Unit 3. Section 2. Function Families

Review from Section 1.

	Standard Form	Vertex Form
Equation	$f(x) = ax^2 + bx + c, a \neq 0$	$f(x) = a(x-h)^2 + k, a \neq 0$
Vertex	$\left(-\frac{b}{2a}, f\left(\frac{b}{2a}\right)\right)$	(h, k)
Axis of Symmetry	$x = -\frac{b}{2a}$	$x = h$
Extremum	$x = -\frac{b}{2a}$	$x = h$
	The extremum is a **minimum** if $a > 0$ and a **maximum** if $a < 0$.	

Warm Up

For each of the following quadratic functions in the standard form:

1. Calculate the coordinates of the vertex.
2. Use the coordinates from step 1 to write the vertex form equation of the same function.
3. In Desmos, type the original function and the function from step 1. Do the functions overlap? Why or why not?

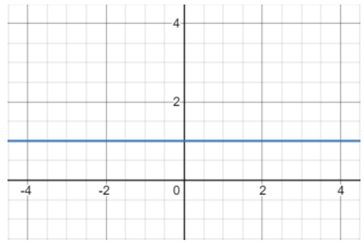
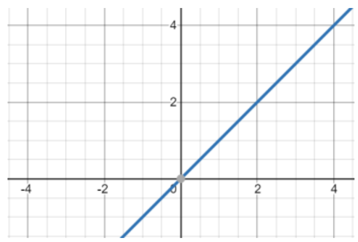
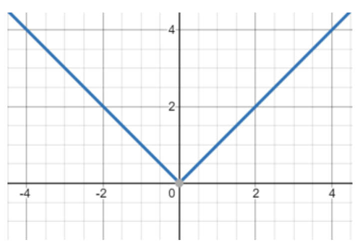
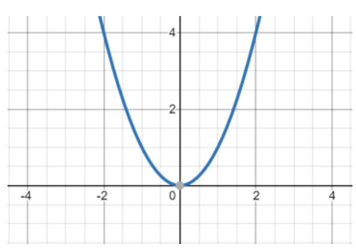
	$f(x) = 4x^2 + 3x - 1$	$g(x) = -x^2 + x$
a		
b		
$-\frac{b}{2a}$		
$f\left(-\frac{b}{2a}\right)$		
1) Vertex		
2) Vertex Form		
3) Overlap?		

Function Families

Write down characteristics of a specific family. It can be your own family, or one from movies, books, or your own imagination.

A **family of functions** is a group of functions with graphs that display one or more similar characteristics.

The **parent function** of a family is the function with the simplest form. All the other functions in the family can be obtained from the parent function.

Family Name	Parent Function	Graph	Characteristics
Constant	$f(x) = 1$		
Linear	$f(x) = x$		
Absolute Value	$f(x) = \|x\|$		
Quadratic	$f(x) = x^2$		

Function Transformations

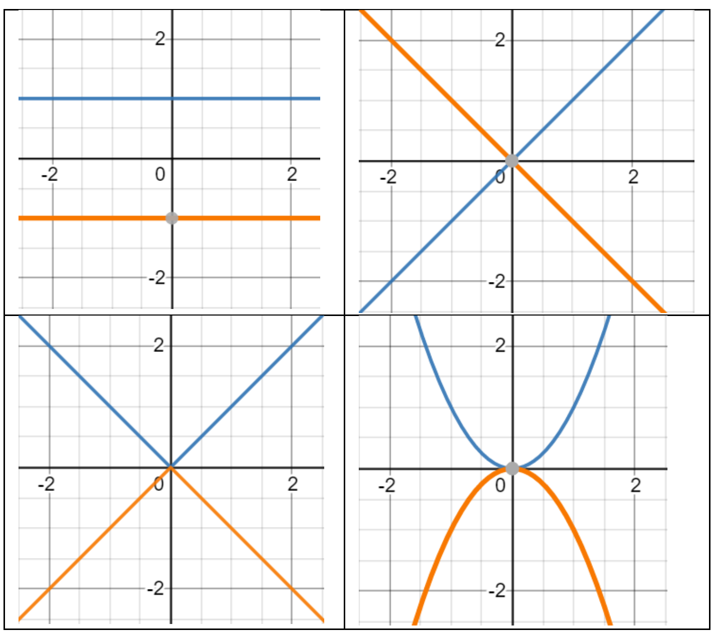
A **transformation** of a function consists of one or more of the following sliding, flipping, compressing or stretching the graph. The result is a new graph and a new function.

