Your Name

Mrs. Theo

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Notes

Lesson 1.2

Linear Functions and Transformations

Math Skill Objective: To be able to identify the parent function given a function. To be able to describe transformations of functions. To be able to graph linear and view them as transformations

HSF.BF.B.3

Life Lessons: It is great when friends are in sync and together like two close points. Sometimes when friends move on their path, you could move together in the same direction, like a translation, but some times you move apart and the rate of change you see in the differences between you can be great and make you sad.

Function	Parent Function	Graph	Table	Effects of Parameter a	Effects of Parameter h	Effects of Parameter k
Constant	f(x) = k k is a number y = 6 horizontal line		x: -2 -1 0 1 2 y: 6 6 6 6 6	N/A	N/A	y = 3 vertical shift up 3 y = -5 vertical shift down 5
Linear	f(x) = x f(x) = ax + k y = mx + b		y = x x: -2 -1 0 1 2 y: -2 -1 0 1 2	y = 0.5x vertical shrink by ½ (less steep)	N/A	y = x + 6 vertical shift up 6
Absolute Value			x y	y = 0.5|x|	y = |x - 3|	y = |x| - 3
Quadratic			x y	$y = 0.5x^2$	$y = (x - 3)^2$	$y = x^2 - 3$
Square Root			x y	$y = \sqrt{(-1x)}$	$y = \sqrt{(x - .2)}$	$y = \sqrt{(x)} - .2$
Cubic			x y	$y = 3x^3$	$y = (x+3)^3$	$y = x^3 + 3$
Cubic Root			x y	$y = \sqrt[3]{(-1x)}$	$y = \sqrt[3]{(x - .2)}$	$y = \sqrt[3]{(x)} - .2$
Exponential			x y	$y = -1(3)^x$	$y = 3^{x-1}$	$y = 3^x - 1$

Linear Functions

$y = mx + b$ $\quad$ $y = ax + k$

m is slope
multiplied in front of x

b is y-intercept
on y-axis (0, b)
± after x
Note: x = 0

a = m
vertical stretch
pulls points up/down

k = b
vertical shift
takes whole function up or down

Calculate Slope

Slope is:

- The stretch of a linear function
- The rate of change between two points
- slope = m = a = $\frac{\text{rise}}{\text{run}} = \frac{y_1 - y_2}{x_1 - x_2}$

rate of change for a line is constant

$\frac{\text{vertical change}}{\text{horizontal change}}$

ex. (3,2) and (-4, 5)

1st x_1, y_1 2nd x_2, y_2

$m = \frac{(2)-(5)}{(3)-(-4)} = \frac{-3}{7}$

$m = \frac{(5)-(2)}{(-4)-(3)} = \frac{3}{-7}$

same thing

ex. (-2, 4) and (7, 4)

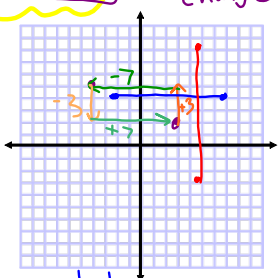
$m = \frac{4-4}{-2-7} = \frac{0}{-9} = 0$

$m = 0$

horizontal line

$y = 4$

$y = 0x + 4$



ex. (5,-3) and (5, 8)

$m = \frac{-3-8}{5-5} = \frac{-11}{0} = \text{error}$

m = undefined slope

vertical line

$x = 5$

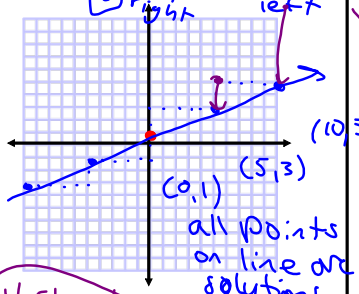
Graphing a Line

1. Make a point at the y-intercept (0,b)
2. From the point move up and over the slope and make a point where you finish
3. Connect the points with a straight line

$y = \frac{2}{5}x + 1$ Transformation

k=b= 1 yint: (0, 1)

a= m= $\frac{2}{5}$ (rise up / run right) $= \frac{-2}{-5}$ (rise down / run left)



all points on line are solutions to $y = \frac{2}{5}x + 1$

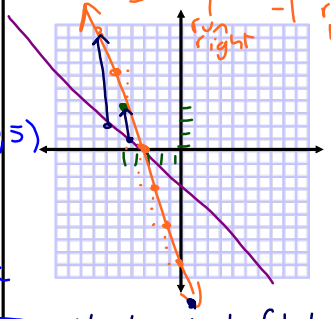
- Vertical shift up 1
- Vertical shrink by $\frac{1}{2}$ (less steep)

