Graphs of functions can be moved or resized. We will be examining the following types of changes to a function: translations, reflections, and stretches and compressions.

# Translations

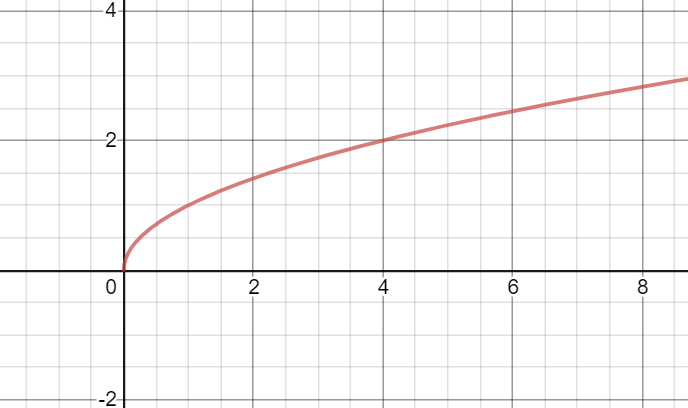
A translation involves moving the graph around on the coordinate plane. We can move the graph left, right, up and down. Given the function, , we can transform the graph by…

| Notation | Transformation |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |

Examples:

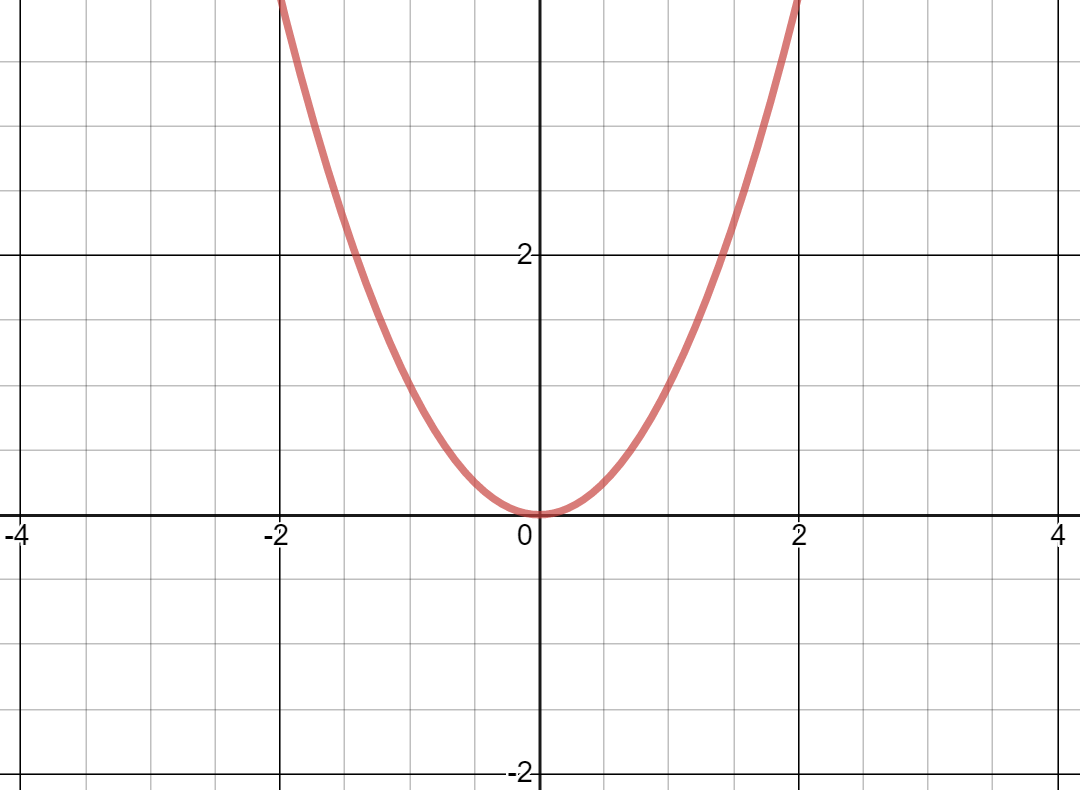
