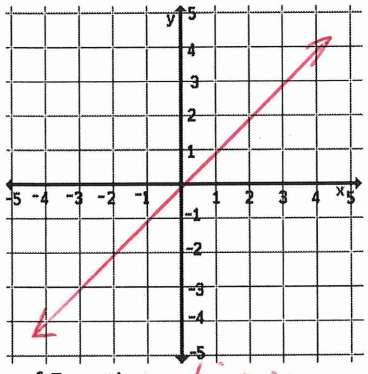
Name: Period: Date:

Math Lab: Transformations of Parent Graphs

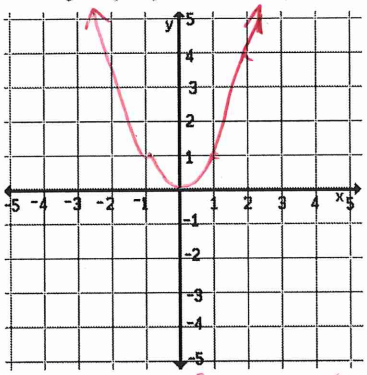
Use your graphing calculator to sketch each graph as accurately as possible. Trace over each curve in red and identify each type of function.

$f(x) = x$



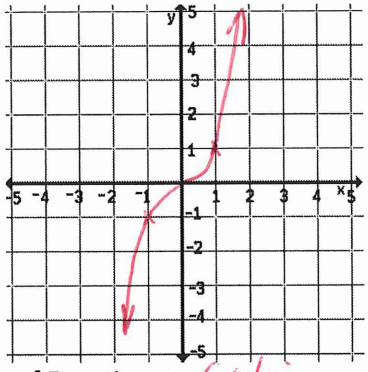
Type of Function: Linear
Domain:
Range:

$f(x) = x^2$



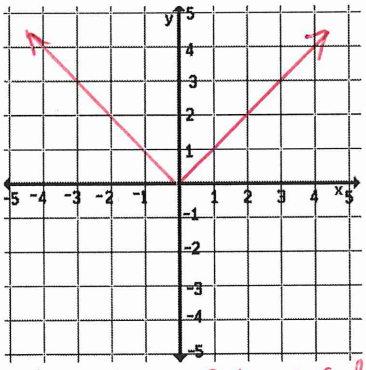
Type of Function: Quadratic
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$

$f(x) = x^3$



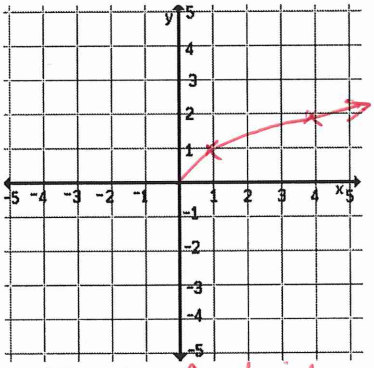
Type of Function: Cubic
Domain: (∞, ∞)
Range: $(-\infty, \infty)$

$f(x) = |x|$



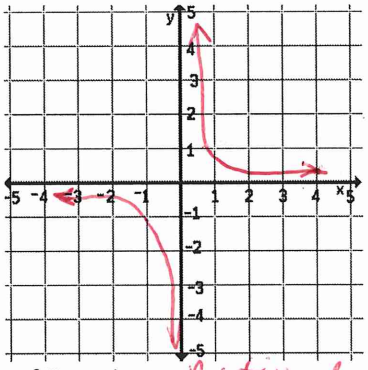
Type of Function: Abs Value
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$

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



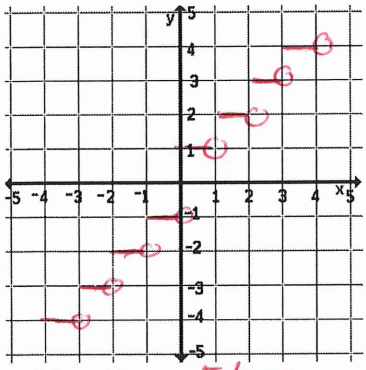
Type of Function: Radical
Domain: $[0, \infty)$
Range: $[0, \infty)$