1. Make a point at the given coordinate
2. From the point move up and over the slope and make a point where you finish
3. Connect the points with a straight line

(-5, 4) m= -3 Transformation

k=b= -1 yint:

a= m= $-3 = \frac{-3}{1} = \frac{3}{-1}$ (rise down / run right; rise up / run left)



- Vertical shift down 1
- Reflection over X-axis (horizontal reflection)
- Vertical stretch by 3

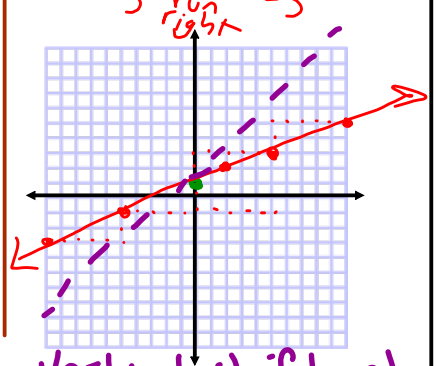
Graphing a Line

1. Make a point at the y-intercept (0,b)
2. From the point move up and over the slope and make a point where you finish
3. Connect the points with a straight line

$y = \frac{2}{5}x + 1$ Transformation

k=b= 1 yint: (0, 1)

a= m= $\frac{2}{5}$ (rise up / run right) $= \frac{-2}{-5} = 0.4$



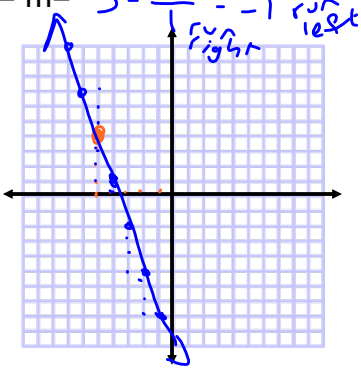
Vertical shift up 1
Vertical shrink

1. Make a point at the given coordinate
2. From the point move up and over the slope and make a point where you finish
3. Connect the points with a straight line

(-5, 4) m= -3 Transformation

k=b= yint:

a= m= $-3 = \frac{-3}{1} = \frac{3}{-1}$ (rise down / run right; rise up / run left)

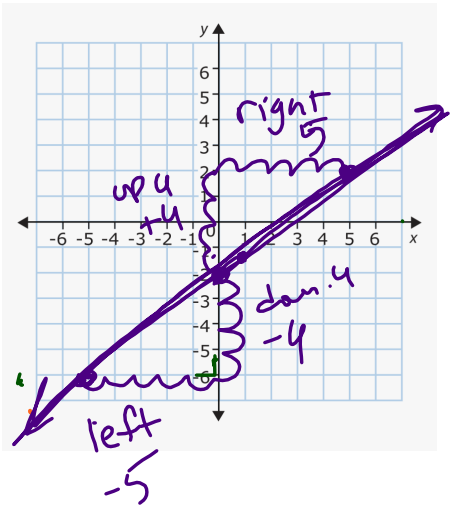


1.2 Day 1 Bell Ringer: Complete here or on paper, take a picture and attach it in the class notebook

Graph: $y = \frac{4}{5}x - 2$

a = $m = \frac{4}{5} = \frac{rise}{run} = \frac{-4}{-5}$ y int = b

k = $b = -2$ $(0, -2)$



Describe Transformation

Vert. Shrink $\frac{4}{5}$

Vert. Shift down 2

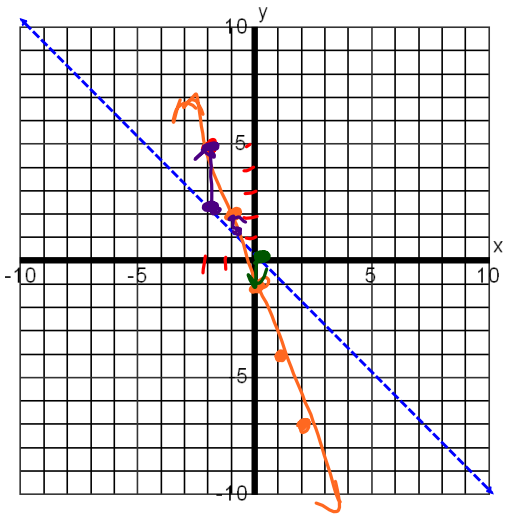
Domain

Range

Make a Table of Values and Graph

1. y = -3x - 1

x	y = -3( ) - 1	(x,y)
-2	$y = -3(-2) - 1 = +6 - 1 = 5$	(-2, 5)
-1	$y = -3(-1) - 1 = 3 - 1 = 2$	(-1, 2)
0	$y = -3(0) - 1 = 0 - 1 = -1$	(0, -1)
1	$y = -3(1) - 1 = -3 - 1 = -4$	(1, -4)
2	$y = -3(2) - 1 = -6 - 1 = -7$	(2, -7)



