to identify the vertical and horizontal asymptotes

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

8. Circle



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

* center: (h, k)
* radius $= r$

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

$x^2+y^2=16$

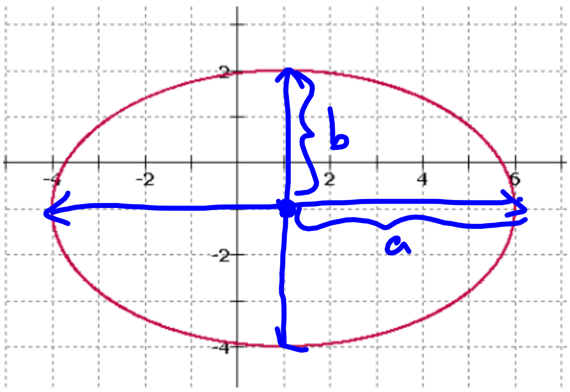
$r=4$

Centre: $(0,0)$

$(x+2)^2+(y-3)^2=25$

C: $(-2,3)$ $r=5$

9. Ellipse

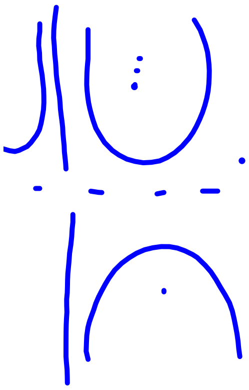


- General form: $\dfrac{(x-h)^2}{a^2}+\dfrac{(y-k)^2}{b^2}=1$

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

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

New Functions from Old Functions...TRANSFORMATIONS



- 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...

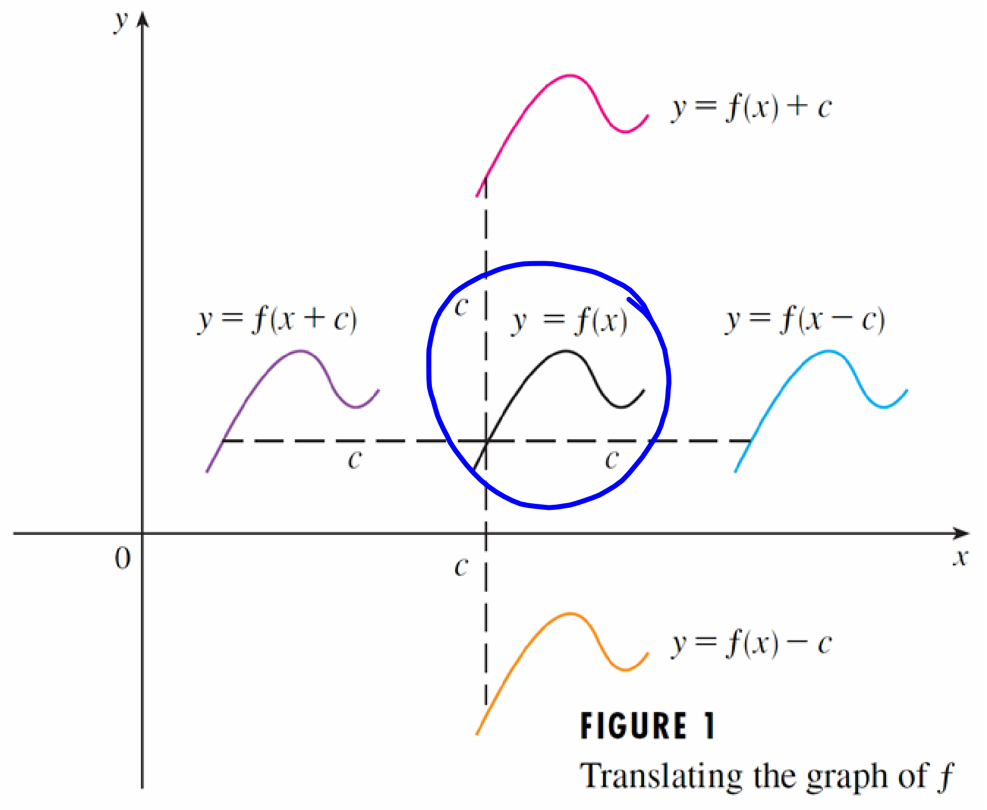


FIGURE 1
Translating the graph of f

Identify the translations for each of the following...

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

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

$\Rightarrow$ Left 7

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

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

$\Rightarrow$ Up 3

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

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

$f(x-3)-2$

Right 3 and Down 2

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

$f(x)=\frac{1}{x}$

$f(x-5)+7$

Right 5 & Up 7