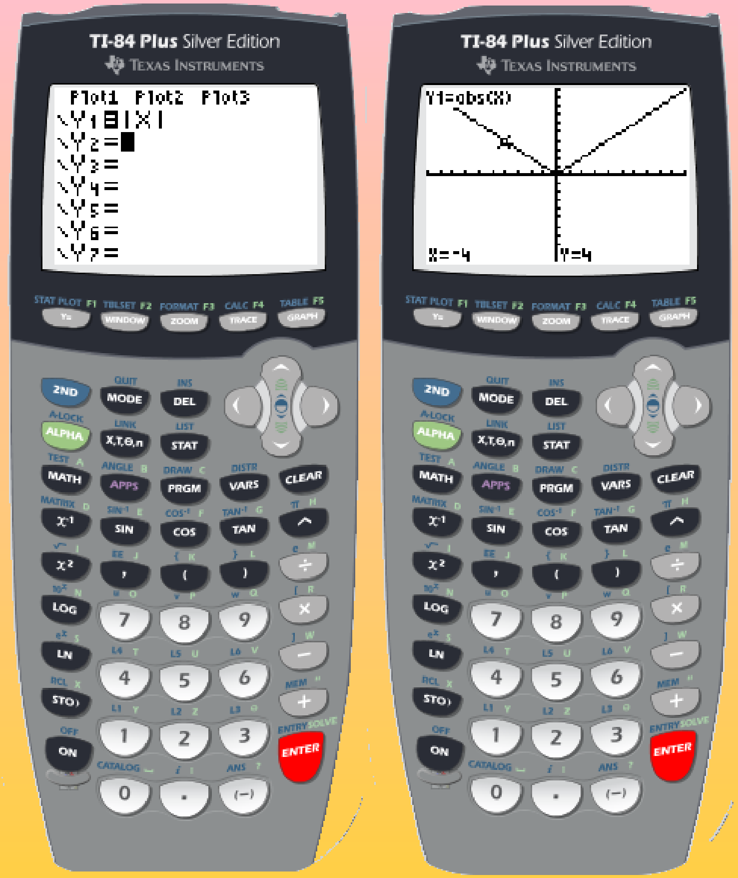


Absolute Value Graphs

$y = |x|$

The parent graph of an absolute value function is

V-shape

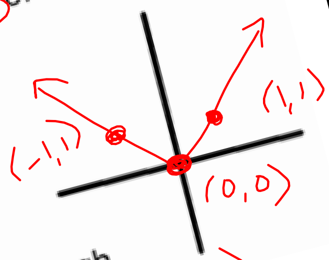
with vertex at

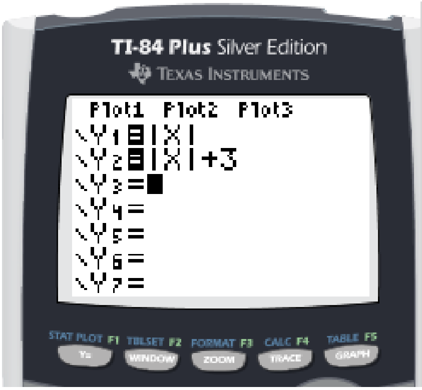
(0,0)

origin

and passes through

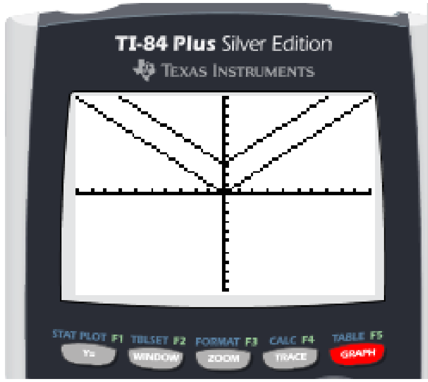
(1,1) and (-1,1)

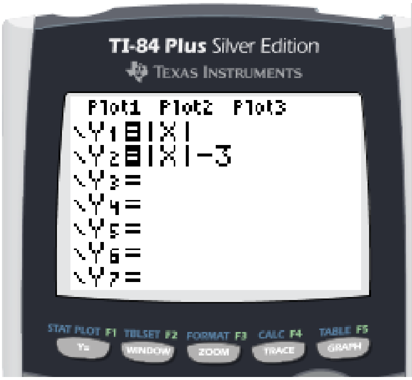




How does **adding** a number to the function change the graph?

