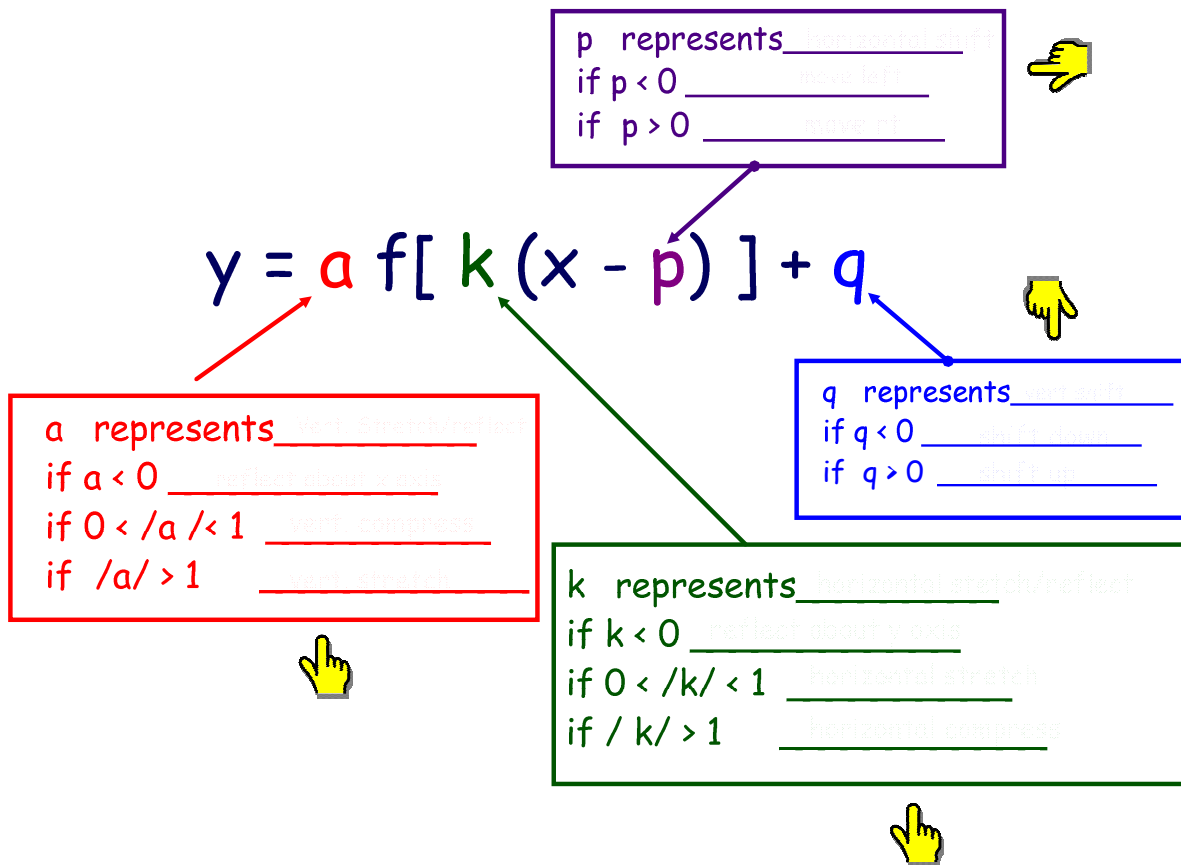


3.7 Combining Transformations

3.7 Combining Transformations

Summarize the transformations we have studied so far:

If $y = f(x)$, then describe the effect of a , k , p and q .



Order of Transformations

1st (multiplying operations)

- Stretching
- Reflecting

2nd (adding/subtracting operations)

- Translations (left/right; up/down)

Stretch Before you move
(or you'll hurt something :)

Ex. 1 Describe the transformations compared to $y = f(x)$.

function	1 st transformations	2 nd transformations
$y = -2f(x-3) + 1$	-Vert. stretch 2 -Vert. Refl (x-axis)	-Shift right 3 -Shift up 1
$y = f(3(x+2)) - 5$	-Horz. comp. of 3	-Shift down 5 -Shift left 2
$y = f(\frac{1}{2}(x+5)) + 7$	-Horz. stretch of 2	-Shift up 7 -Shift left 5
$y = -5f(-2(x-4)) - 1$	-Vert. stretch of 5 -Vert. reflection (over x-axis) -Horz. comp. of 2 -Horz. reflection (over y-axis)	-Shift down 1 -Shift right 4

Ex. 2 In some cases you may need to factor to determine the "true" transformation. Identify the transformations on the base function for each.

