4 ways to transform a graph or function

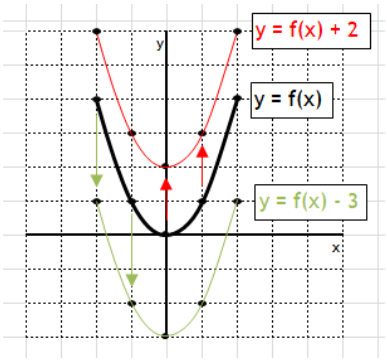
Adding a value either before or after the function is evaluated

Multiplying by a value either before or after the function is evaluated

1. f(x) + a (Adding 'a' after the function is evaluated)

a. f(x) + 2 This will evaluate the function then translate it 2 squares upwards.
(0 , 0) would become (0 , 2)
(1 , 1) would become (1 , 3)

b. f(x) - 3 This will evaluate the function then translate it 3 squares downwards.
(-1, 1) would become (-1 , -2)
(-2 , 4) would become (-2 , 1)

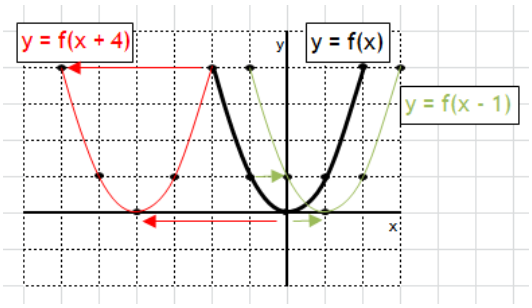


Conclusion
Adding 'a' after the function is evaluated will be a vertical translation of 'a' units

2. f(x + a) (Adding 'a' before the function is evaluated)

a. f(x + 4) This will add 4 before the function is evaluated. The effect will be to translate the graph 4 squares left.
(0 , 0) would become (-4 , 0)
(-2 , 4) would become (-6 , 4)

b. f(x - 1) This will subract 1 before the function is evaluated. The effect will be to translate the graph 1 square right.
(0 , 0) would become (1 , 0)
(-1 , 1) would become (0 , 1)



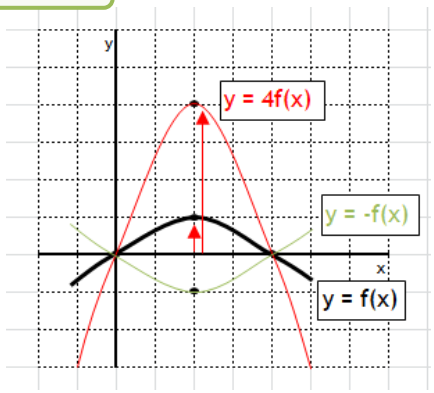
Conclusion
Adding 'a' before the function is evaluated will be a horizontal translation of '-a' units

The horizontal translation is in the opposite direction to that you may expect

3. af(x) (Multiplying by 'a' after the function is evaluated)

a. 4f(x) This will evaluate the function then multiply the answer by 4.
The effect will be to stretch the graph vertically.
(0 , 0) would remain (0 , 0)
(2 , 1) would become (2 , 4)

Scale factor 4



b. -f(x) This will evaluate the function then multiply the answer by -1. The effect will be to change the sign.
It will reflect the graph in the x axis.
(0 , 0) would remain (0 , 0)
(0 , 1) would become (0 , -1)

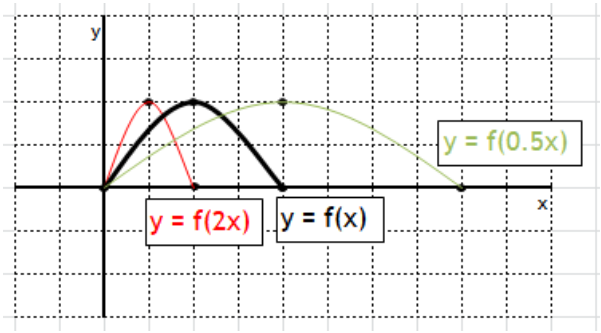
Scale factor -1

Conclusion
Multiplying by 'a' after the function is evaluated will be a vertical stretch with scale factor 'a'

4. f(ax) (Multiplying by 'a' before the function is evaluated)

a. f(2x) This will multiply the value of x by 2 then evaluate the function. The effect is to half the width of the graph.
(0 , 0) would remain (0 , 0)
(4 , 0) would become (2 , 0)
(2 , 2) would become (1 , 2)

The inverse of x 2 is x 0.5 (or ÷ 2)



b. f(0.5x) This will multiply the value of x by 0.5 then evaluate the function. The effect is to double the width of the graph.
(0 , 0) would remain (0 , 0)
(4 , 0) would become (8 , 0)
(2 , 2) would become (4 , 2)

The inverse of x 0.5 is x 2

Conclusion
Multiplying by 'a' before the function is evaluated will be a horizontal stretch with scale factor 1/'a'