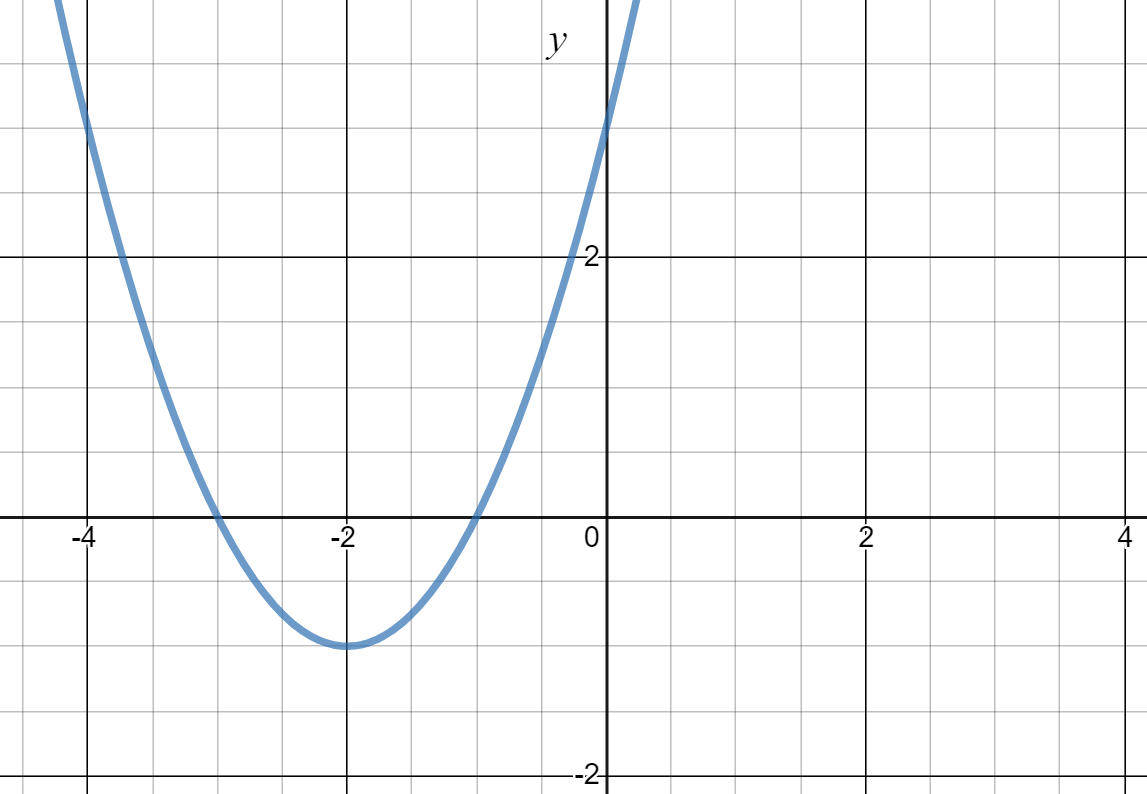
1) Given the function , describe the types of translations of .

2) Given the function below, sketch a graph of .



3) The function has been shifted 3 units to the right and 5 units down. Find the equation of a new function in terms of to represent this function.

4) Given the graph of a function , find the equation of a new function that correctly describes the graph of in terms of .

5) Suppose is a point on the graph of . What is a point that will be on the graph of ?