Describe the Transformations

Vertical Shift down 1 b/c K = -1

Vertical Reflection over x axis b/c a is negative a = -3

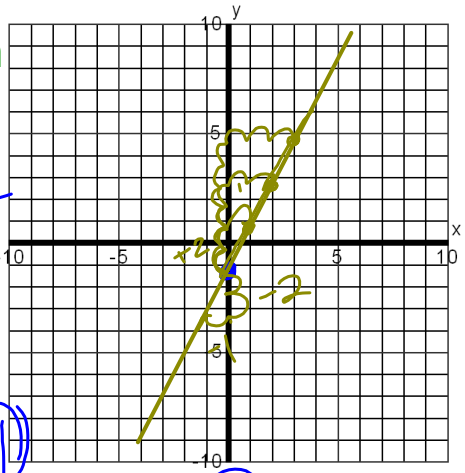
Vertical Stretch by 3 b/c a = -3

Graph the line using b and m

$y = mx + b$

m is slope
multiplied infront of x
$\frac{rise}{run} = \frac{Vertical}{horizontal}$

y-intercept (0, b)
± to x



$y = 2x - 1 \rightarrow y = 2x + (-1)$

b = -1 y-int: (0, -1)

$m = 2 = \frac{2}{1} = \frac{-2}{-1}$

$y = 2 - 3x$

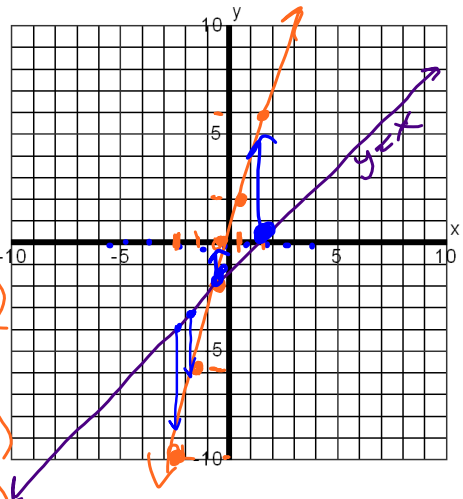
$y = -3x + 2$

$\frac{2}{1} = \frac{4}{2} = \frac{6}{3}$

Make a Table of Values and Graph

$y = 4x - 2$

x	y = 4( )-2	(x,y)
-2	4(-2)-2=-10	(-2,-10)
-1	4(-1)-2=-6	(-1,-6)
0	4(0)-2=-2	(0,-2)
1	4(1)-2=2	(1,2)
2	4(2)-2=6	(2,6)



Describe the Transformation:

Vert. Stretch by 4

m = a = 4

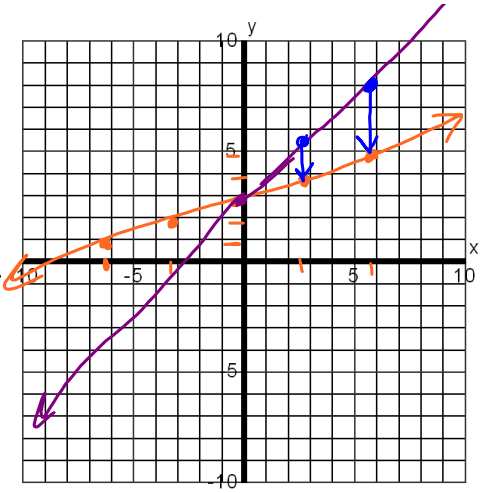
Vert. shift down 2

b = k = -2

Make a Table of Values and Graph

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

x	$y = \frac{1}{3}( ) + 3$	(x,y)
-6	$\frac{1}{3}(-6)+3=1$	(-6,1)
-3	$\frac{1}{3}(-3)+3=2$	(-3,2)
0	$\frac{1}{3}(0)+3=3$	(0,3)
3	$\frac{1}{3}(3)+3=4$	(3,4)
6	$\frac{1}{3}(6)+3=5$	(6,5)