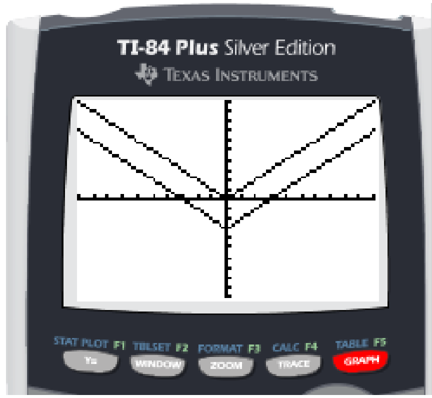
Moves the graph up





How does **subtracting** a number from the function change the graph?

Moves the graph down



Transformations

+k shifts up
-k shifts down
vertical
translation

reflection

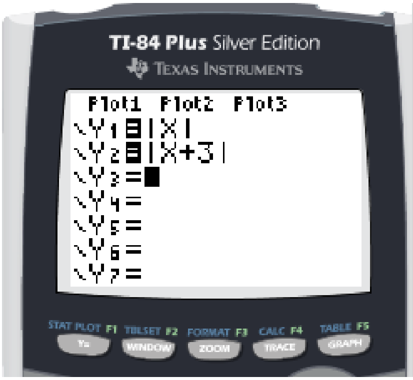
$$y = a|x-h| + k$$

dilation

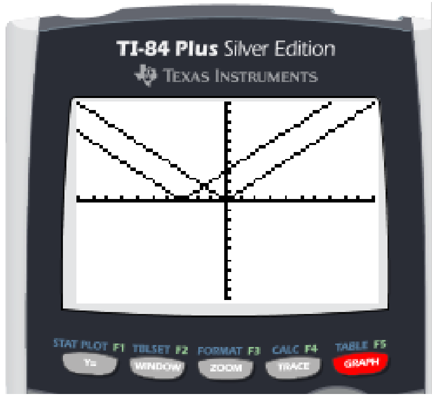
translation

Vertex

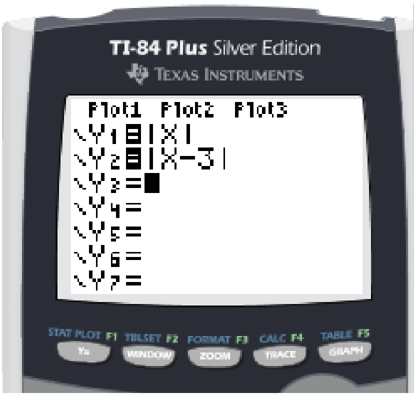
(,)



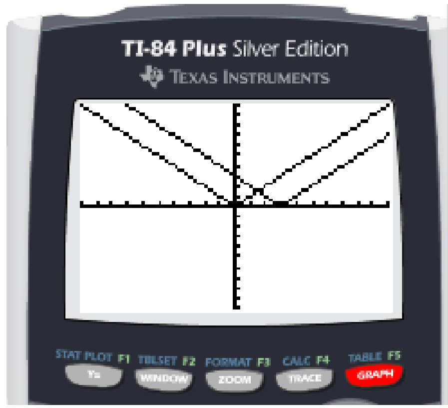
How does **<u>adding</u>** a number to the x inside the function change the graph?



Moves the graph left



How does **<u>subtracting</u>** a number from the x inside the function change the graph?



