Math 115E Activity 18

Chapter 6
Transformations

Transformation Rules

Function	Vertical Translation	Result	Point
$y = x^2$	**Upward** by k units	$y = x^2 + k$	$(x, y + k)$
$y = x^2$	**Downward** by k units	$y = x^2 - k$	$(x, y - k)$
$y = x^2$	**Right** by h units	$y = (x - h)^2$	$(x - h, y)$
$y = x^2$	**Left** by h units	$y = (x + h)^2$	$(x + h, y)$
$y = x^2$	**Stretch** for $|c| \geq 1$	$y = 2f(x)$	$(x, 2y)$
$y = x^2$	**Shrink** for $0 < |c| < 1$	$y = \frac{1}{2}f(x)$	$(x, \frac{1}{2}y)$
$y = x^2$	**Reflection** over the $x - axis$	$y = -x^2$	$(x, -y)$
$y = x^2$	**Reflection** over the $y - axis$	$y = (-x)^2$	$(-x, y)$

Quadratic Function Transformations

Convert each of the following transformations from function notation into descriptive words
Also pay attention to which transformations come first before others.

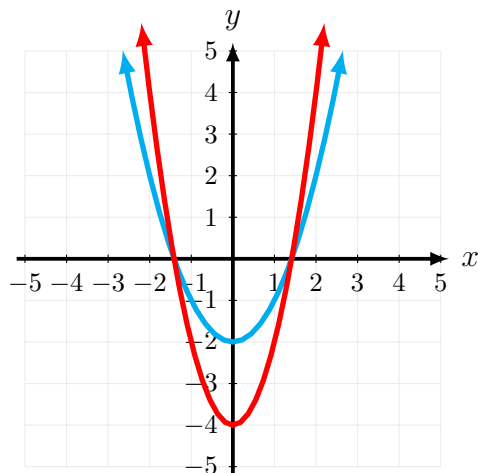| $y = \frac{1}{2}f(x - 1) + 2$	$y = 5f(x) + 3$	$y = -2f(x + 1) - 2$	$y = f(x - 3) + 4$
Scaling Shrink by 1/2	Scaling Stretch by 5	Scaling Stretch by 2	Scaling - - - - - - - - - -
Horizontal Shift Right by 1	Horizontal Shift - - - - - - - - - -	Horizontal Shift Left by 1	Horizontal Shift Right by 3
Vertical Shift Upward by 2	Vertical Shift Upward by 4	Vertical Shift Downward by 2	Vertical Shift Upward by 4
Reflecton - - - - - - - - - -	Reflecton - - - - - - - - - -	Reflecton - - - - - - - - - -	Reflecton Over the x-axis

Transformation given a point

A Transformation in the form $y = af(x - h) + k$ with a point (x_0, y_0) from the original function $f(x)$ will have the following point as the result $(x - h, ay + k)$
Notice that only the x-value gets shifted and the y value remains the same then transformed

If $(3, 4)$ is a point on the graph $f(x)$, using the same transformations as before, what ordered pair must also be on the graph of y? We do not know the original function, but what can we do?
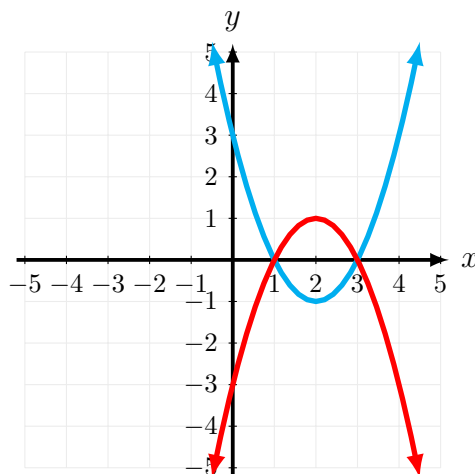
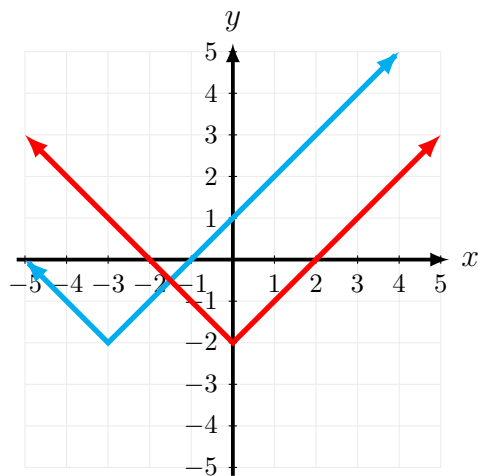| $y = \dfrac{1}{2}f(x - 1) + 2$	$y = 5f(x) + 3$	$y = -2f(x + 1) - 2$	$y = f(x - 3) + 4$
Let's use $(3, 4)$	Let's use $(3, 4)$	Let's use $(3, 4)$	Let's use $(3, 4)$
x-value change: $x_0 + h = x_1$ $3 + 1 = 4$	x-value change: $x_0 + h = x_1$ $3 + 0 = 3$	x-value change: $x_0 - 1 = x_1$ $3 - 1 = 2$	x-value change: $x_0 + 3 = x_1$ $3 + 3 = 6$
y-value change: $ay + k = y_1$ $\frac{1}{2}(4) + 2 = 4$	y-value change: $ay + k = y_1$ $5(4) + 3 = 23$	y-value change: $ay + k = y_1$ $-2(4) - 2 = -10$	y-value change: $ay + k = y_1$ $4 + 4 = 8$
Final point $(x_0, y_0) \rightarrow (x_1, y_1)$ $(3, 4) \rightarrow (4, 4)$	Final point $(x_0, y_0) \rightarrow (x_1, y_1)$ $(3, 4) \rightarrow (3, 23)$	Final point $(x_0, y_0) \rightarrow (x_1, y_1)$ $(3, 4) \rightarrow (2, -10)$	Final point $(x_0, y_0) \rightarrow (x_1, y_1)$ $(3, 4) \rightarrow (6, 8)$

Transformations From Graph

Adjust $y = f(x)$ below with transformation $y = 2f(x)$

Adjust $y = g(x)$ below with transformation $y = -g(x)$

Adjust $y = h(x)$ below with transformation $y = h(x - 3)$

Adjust $y = k(x)$ below with transformation $y = -k(x) - 2$