Describe the Transformation:

Vert. shift up 3

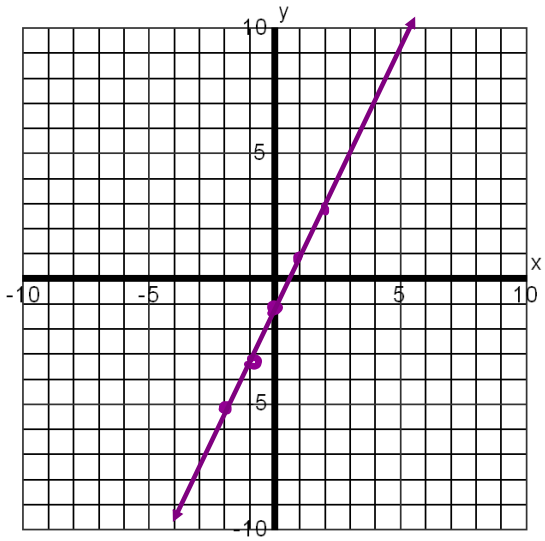
$b = k = 3$

Vert shrink by $\frac{1}{3}$

$m = a = \frac{1}{3}$

1. y = 2x - 1

x	y = 2( ) -1	(x,y)
-2		
-1		
0		
1		
2		



Describe the Transformations

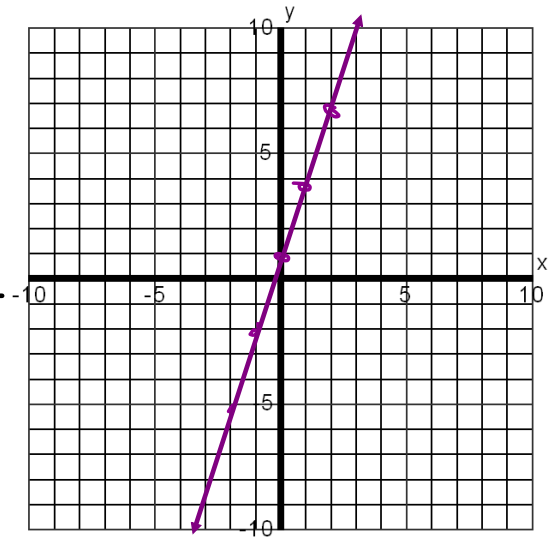
Vertical Stretch by 2

Vertical Shift down 1

Make a Table of Values and Graph

2. y = 3x + 1

x	y = 3( ) +1	(x,y)
-2		
-1		
0		
1		
2		



Describe the Transformations

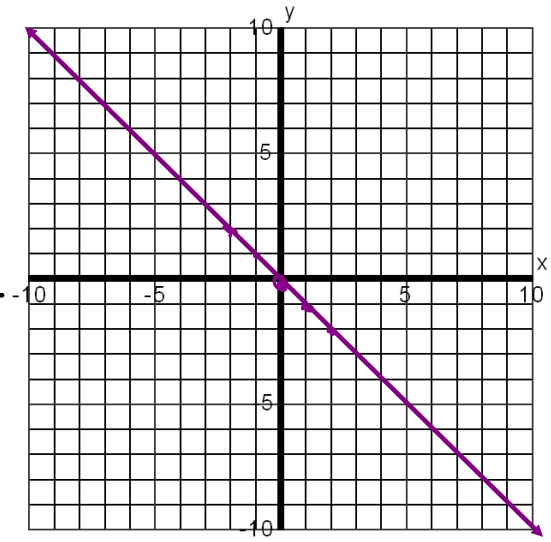
Vertical Stretch by 3

Vertical Shift up 1

Make a Table of Values and Graph

3. y = - x

x	y = -1( )	(x,y)
-2		
-1		
0		
1		
2		



Describe the Transformations

Vertical Reflection over the x axis

Make a Table of Values and Graph

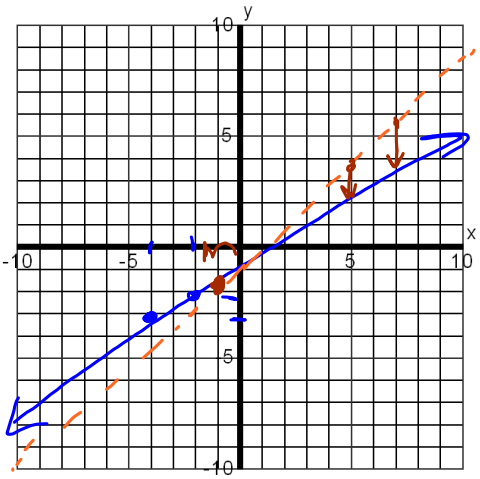
$$y = \frac{1}{2}x - 1$$

x	$y = \frac{1}{2}(\ ) - 1$	(x,y)
-4	$\frac{1}{2}(-4) - 1 = -3$	(-4,-3)
-2	$\frac{1}{2}(-2) - 1 = -2$	(-2,-2)