Moves the graph right

Transformations

+k shifts up
-k shifts down
vertical
translation

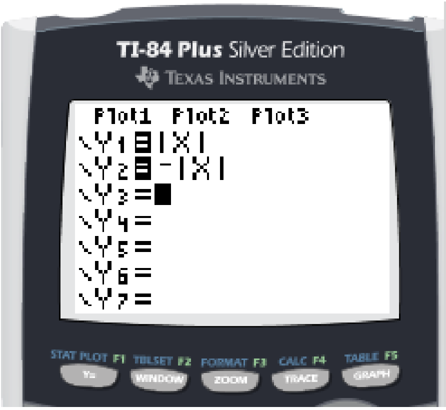
reflection

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

dilation

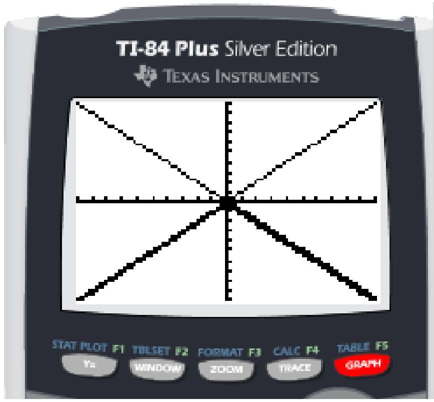
translation
horizontal
|x-h| shifts right   x-(+h)
|x+h| shifts left   x-(-h)

Vertex
(h , k)



How does **multiplying** the function **by a negative** change the graph?

Flips (reflects) upside down over the x-axis



Transformations

a>0 opens up
a<0 opens down
reflection

+k shifts up
-k shifts down
vertical
translation

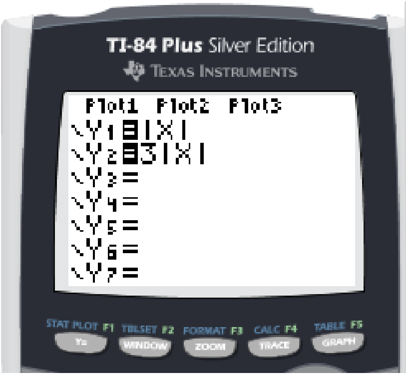
$$y = a\left|x-h\right| + k$$

dilation

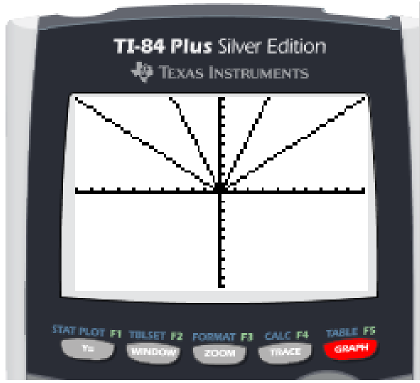
translation
horizontal

|x-h| shifts right x-(+h)
|x+h| shifts left x-(-h)

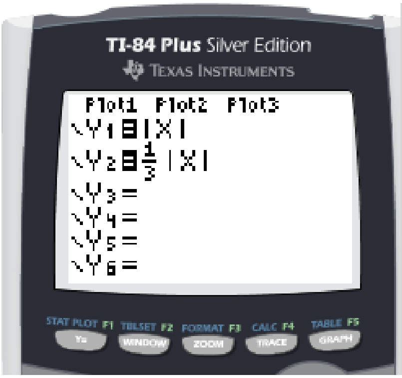
Vertex
(h , k)



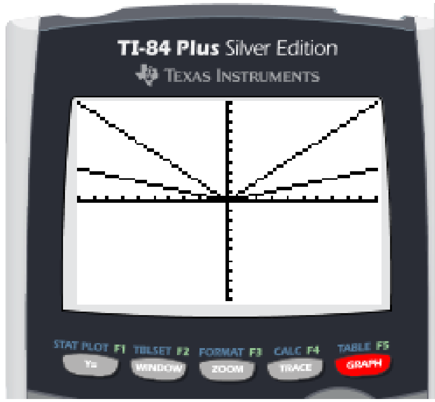
How does **multiplying** the function by a **number greater than 1** change the graph?



Makes the graph narrower



How does **multiplying** the function by a **number between 0 and 1** change the graph?