Reflection Over the x-axis

A **reflection** over the x-axis is a transformation that moves every point in the graph straight up or down at the same distance across the x-axis as the original point is to the x-axis. We can write the reflection algebraically as

$$(x, f(x)) \rightarrow (x, -f(x))$$

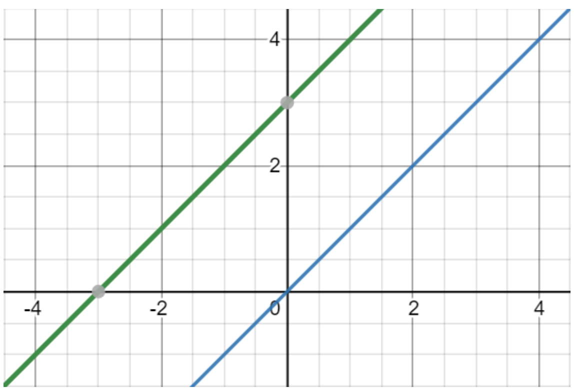
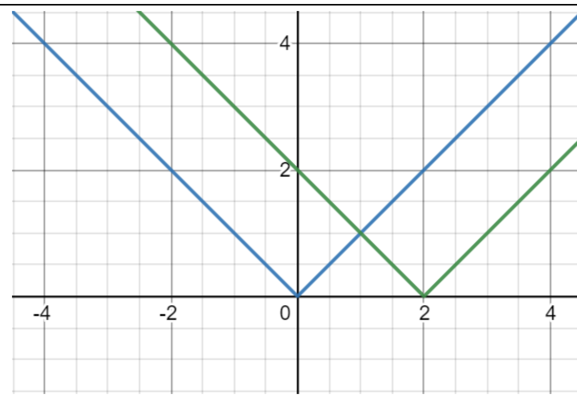
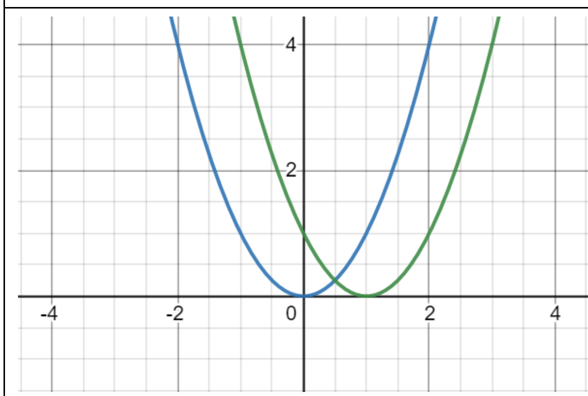
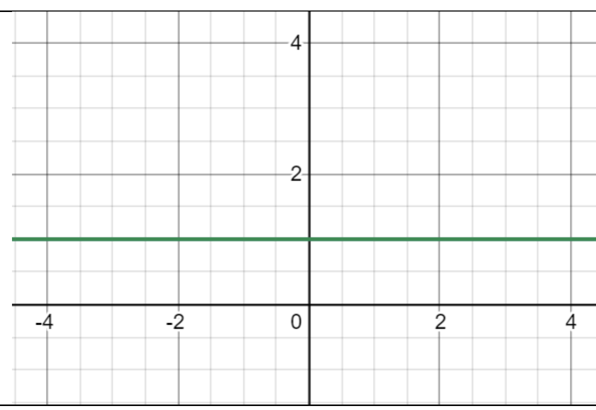
For each function, choose a point on the blue graph, and draw an arrow to the reflection of that point over the x-axis.