a) $y = f(3x + 6)$
 $y = f(3(x+2))$

- horz. comp. of 3
- shift left by 2

b) $y = \sqrt{-x + 5}$

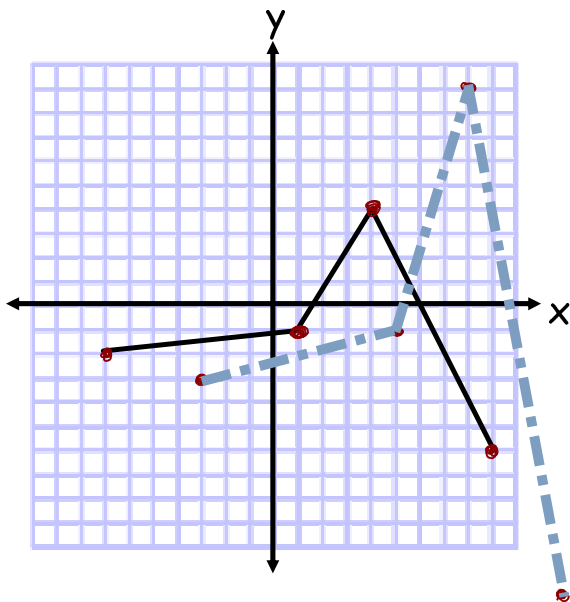
$$y = \sqrt{-(x-5)}$$

- Horz. refl.
- Shift right 5

Ex. 3 Given the graph of $f(x)$, draw the function indicated.

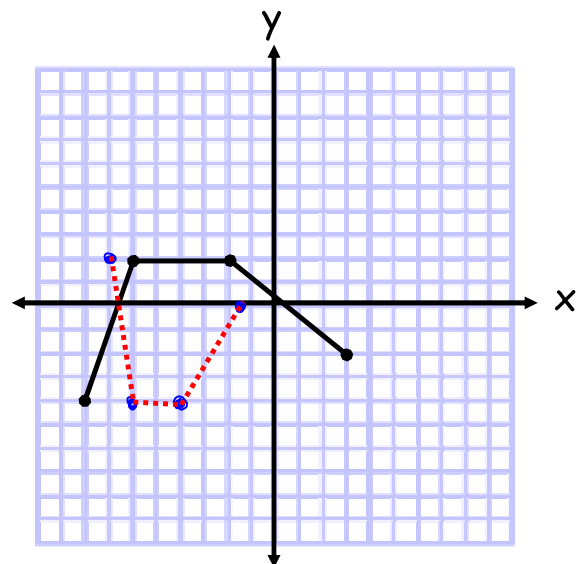
a) $y = 2f(x-4) + 1$

$(x, y) = (x+4, 2y+1)$
 $(-7, -2) \rightarrow (-3, -3)$
 $(1, -1) \rightarrow (5, -1)$
 $(4, 4) \rightarrow (8, 9)$
 $(9, -6) \rightarrow (13, -11)$



b) $y = -f(2x+6) - 2$

$y = -f(2(x+3)) - 2$
 $(x, y) \rightarrow (\frac{x}{2}-3, -y-2)$
 $(-8, -4) \rightarrow (-7, 2)$
 $(-6, 2) \rightarrow (-6, -4)$
 $(-2, 2) \rightarrow (-4, -4)$
 $(3, -2) \rightarrow (-1.5, 0)$



Ex. 4 Create the equation of the function using the given base and transformations.

a) $y = x^2$, reflected in the x-axis, vertical stretch by 3, left 6, down 2.

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

b) $y = \frac{1}{x}$, horizontal stretch by 2, reflection in the y-axis, right 7, up 3.

$$\begin{aligned} f(x) &= \frac{1}{-\frac{1}{2}(x-7)} + 3 \\ &= \frac{-2}{x-7} + 3 \end{aligned}$$

c) $y = \sqrt{x}$, horizontal stretch by $\frac{1}{3}$ (compression by 3), reflection in the x-axis, reflection in the y-axis, left 6, down 2.

$$y = -\sqrt{-3(x+6)} - 2$$

Ex. 5 Given $f(x)$, sketch the transformed function.