Makes the graph wider

Transformations

$a>0$ opens up
$a<0$ opens down
reflection

+k shifts up
-k shifts down
vertical
translation

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

|a|>1 narrows
|a|=1 no dilation
|a|<1 widens
±a is the slope from the vertex to the next point
dilation

translation
horizontal

|x-h| shifts right x-(+h)
|x+h| shifts left x-(-h)

Vertex
(h , k)

Example 1 Graph and describe an absolute value function

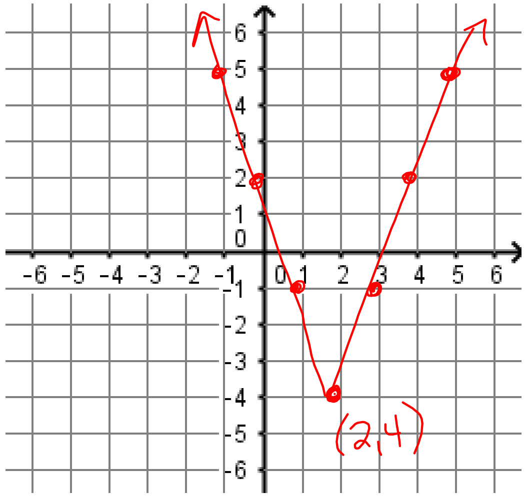
A] $y = 3|x - 2| - 4$ h k

Vertex: $(2, -4)$ (h, k)

Opens: up since $a > 0$

Dilation: 3 (narrows)

Slope from vertex ± 3



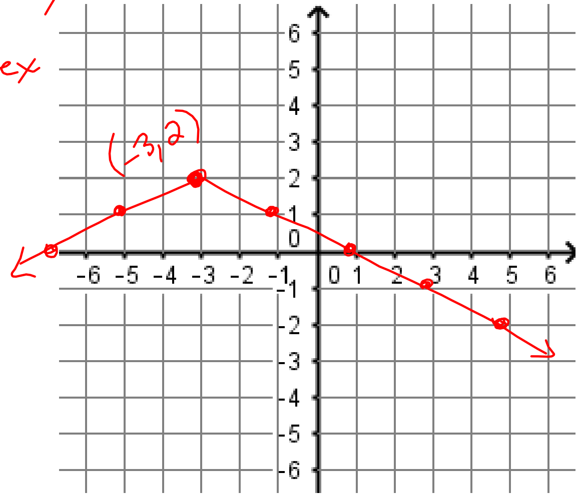
B] $y = -\frac{1}{2}|x + 3| + 2$ $x - (-3)$ h k

Vertex: $(-3, 2)$

Opens: down since $a < 0$

Dilation: $\frac{1}{2}$ (widens)

Slope from vertex $\pm \frac{1}{2}$



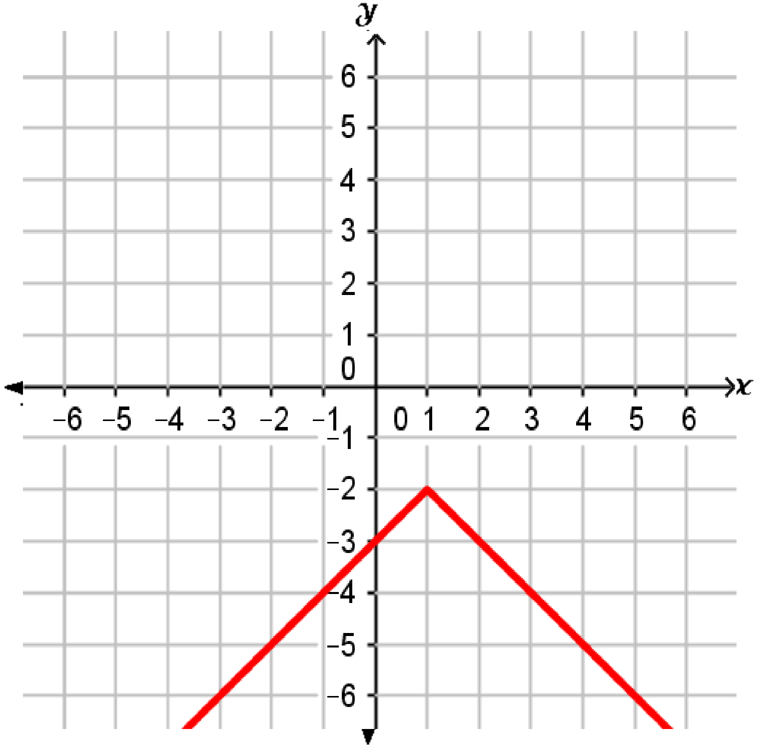
On your whiteboard...