Horizontal Translations

A **horizontal translation** moves every point of the graph on a horizontal line in the same direction by the same constant distance.

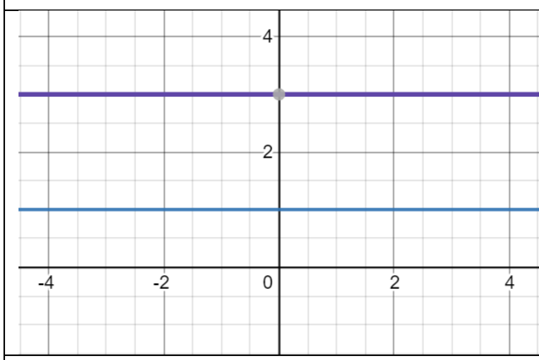
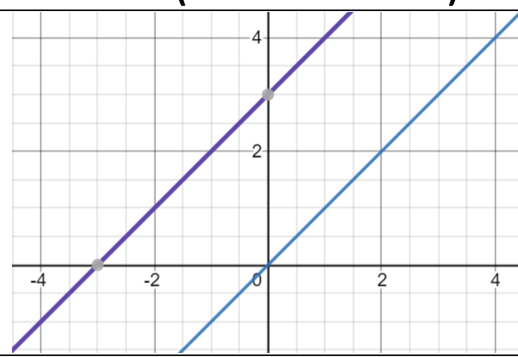
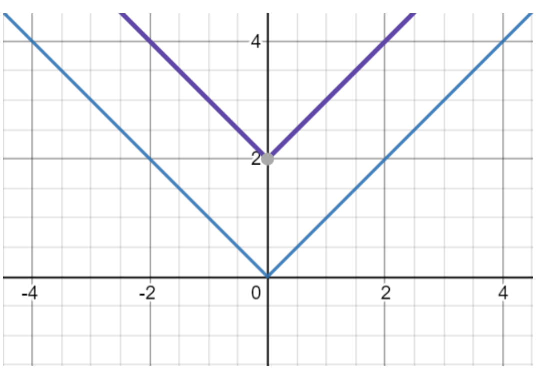
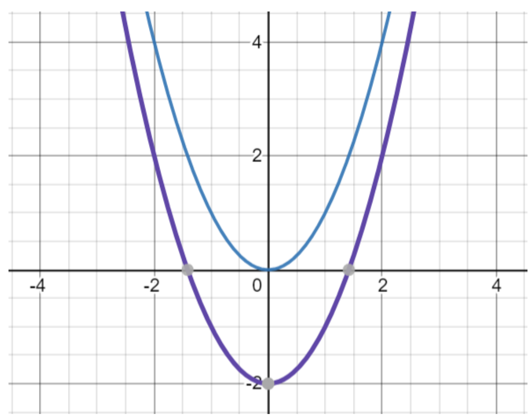
For each function, choose a point on the blue graph, and draw an arrow to the horizontal translation of that point in the green graph.

<table>
<tr><th>Left Translation</th><th>Right Translation</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><th>Right Translation</th><th>Translation?</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Vertical Translations

A **vertical translation** moves every point of the graph on a vertical line in the same direction by the same constant distance.

For each function, choose a point on the blue graph, and draw an arrow to the vertical translation of that point in the purple graph.

Up Translation	Up Translation (Left Translation?)
	
Up Translation	**Down Translation**
	

Vertical Dilations

A **vertical dilation** moves every point of the graph on a vertical line in the same direction by an amount proportional to the value of the function at that point.

For each function, choose a point on the blue graph, and draw an arrow to the vertical dilation of that point in the red graph.