$f(x) = 1/x$



Type of Function: Rational
Domain: $(-\infty, 0) \cup (0, \infty)$
Range: $(-\infty, 0) \cup (0, \infty)$

$f(x) = [\![x]\!]$



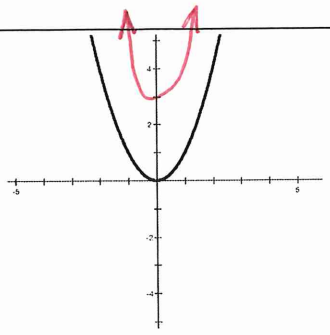
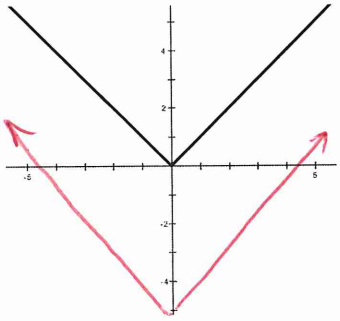
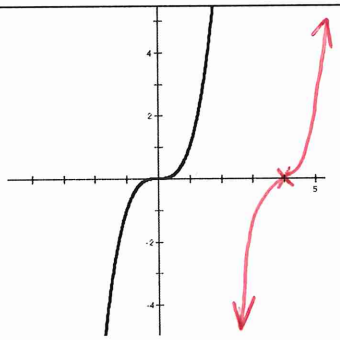
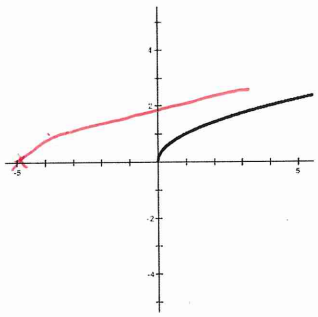
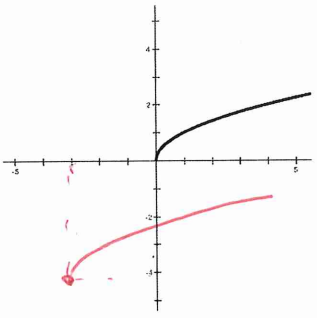
Type of Function: Floor
Domain: $(-\infty, +\infty)$
Range: All integers

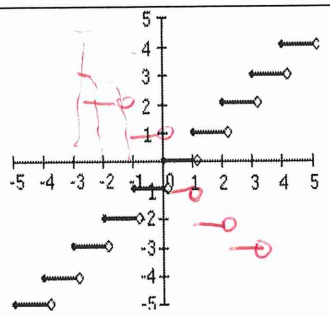
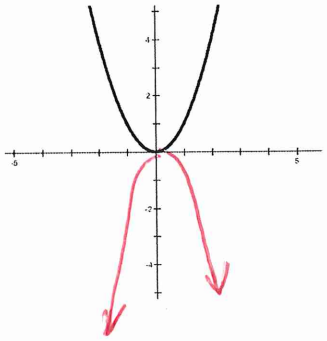
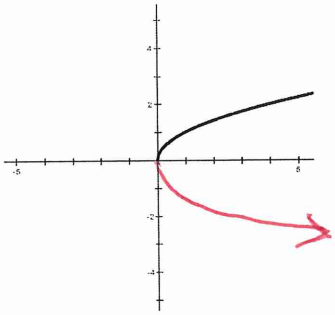
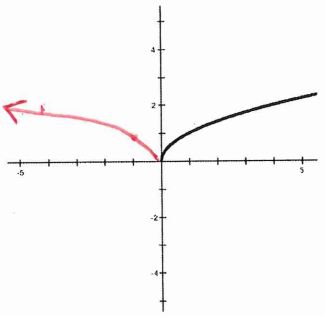
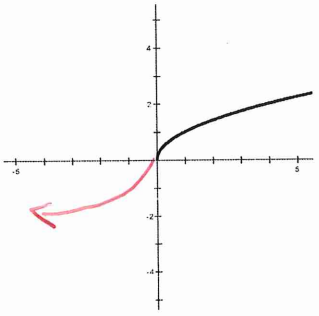
What do all of these parent graphs have in common?