$$y = -|x-1| - 2$$

Vertex: (1, -2)

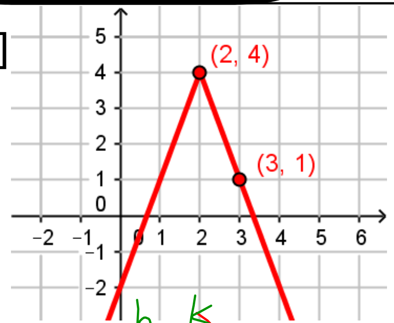
Opens: down

Dilation: none (a = -1)



Example 2 Write an absolute value equation

A]



h k

Vertex: (2, 4)

so h= 2 and k= 4

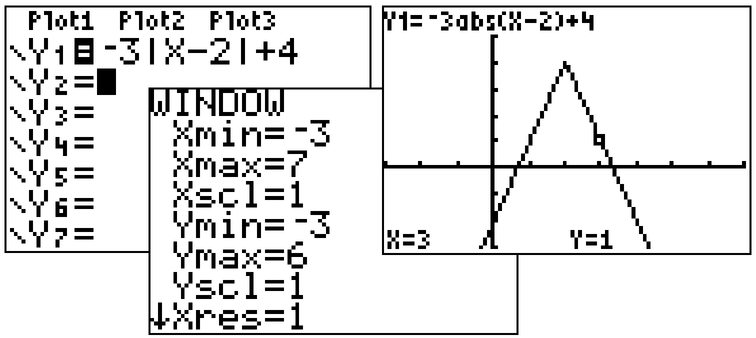
Slope: ±3

Opens down so a= -3

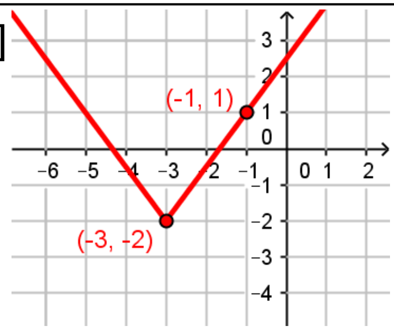
$$\boxed{y = a|x-h|+k}$$

Equation: $y = -3|x-2|+4$

Domain: $\mathbb{R}$ Range: $y \leq 4$



B]



Vertex: (-3, -2)

