

Transformations:

- helps us to understand the connections between the algebraic equation and its graph
- rigid - same shape and size (translation, reflection, rotation)
- non-rigid - distorts the shape by stretching and shrinking (dilation)

Domain changes

Range changes

Transformation Equation

$$y = \pm \ominus f(\pm \# (x \pm \Delta)) \pm \blacksquare$$

- order matters with combinations of transformations
- when using a table - multi. & divide first, add & subtract second

Domain changes

Range changes

$$y = \pm \Theta f(\pm \#(x \pm \Delta)) \pm \blacksquare$$

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

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\pm if (-) reflection over x-axis (range Δ)

Θ vertical expansion or compression (range Δ)

$\Theta > 1$ expansion

$\Theta < 1$ compression

\pm if (-) reflection over y-axis (domain Δ)

$\#$ horizontal expansion or compression (domain Δ)

$0 < \# < 1$ expansion

$\# > 1$ compression

Δ translation left or right (domain Δ)

(+) left (-) right

\blacksquare translation up or down (range Δ)

(+) up (-) down

x's lie

Information to remember about
transformations....

x's lie

any change to the domain (x's) is opposite of what
appears in the equation

- translations

$$y = \sqrt{x} + 5$$

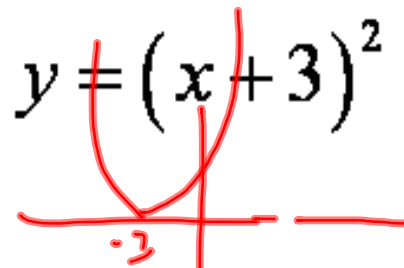
up 5

$$y = \frac{1}{x-4}$$

right 4

$$y = \frac{1}{x} + 3$$

up 3

$$y = (x+3)^2$$


$$y = \sqrt{x+7}$$

left 7

$$y = x^2 - 2$$

down 2

- reflections

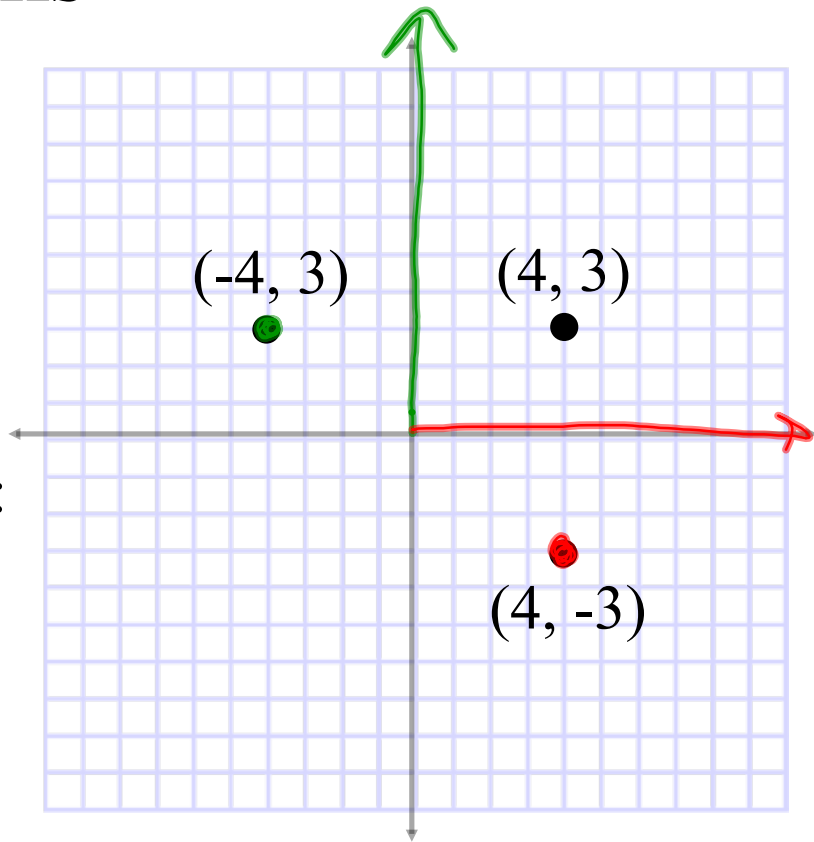
across the y-axis:
 $y = f(-x)$

$(-4, 3)$

$(4, 3)$

across the x-axis:
 $y = -f(x)$

$(4, -3)$



$$y = \sqrt{-x}$$

✓

$$y = -|x|$$

✗

$$y = -\frac{1}{x}$$

✗

$$y = (-x)^3$$

✓

$$y = 2^{-x}$$

✓

$$y = \frac{1}{x} \log_2 x$$

- dilations

- vertically

$$y = \# f(x)$$

- horizontally

$$y = f(\# x)$$

$$y = \frac{1}{2}(x)^3$$

V, shrink $\frac{1}{2}$

$$y = 2^x$$

$$y = 2^{3x}$$

H, shrink, $\frac{1}{3}$

$$y = \frac{3}{x}$$

vert. stretch 3

$$y = \sqrt{2x}$$

H, shrink, $\frac{1}{2}$

$$y = \left| \frac{x}{4} \right|$$

H, grow, 4

$$y = 3 \log_2 x$$

V stretch 3

Describe the transformations:

