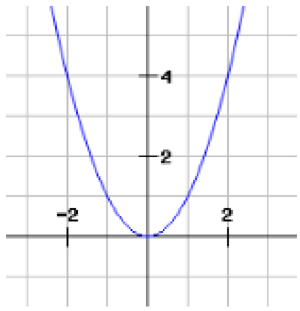
Transformations

1. Transformations "alter" graphs. Several types of transformations are possible, including:

$$y = f(x) + b \qquad y = f(x+b) \qquad y = af(x) \qquad y = f(ax)$$

$$y = -f(x) \qquad y = f(-x) \qquad y = f(x+b) + c$$

a) Functions can undergo **vertical** shifts, called ___________________________. A vertical shift can be represented in a general way by $y =$ _____________ from the list above. These are easy to describe with ______________, specifically as $\begin{pmatrix} 0 \\ b \end{pmatrix}$.

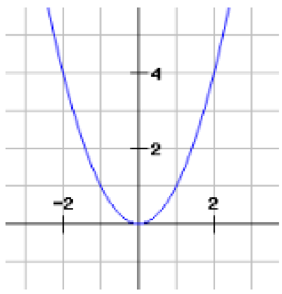


This is a graph of $y = x^2$.

Sketch the graph of $y = x^2 + \mathbf{3}$ on the same axes.

This example would be a ______________ by $\begin{pmatrix} 0 \\ \ \end{pmatrix}$.

b) Functions can undergo **horizontal** shifts as well, also called ____________________. A horizontal shift can be represented in a general way by $y =$ _____________ from the list above.



This is a graph of $y = x^2$

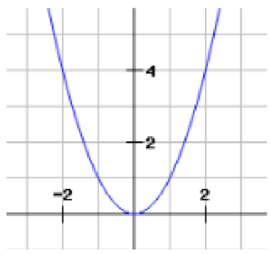
Sketch the graph of $y = (x-2)^2$ on the same axes, after completing the table:

X	-2	-1	0	1	2
y	16	9			

Again, these transformations are easy to describe with ______________, such as $\begin{pmatrix} -b \\ \_\_ \end{pmatrix}$. The only important detail is to switch the _______ of the value on "b" as you learned from the table above.

For this example, the transformation would be described as a______________ by $\begin{pmatrix} \ \\ 0 \end{pmatrix}$.

c) Functions can undergo **horizontal** and **vertical** shifts at the same time. In a general way, this can be represented by $y =$ __________ from the list above. This would represent a _____________ by $\begin{pmatrix} \ \\ \ \end{pmatrix}$.



This is a graph of $y = x^2$. Sketch the graph of $y = (x+2)^2 + 1$ on the same axes. Use this table if you need to.

x	-2	-1	0	1	2
y					

For this example, the transformation would be described as a______________ by $\begin{pmatrix} \ \\ 0 \end{pmatrix}$.

Recall: This is a certain form of the quadratic equation. Name it.

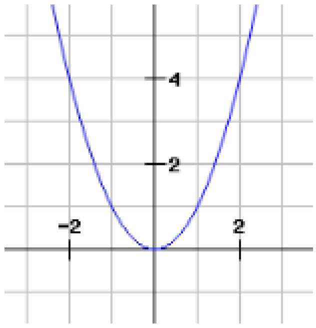
d) Functions can also be stretched. A vertical stretch increases the y-coordinates by some scale factor.

The general function $y =$ __________ from the list above would represent a vertical stretch of the function, scale factor a.

This is a graph of $y = x^2$.

Sketch the graph of $y = 2x^2$ on the same axes, after completing the table if you need it.

x	-2	-1	0	1	2
y	8				

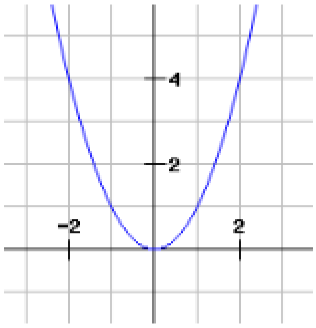


e) A horizontal stretch can be represented by the function $y =$ ___________.

This is a graph of $y = x^2$.

Sketch the graph of $y = (2x)^2$ on the same axes, after completing the table if you need it. Solve for x instead of y:

x	-1	-.5		
y	4	1	0	1



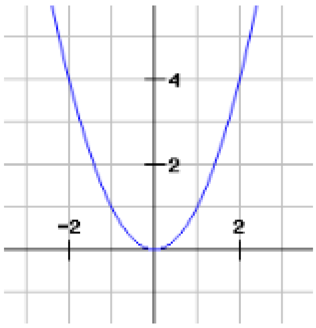
As you can see, this amounts to leaving the y-coordinates alone and ____________ the x coordinates by ____. Like for the shifts, the $x - axis$ transformations have the opposite effect than the one you might expect. This function is equivalent to y=__________ due to the rules of indices.

f) There are also reflections, for example y= _______________ is a reflection in the ____ - axis, because one has effectively negated the ___ co-ordinate.

This is a graph of $y = x^2$.

Sketch the graph of $y = -x^2$ on the same axes after completing the table if you need it.

x	-2	-1	0	1	2
y					



g) The last type of reflection, y= __________, which is a reflection in the ___- axis, can not be shown using a quadratic function. Why?