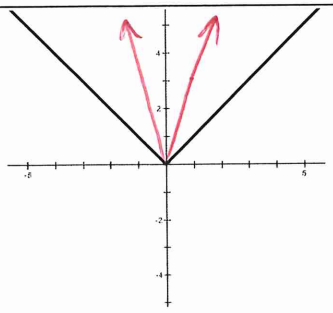
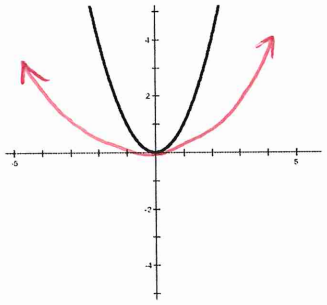
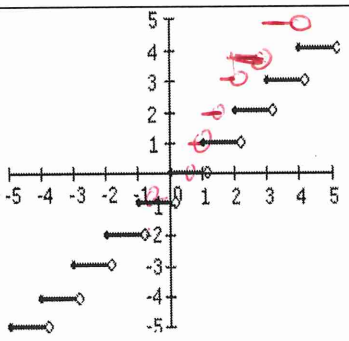
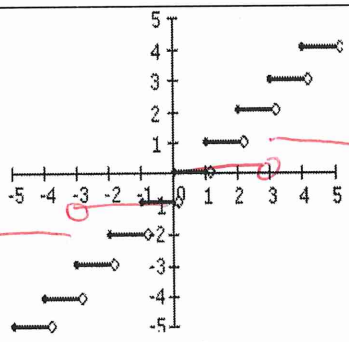
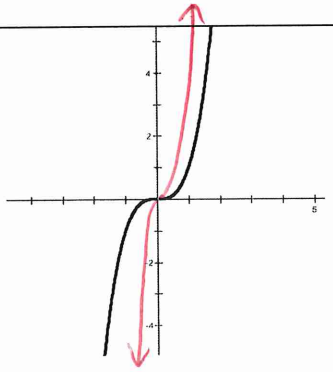
All go through (1, 1)

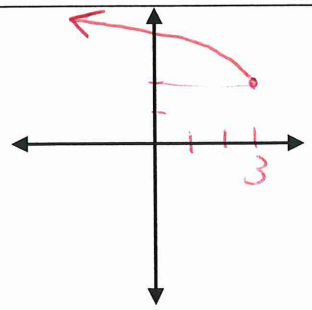
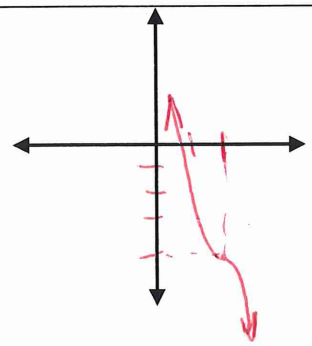
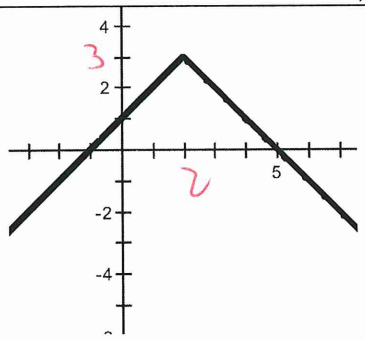
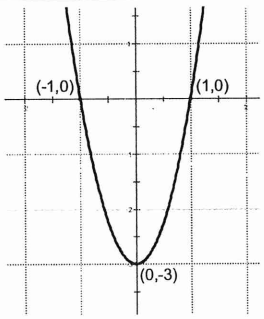
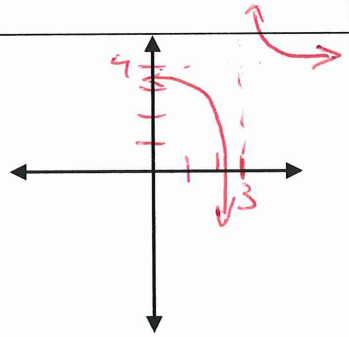
$[\![\ ]\!]$