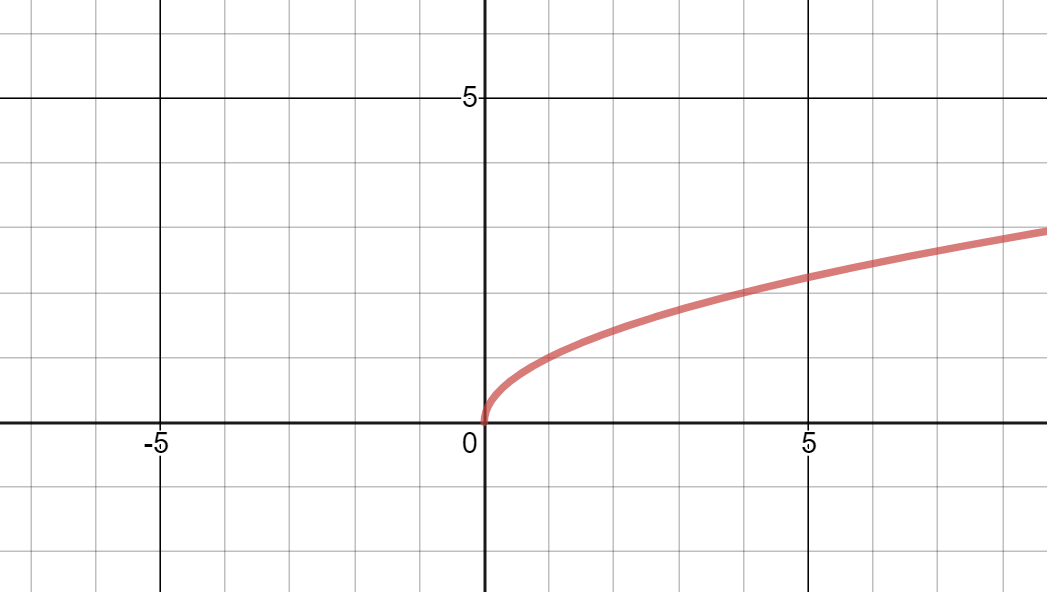
# Reflections

A reflection is like a mirror image. Think of "folding" the graph over.

| Notation | Transformation |
| --- | --- |
|  |  |
|  |  |

Examples:

1) The graph of the function, is given in the graph below. What would the graph of look like? Draw a sketch of the function on the graph below.



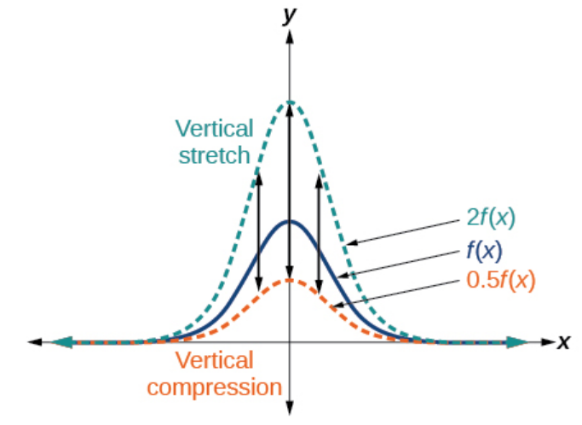
2) A function of is given in the table below. Create a table for the functions and .

|  |  |
| --- | --- |
|  | 5 |
| 0 | 10 |
| 2 | 15 |
| 4 | 20 |

Adding a constant to the inputs or outputs of a function changed the position of a graph with respect to the axes, but it did not affect the **shape of a graph.** We now explore the effects of multiplying the inputs or outputs by some quantity.

| Notation | Transformation |
| --- | --- |
| where is a constant |  |
|  |

# Vertical Stretches and Compressions



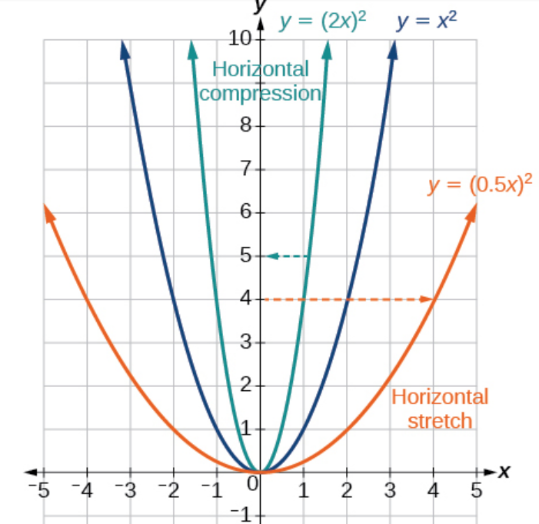
Example

A function of is given in the table below. Create a table for the function .

