

Anatomy of a Transformation, applied to $f(x) = x^2$

vertical stretch (if >1) or vertical Shrink (if <1)
 Multiply y by this number.

Horizontal shrink (if >1) or stretch (if <1)
 Divide x by this number.

y Shift. Positive value shifts up; negative down.
 Add this number to y .

Negative sign in front reflects around x-axis.
 Reverse the sign of y .

Negative inside the parent reflects around y-axis.
 Reverse the sign of x .

x Shift. Negative values shift right; positive left. (Go figure.)
 Subtract this number from x .

$$f(x) = -2(-3(x - 4))^2 + 6$$

Notes

- ▶ You should apply these transformations left-to-right:
- ▶ Note that the transformations that apply to x are generally the reverse of what intuition would tell you:
 - ▶ The number inside the parent function is an *x divisor*, instead of multiplier; the “3” in the above example will make the graph $\frac{1}{3}$ as wide as normal.
 - ▶ The x offset is to the left when positive, to the right when negative.