so h= -3 and k= -2

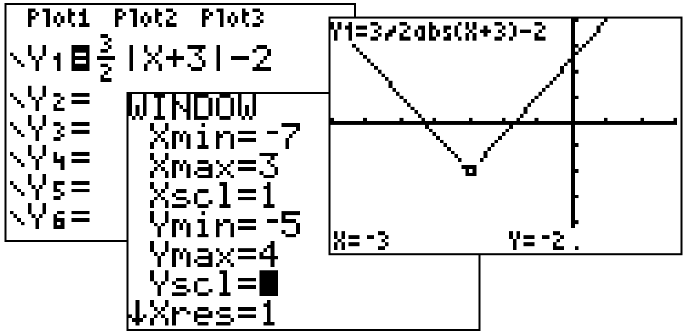
Slope: ± $\frac{3}{2}$

Opens up so a= $\frac{3}{2}$

$$\boxed{y = a|x-h|+k}$$

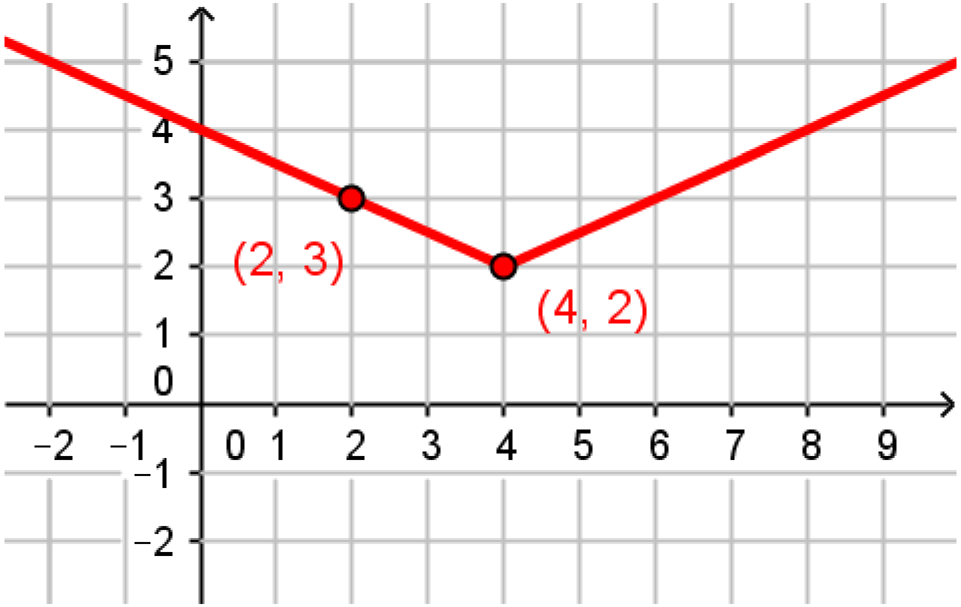
Equation: $y = \frac{3}{2}|x+3|-2$

Domain: $\mathbb{R}$ Range: $y \geq -2$

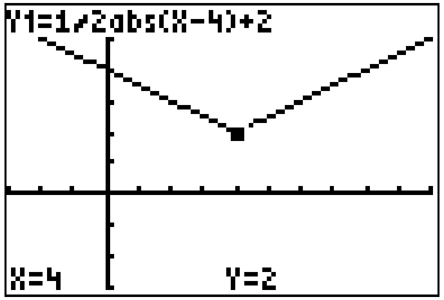


On your whiteboard...

Write an absolute value equation



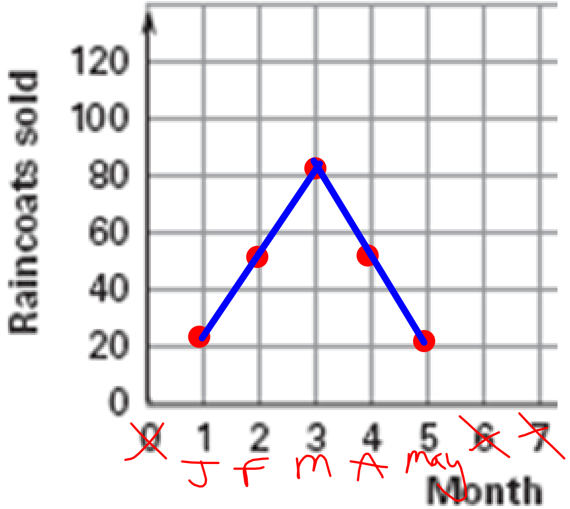
$$y = \frac{1}{2}\left|x - 4\right| + 2$$



Example 3 Applications of Absolute Value

A raincoat retailer has modeled the number of raincoats sold from Jan. through May by the function $R = -30|t-3| + 80$. Assume that t=1 is January.

y of the vertex (3,80)



- What is the **maximum** number of raincoats sold in one month? 80 coats

x of vertex

- In what month is the maximum reached? (3,80) March

- How many raincoats were sold in April? $-30|4-3|+80 = 50$