|  |  |
| --- | --- |
| 2 | 1 |
| 4 | 3 |
| 6 | 7 |
| 8 | 11 |

| Notation | Transformation |
| --- | --- |
| where is a constant |  |
|  |

# Horizontal Stretches and Compressions

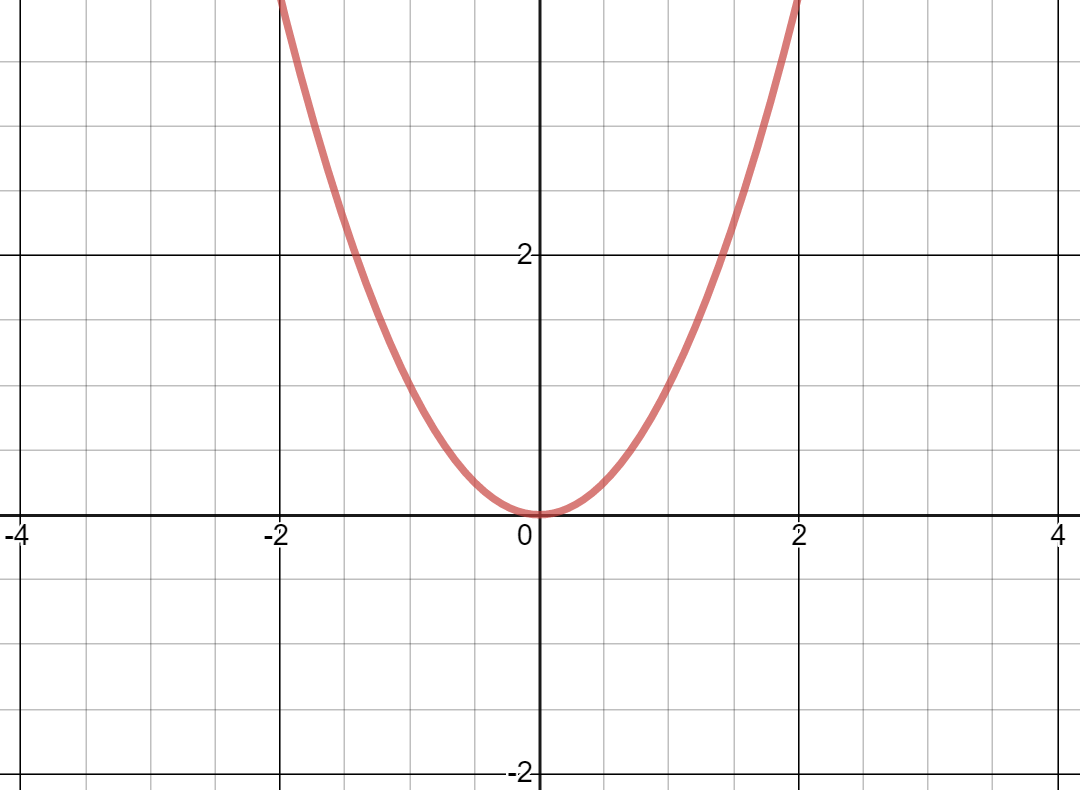
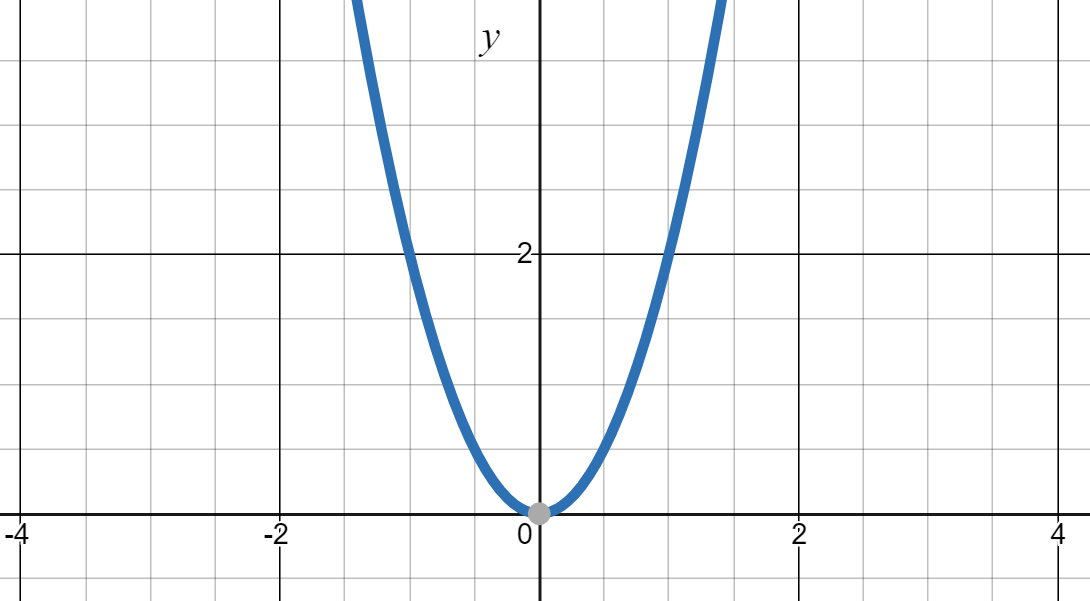