a) $f(x) = x^2$, sketch $y = -\frac{1}{2}f(3-x) + 4$

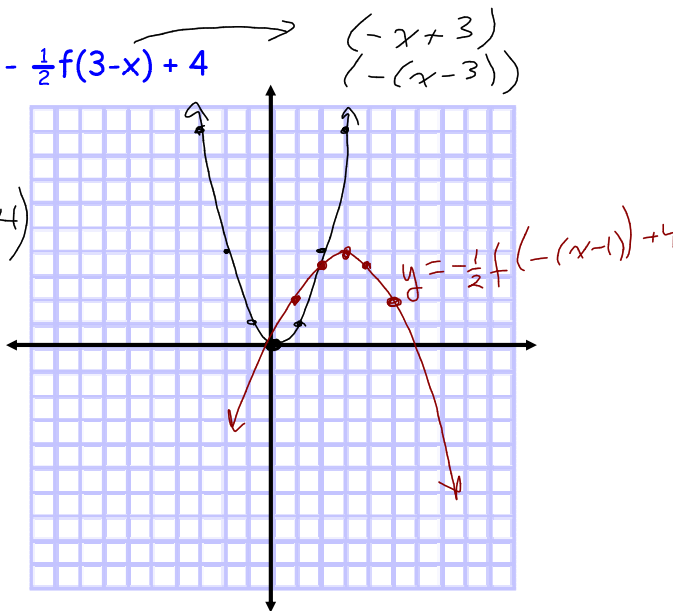
$$y = -\frac{1}{2}f(-(x-3)) + 4$$

$$(x, y) \rightarrow (-x+3, -\frac{y}{2}+4)$$

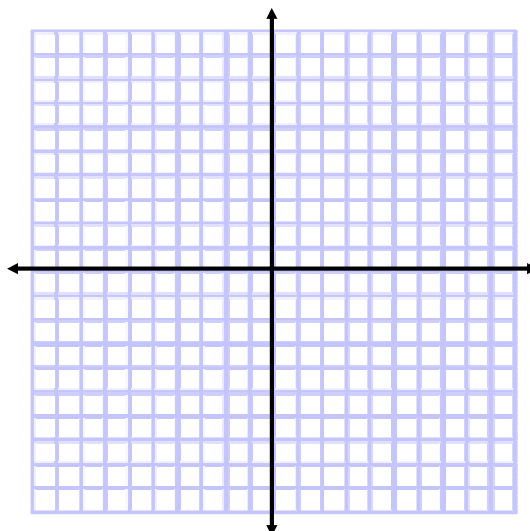
$$(0, 0) \rightarrow (3, 4)$$

$$(1, 1) \rightarrow (2, 3.5)$$

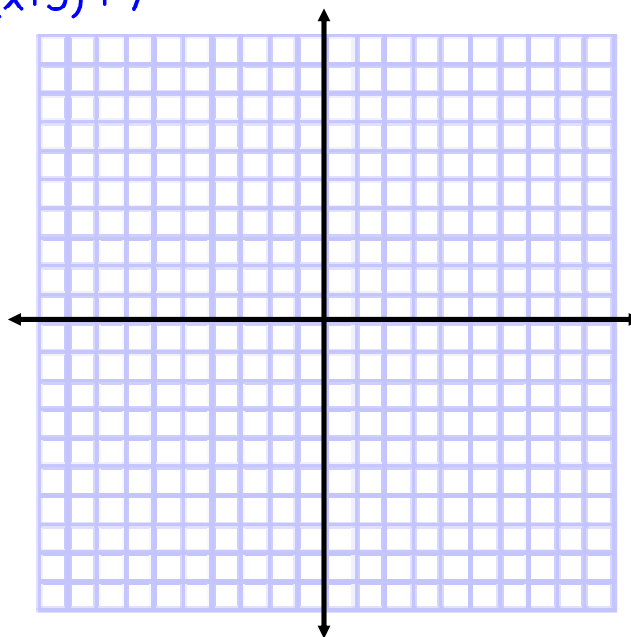
$$(2, 4) \rightarrow (1, 2)$$



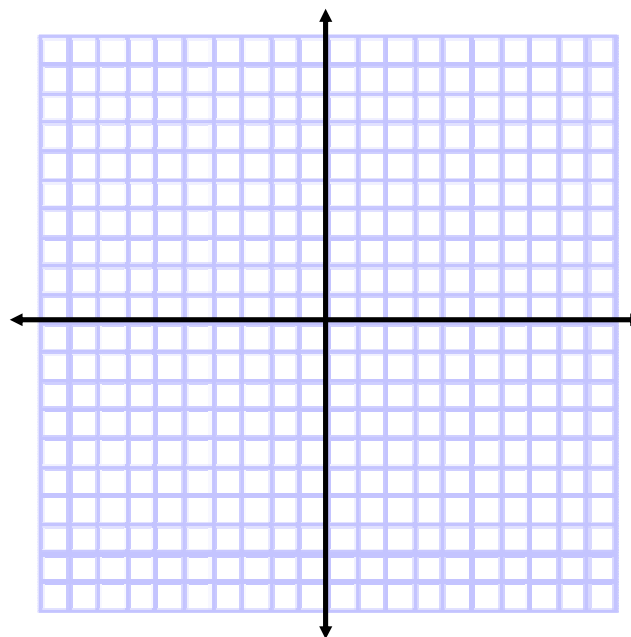
b) $f(x) = \sqrt{x}$, sketch $y = f(-2x + 8) - 5$



c) $f(x) = |x|$, sketch $y = -f(x+5) + 7$



d) $f(x) = \frac{1}{x}$, sketch $y = 2f(-x + 3) - 4$



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