Greatest integer less than or equal to

Equation of Parent Function	Description of Transformation	Equation of Transformed Function	Graph of Transformed Function (in red)	Domain and Range of Transformed Function
$f(x) = x^2$	Translate up 3 units	$f(x) + 3 =$ x^2+3		D: $(-\infty, \infty)$ R: $[3, \infty)$
$f(x) = \lvert x \rvert$	Translate Down 5 units	$f(x) - 5 =$ $\lvert x \rvert - 5$		D $(-\infty, +\infty)$ R $[-5, \infty)$
$f(x) = x^3$	Right by 4.	$f(x - 4) =$ $(x-4)^3$		D: $(-\infty, +\infty)$ R: $(-\infty, +\infty)$
$f(x) = \sqrt{x}$	Left by 5	$f(x + 5) =$ $\sqrt{x+5}$		D: $[-5, \infty)$ R: $[0, \infty)$
$f(x) = \sqrt{x}$	Left by 3, Down by 4.	$f(x + 3) - 4 =$ $\sqrt{x+3} - 4$		D: $[-3, +\infty)$ R: $[-4, +\infty)$

Equation of Parent Function	Description of Transformation	Equation of Transformed Function	Graph of Transformed Function (in red)	Domain and Range of Transformed Function
$f(x) = [\![x]\!]$	flip upside down	$-f(x) =$ $-\lfloor x \rfloor$		D: $(-\infty, +\infty)$ $\mathbb{Z}$
$f(x) = x^2$	flip upside down	$-f(x) =$ $-x^2$		D: $(-\infty, \infty)$ R: $[-\infty, 0]$
$f(x) = \sqrt{x}$	flip upside down	$-f(x) =$ $-\sqrt{x}$		D: $[0, \infty)$ R: $(\infty, 0]$
$f(x) = \sqrt{x}$	flip sideways	$f(-x) =$ $\sqrt{-x}$		D: $(-\infty, 0]$ R: $[0, \infty)$.
$f(x) = \sqrt{x}$	flip sideways und upside down.	$-f(-x) =$ $-\sqrt{-x}$		D: $(-\infty, 0]$ R: $(-\infty, 0]$

Equation of Parent Function	Description of Transformation	Equation of Transformed Function	Graph of Transformed Function (in red)	Domain and Range of Transformed Function
$f(x) = \lvert x \rvert$	"narrows"	$3 \cdot f(x) =$ $3 \cdot \lvert x \rvert$		D: $(-\infty, +\infty)$ R: $[0, \infty)$
$f(x) = x^2$	"widens"	$\frac{1}{2} \cdot f(x) =$		D $(-\infty, +\infty)$ R: $[0, \infty)$
$f(x) = [\![x]\!]$	Narrows Horizontally	$f(2x) =$ $[\![2x]\!]$		D $(-\infty, +\infty)$ R: $\mathbb{Z}$
$f(x) = [\![x]\!]$	Widens Horiz	$f\left(\frac{1}{3}x\right) =$ $[\![\frac{1}{3}x]\!]$		D: $(-\infty, +\infty)$ R: $\mathbb{Z}$
$f(x) = x^3$	"narrows"	$6 \cdot f(x) =$ $6x^3$		D $(-\infty, +\infty)$ R: $(-\infty, +\infty)$

Equation of Parent Function	Description of Transformation	Equation of Transformed Function	Graph of Transformed Function (in red)	Domain and Range of Transformed Function
$f(x) = \sqrt{x}$	Reflected around y axis - Right 3 - up 2	$f(-(x-3))+2 =$ $\sqrt{-(x-3)}+2$		Domain $(-\infty, 3]$ Range $[2, \infty)$
$f(x) = x^3$	Reflect in x Right 2 - Down 4	$-f(x-2)-4$ $f(x) = -(x-2)^3 - 4$		D = $(-\infty, \infty)$ R: $(-\infty, -\infty)$
$f(x) = \lvert x \rvert$	-Reflection in x - Right 2 - up 3	$-f(x+2)+3$ $-\lvert x+2 \rvert + 3$		D $(-\infty, \infty)$ R: $(-\infty, 3]$
$f(x) = x^2$	-Vertical stretch by 3 - Shift Down by 3	$3f(x)-3 =$ $3x^2-3$		D $(-\infty, \infty)$ R $[-3, \infty)$
$f(x) = \frac{1}{x}$	A rational function has been translated up 4 units and 3 units to the right.	$f(x-3)+4 =$ $\frac{1}{x-3}+4$		D: $(-\infty, 3) \cup (3, \infty)$ R: $(-\infty, 4) \cup (4, \infty)$

Summarize

For each of the following, describe the transformation happening to the function.