Examples

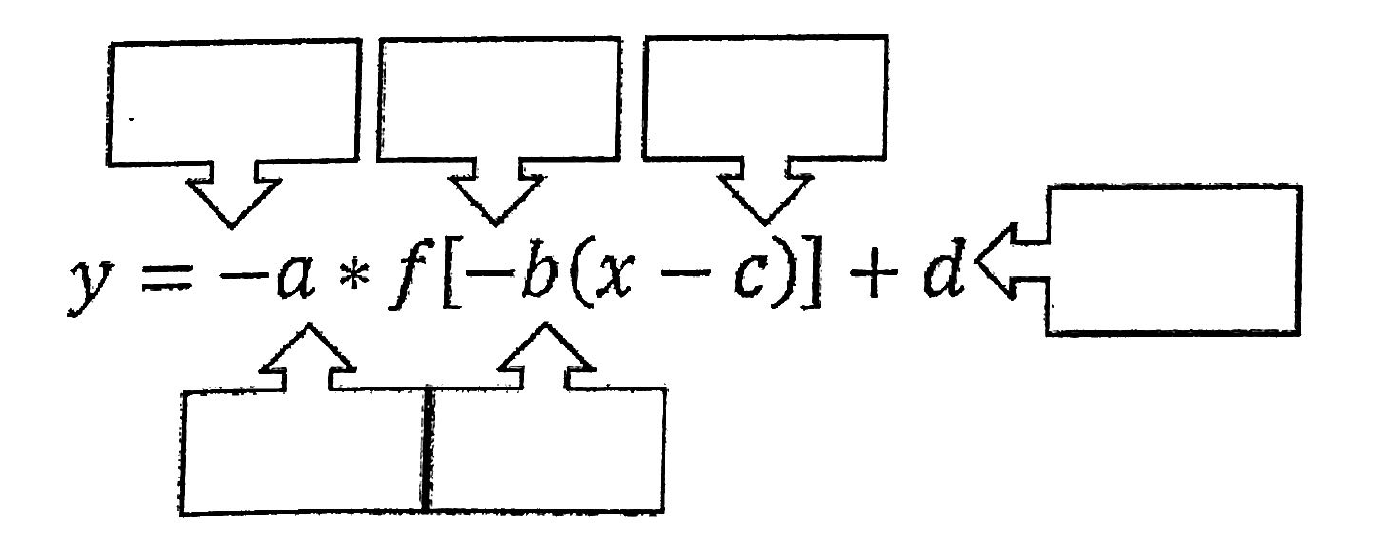
1) A function of is given in the table below. Create a table for the function .

|  |  |
| --- | --- |
| 2 | 1 |
| 4 | 3 |
| 6 | 7 |
| 8 | 11 |

2) Given the graph of the function , find the equation of a new function that correctly describes the graph of in terms of .

