

1.2 Transform Linear Abs Value with work

1.2 Transformations of Linear & Absolute Value Functions

Parent Functions

(stop video at 2:10)

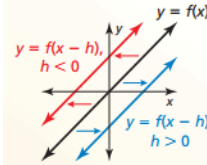
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Translations:

Slide or shifting a parent function left (inside +), right(inside -), up(outside +), or down(outside -).

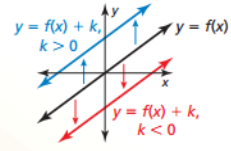
Horizontal Translations

The graph of $y = f(x - h)$ is a horizontal translation of the graph of $y = f(x)$, where $h \neq 0$.



Vertical Translations

The graph of $y = f(x) + k$ is a vertical translation of the graph of $y = f(x)$, where $k \neq 0$.



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Practice:

Translate the following parent functions.

1. $f(x) = x$; up 2 $k=2$ $f(x)+2$ 2. $f(x) = x$; left 3 $h=-3$ $f(x-(-3))$

$$g(x) = (x) + 2$$

$$g(x) = (x+3) \quad f(x-(-3))$$

3. $f(x) = |x|$; down 1 $k=-1$ $f(x)-1$ 4. $f(x) = |x|$; right 8 $h=8$ $f(x-h)$

$$g(x) = |x| - 1$$

$$g(x) = |x-8| \quad f(x-h)$$

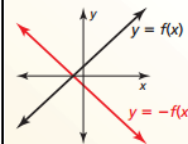
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Reflections:

Flip or mirror image over an axis, point, or object

Reflections in the x-axis

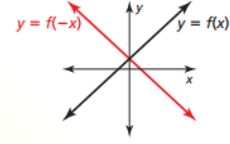
The graph of $y = -f(x)$ is a reflection in the x-axis of the graph of $y = f(x)$.



Multiplying the **outputs** by -1 changes their signs.

Reflections in the y-axis

The graph of $y = f(-x)$ is a reflection in the y-axis of the graph of $y = f(x)$.



Multiplying the **inputs** by -1 changes their signs.

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Practice:

Reflect the following parent functions.

1. $f(x) = x$; over the x-axis

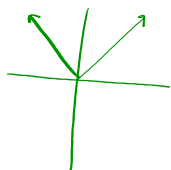
$$g(x) = -(x)$$

2. $f(x) = |x|$; over the x-axis

$$g(x) = -|x|$$

3. $f(x) = |x|$; over the y-axis

$$g(x) = |-x|$$



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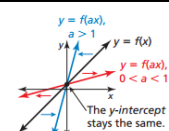
Stretch/Compress:

to squeeze or pull a function up/down or left right (fun house mirror)

Horizontal Stretches and Shrinks

The graph of $y = f(ax)$ is a horizontal stretch or shrink by a factor of $\frac{1}{a}$ of the graph of $y = f(x)$, where $a > 0$ and $a \neq 1$.

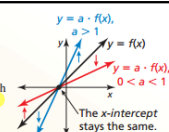
Multiplying the **inputs** by a before evaluating the function **stretches** the graph horizontally (away from the y-axis) when $0 < a < 1$, and **shrinks** the graph horizontally (toward the y-axis) when $a > 1$.



Vertical Stretches and Shrinks

The graph of $y = a \cdot f(x)$ is a vertical stretch or shrink by a factor of a of the graph of $y = f(x)$, where $a > 0$ and $a \neq 1$.

Multiplying the **outputs** by a stretches the graph vertically (away from the x-axis) when $a > 1$, and shrinks the graph vertically (toward the x-axis) when $0 < a < 1$. The x-intercept stays the same.



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1.2 Transform Linear Abs Value with work

Practice:

Stretch or Compress the parent function given.

- $f(x) = |x|$; Horizontal by a factor of 2 $a=2$
 $g(x) = \frac{1}{2}|x|$; HS $|\frac{1}{a}x|$
- $f(x) = |x|$; Vertical by a factor of 3 $a=3$
 $g(x) = 3|x|$; VS $a f(x)$
- $f(x) = |x|$; Vertical by a factor of $\frac{2}{3}$ $a=\frac{2}{3}$
 $g(x) = \frac{2}{3}|x|$; VC $a f(x)$

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Practice: **Combining Transformations** $(\frac{1}{a}x)$

- Let the graph of $h(x)$ be a horizontal stretch by a factor of 8 followed by a translation 10 units down of the graph of $f(x) = x$. $f(\frac{1}{8}x) - 10$

$$h(x) = (\frac{1}{8}x) - 10$$

- Let the graph of $g(x)$ be a reflection over the x -axis followed by a translation 5 units left of the graph of $f(x) = |x|$.

$$g(x) = -|x+5|$$

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Function Families & Transformation Rules

Use the \pm signs to determine the direction of the transformation in all the function families by comparing your parent function and new function in the calculator.

CONSTANT	$f(x) = 1$			
	$f(x) = 5$	$f(x) = -6$	$f(x) = 2$	$f(x) = \frac{1}{2}$
	$f(x) = x$	$f(x) = x - 6$	$f(x) = 2x$	$f(x) = \frac{1}{2}x$
LINEAR	$f(x) = x + 5$	$f(x) = x - 6$	$f(x) = 2x$	$f(x) = \frac{1}{2}x$
	$f(x) = -x$	$f(x) = x $	$f(x) = x - 3 $	$f(x) = x + 4 $
ABSOLUTE VALUE	$f(x) = x + 5$	$f(x) = x - 6$	$f(x) = x - 3 $	$f(x) = x + 4 $
	$f(x) = 2 x $	$f(x) = \frac{1}{2} x $	$f(x) = \frac{1}{2} x $	$f(x) = - x $
QUADRATIC	$f(x) = x^2$	$f(x) = x^2 + 5$	$f(x) = x^2 - 6$	$f(x) = (x - 3)^2$
	$f(x) = x^2 + 5$	$f(x) = x^2 - 6$	$f(x) = (x - 3)^2$	$f(x) = (x + 4)^2$
	$f(x) = 2x^2$	$f(x) = \frac{1}{2}x^2$	$f(x) = -x^2$	

Handwritten notes: $\uparrow 5u$, $\downarrow 6u$, $\rightarrow 3u$, $\leftarrow 4u$, VS , VC , 2 , $by \frac{1}{2}$, R_y .

Transformation Rules: Write in your own words how to transform each parent function to get the result below.

UP	$f(x) + k$
DOWN	$f(x) - k$
RIGHT	$f(x - h) + h$ (inside $\frac{1}{2}$ opp.)
LEFT	$f(x + h) - (-h)$ (inside $\frac{1}{2}$ opp.)
VERTICAL STRETCH	$a f(x)$ $a > 1$
VERTICAL COMPRESSION	$a f(x)$ $0 < a < 1$
REFLECTION OVER X-AXIS	$-f(x)$ OR R_y $f(-x)$

HW: Worksheets

Extra: pg. 16: 3 - 21 (o), 27 - 33 (o), 46 - 51

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