Rigid Transformations	
Function Notation	Description of transformation
$f(x) = f(x) + c$	Translate UP c
$f(x) = f(x) - c$	down c
$f(x) = f(x + c)$	left c
$f(x) = f(x - c)$	Right c
$f(x) = -f(x)$	Reflect in X axis
$f(x) = f(-x)$	Reflect in y-axis

Non-rigid Transformations	
Function Notation	Description of transformation
$f(x) = c \cdot f(x)$	Vertical stretch
$f(x) = \frac{1}{c} \cdot f(x)$	Vertical Shrink
$f(x) = f(cx)$	Horiz shrink
$f(x) = f\left(\frac{1}{c}x\right)$	Horiz stretch

Based on the tables, what is the difference between a rigid transformation and a non-rigid transformation?

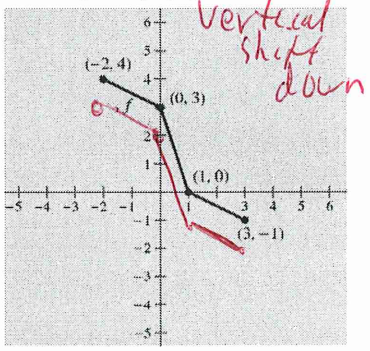
Rigid Trans do NOT change shape.
Non-Rigid Trans change shapes

Extend your thinking

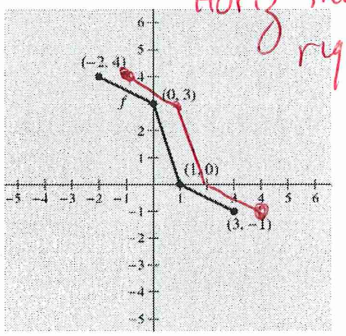
Use the graph of f to sketch each graph. Label each ordered pair.

(Hint: Think about how the transformation affects the x and y-coordinate of each anchor point on the graph.)

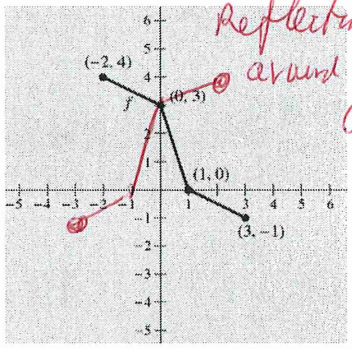
1. $y = f(x) - 1$ Vertical shift down



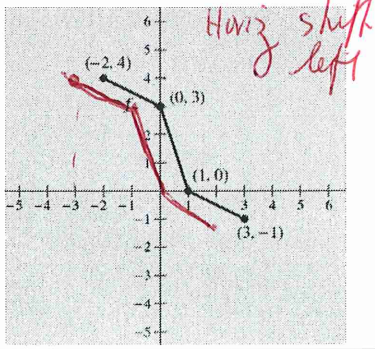
2. $y = f(x - 1)$ Horiz shift right



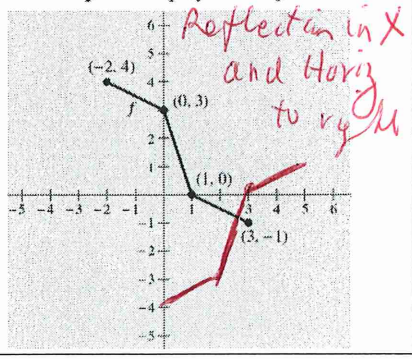
3. $y = f(-x)$ Reflection around y



4. $y = (x + 1)$ Horiz shift left



5. $y = -f(x - 2)$ Reflection in X and Horiz to right



6. $y = \frac{1}{2}f(x)$ Vertical shrink