# Putting It All Together!



For each of the functions below, describe the transformations.

1)

2)

3)

4)

5)

6)

When working with composition of transformations, the order in which the transformations are applied often change the outcome.

# Sequences of Transformations

Sequences of transformations follow order of operations

1)

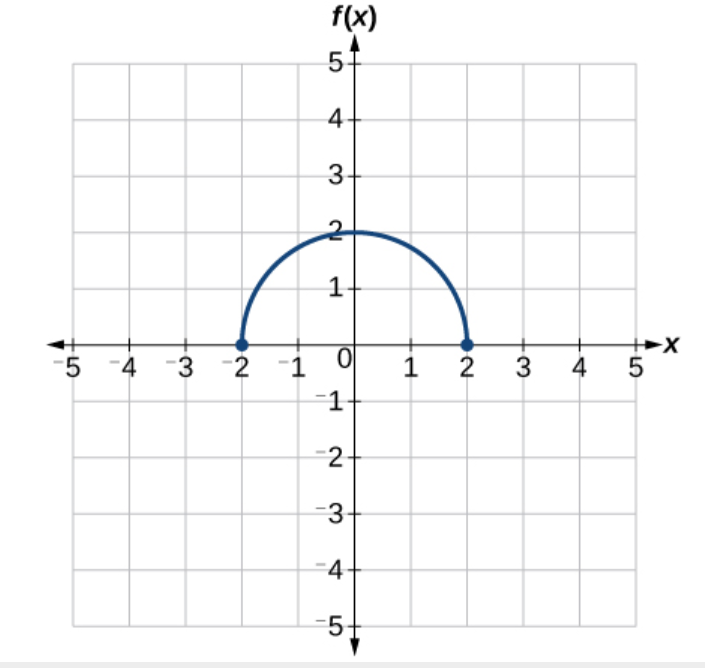
2)

3)

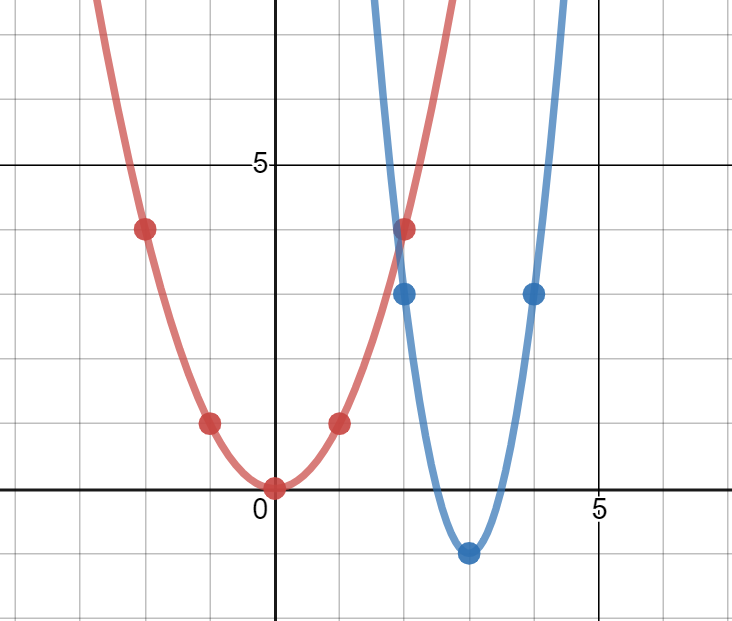
4)

Examples

1) Use the graph of to carefully graph . List the transformations you applied.



2) Determine the types of transformations that were applied to the function to get the function . Then write the equation for .



3) Write the equation of the graph below.

