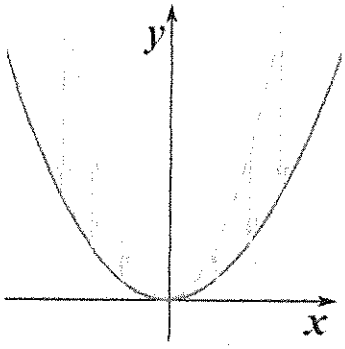
Graphing Quadratic Functions

- A quadratic graph is in a U shape called a parabola
- Quadratic graphs follow the same rules as "Fred"
- Quadratic functions have a vertex that can be found by identifying the horizantal and vertical transformations.
- Quadratic functions that have been transformed are in the form:

VERTEX FORM:
$y = a(x-h)^2 + k$

vertex = (h, k)

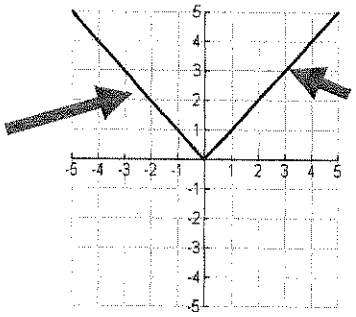
- ❖ F(x) + c — moves the parent graph up c units
- ❖ F(x) - c — moves the parent graph down c units
- ❖ F(x + c) — moves the parent graph left c units
- ❖ F(x – c) — moves the parent graph right c units
- ❖ -(f(x)) — reflects the parent graph vertically (over the x-axis ; $(x, y) \rightarrow (x, -y)$)
- ❖ f(-x) — reflects the parent graph horizantally (over the y-axis ; $(x, y) \rightarrow (-x, y)$)
- ❖ a(f(x)) — vertical stretch or shrink the parent graph



- If $|a| > 1$, then the graph stretches
- If $0 < |a| < 1$, then the graph shrinks

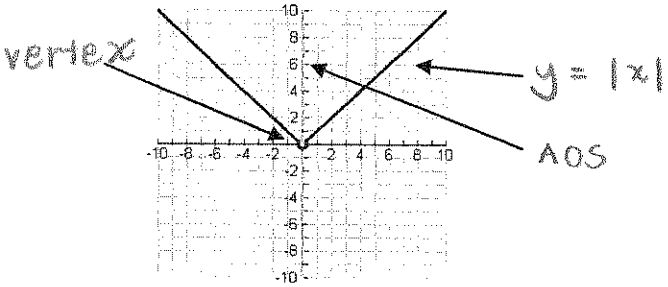
Graphing Absolute Value Functions

- The function f(x) = |x| is an absolute value function
- The graph of this piecewise function consists of 2 rays, is v-shaped, and opens up.



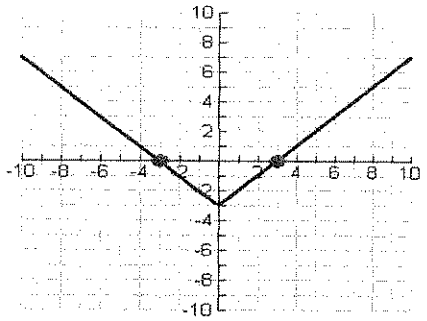
- The highest or lowest point on the graph of an absolute value function is called the vertex.
- An AOS of the graph of a function is a vertical line that divides the graph into mirror images.
  - An absolute value graph has 1 axis of symmetry that passes through the vertex

axis of symmetry



roots
x-ints
solutions

- The zeros of a function f(x) are the values of x that make the value of f(x) zero.
- On this graph where x = -3 and x = 3 are where the function would equal 0.



f(x) = |x| - 3

- A transformation changes a graph's size, shape, position, or orientation.
- A translation is a transformation that shifts a graph horizontally and/or vertically, but does not change its size, shape, or orientation.
- A reflection is when a graph is flipped over a line. A graph flips over the x-axis when -1·f(x) and it flips over the y-axis when f(-1x).
- A dilation changes the size of a graph by stretching or compressing it. This happens when you multiply the function by a number.

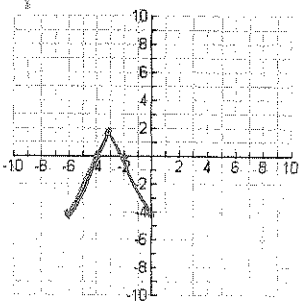
$$y = -a|x - h| + k$$

reflect over x-axis | dilation: vertical stretch/shrink | right | up

Remember that (h, k) is your vertex

- **Example 1**: Identify the transformations:
  1. $y = 3|x + 2| - 3$ vertical stretch by 3, left 2, down 3
  2. $y = |x - 1| + 2$ right 1, up 2
  3. $y = 2|x + 3| - 1$ vertical stretch by 2, left 3
  4. $y = -1/3|x - 2| + 1$ reflect over x-axis, vertical shrink by 1/3, right 2, up 1

- **Example 2:** Graph $y = -2|x + 3| + 2$.
  - What is your vertex? (-3, 2)
  - What are the intercepts? x=0, y=-4 (0, -4)
  - What are the zeros? (-2, 0) & (-4, 0)



* to find a y-intercept, plug in 0 for x

$-2(0+3)+2$

$-2(3)+2$

$-6+2=-4$

* to get the zeros, plug in 0 for y.

$\frac{0}{-2} = \frac{-2|x+3|}{-2} + \frac{2}{-2}$

$\frac{-2}{-2} = \frac{-2|x+3|}{-2}$

$1 = |x+3|$ * create 2 equations

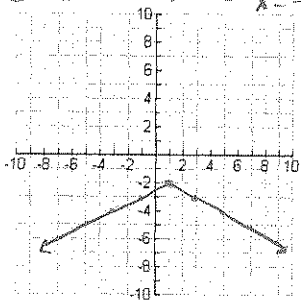
$1 = x+3$ $\quad -1 = x+3$

$-3 \quad -3 \quad -3 \quad -3$

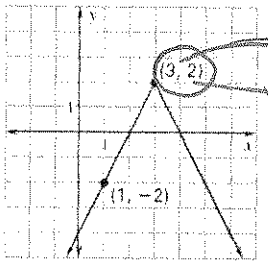
$x = -2 \quad x = -4$

- **You Try:** Graph $y = \frac{-1}{2}|x - 1| - 2$ → (1, -2) = vertex (slope)
  - Compare the graph with the graph of $y = |x|$ (what are the transformations)

check graph: • opens down • is under (from shrink) • right 1 • down 2



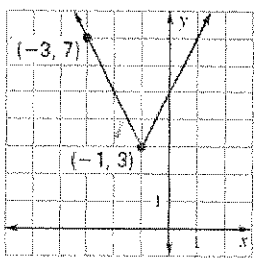
- **Example 3**: Write a function for the graph shown.



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

1. vertex
2. put a negative sign because the graph opens down
3. find slope (-2/1)

- **You Try**: Write a function for the graph shown.



$y = 2|x + 1| + 3$

raphs and Exponential Graphs

*SLOPE = RISE / RUN