

Function Transformations

10th Grade

How a, h and k move any parent graph, with the inside/outside rule.

THE GENERAL FORM

$$g(x) = a \cdot f(b(x - h)) + k$$

Outside the bracket affects y and does what it says. Inside affects x and does the opposite.

k > 0 **shift UP k units** outside — vertical

k < 0 **shift DOWN |k| units** outside — vertical

h > 0 **shift RIGHT h units** inside — horizontal, reversed

h < 0 **shift LEFT |h| units** inside — horizontal, reversed

|a| > 1 **vertical STRETCH** taller and thinner

0 < |a| < 1 **vertical SHRINK** shorter and wider

a < 0 **reflect over the x-axis** flips upside down

b < 0 **reflect over the y-axis** flips left-right

WORKED — $f(x) = x^2$

$$g(x) = -2(x - 3)^2 + 5$$

Reflected over the x-axis, stretched by 2, right 3, up 5. Vertex at (3, 5), opening down.

Read the transformations in that order and the graph draws itself.