$$1. y = \frac{-\sqrt{x-4}}{3}$$

reflects: x-axis
 vertical shrink: $\frac{1}{3}$
 shift Right 4

$$2. y = \frac{1}{x-4} + 5$$

shifts up 5
 Right 4

$$3. y = 2 \bullet 2^{x+3}$$

vert. 2 stretch
 h shift -3

$$y = x^2$$

$$4. y = (5-x)^2$$

$$y = (-x+5)^2$$

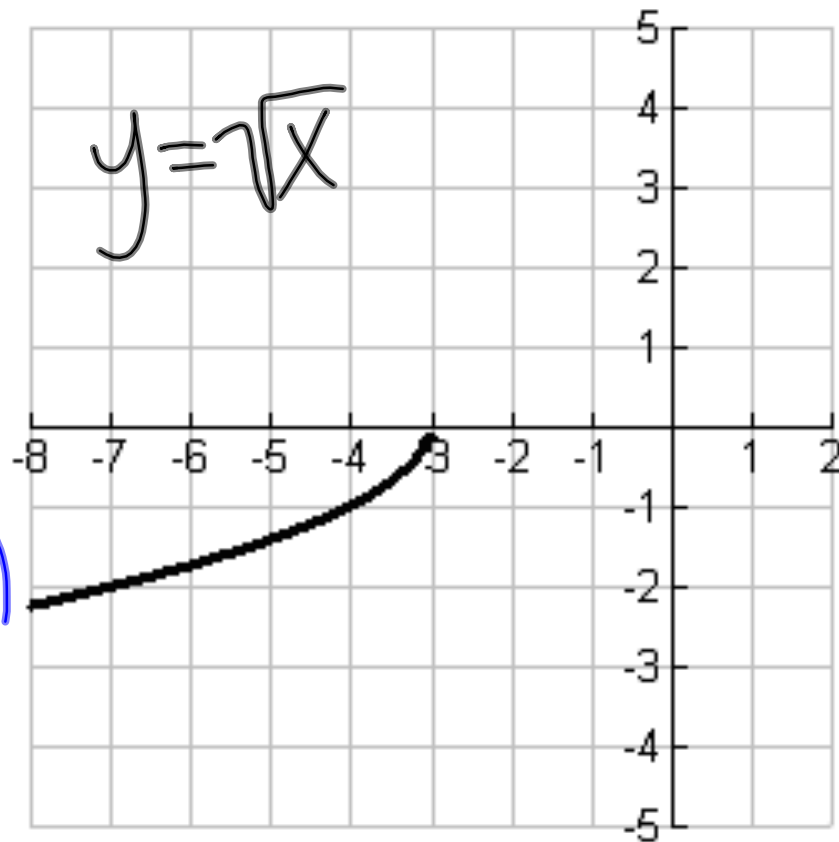
$$y = (-(x-5))^2$$

right 5
 reflect over
 y-axis

Write an equation to represent the transformed function:

Shift Left 3
reflect x
reflect y

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



Write an equation to represent the transformed function:

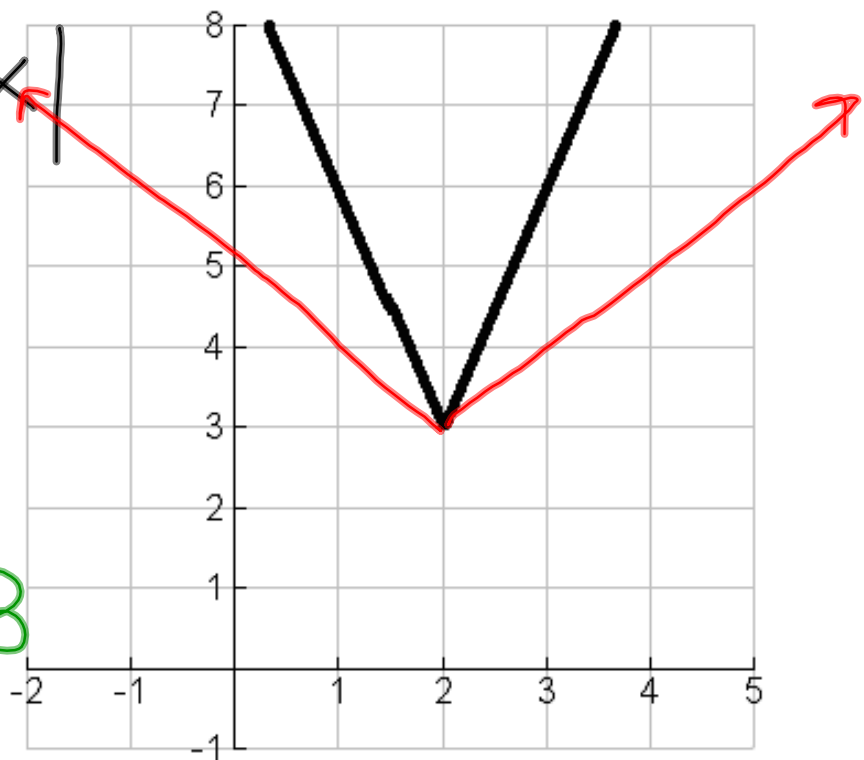
$$y = |x|$$

Right 2

up 3

shrink $\frac{1}{3}$

$$y = |3(x-2)| + 3$$



Find the equation of the reflection over the x-axis:

$$y = 3|x - 7| + 4$$