0		
2		
4		

$\frac{1}{2}\left(\frac{-4}{1}\right) - 1$

$\frac{-4}{2} - 1$

$-2 - 1$



Describe the Transformations

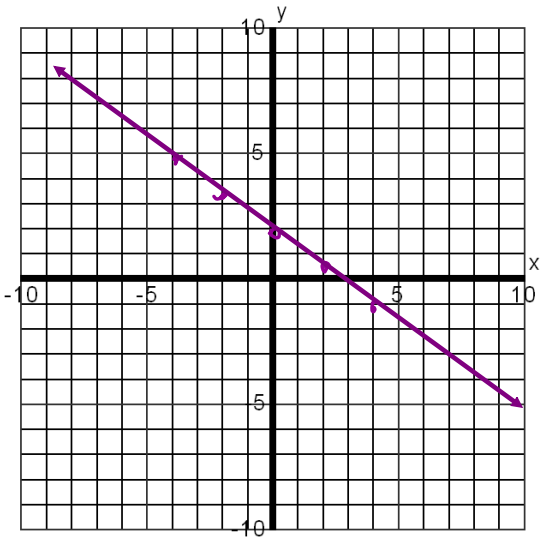
Vertical Shrink by 1/2

Vertical Shift down 1

Make a Table of Values and Graph

$$y = -\frac{3}{4}x + 2$$

x	$y = -\frac{3}{4}(\ ) + 2$	(x,y)
-4		
-2		
0		
2		
4		



Describe the Transformations

Vertical Reflection

Vertical Shrink by 3/4

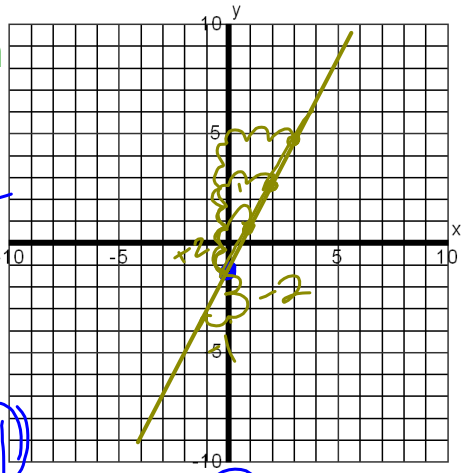
Vertical Shift up 2

Graph the line using b and m

$y = mx + b$

m is slope
multiplied infront of x
rise/run = Vertical/horizontal

y-intercept (0, b)
± to x



$y = 2x - 1 \rightarrow y = 2x + -1$

b = -1 y-int: (0, -1)

$m = 2 = \frac{2}{1} = \frac{-2}{-1}$

$y = 2 - 3x$

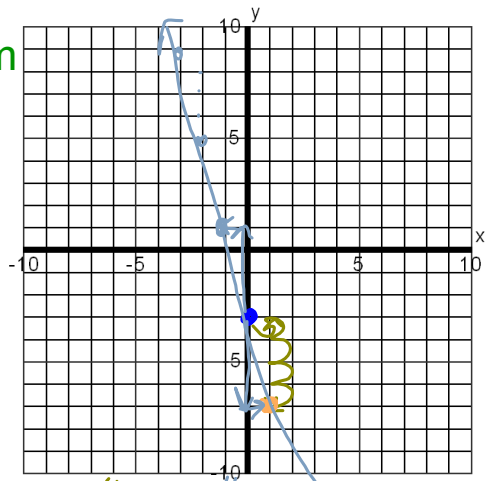
$\rightarrow y = -3x + 2$

$\frac{2}{1} = \frac{4}{2} = \frac{6}{3}$

Graph the line using b and m

$y = -4x - 3$

b = -3 y-int: (0, -3)



$m = -4 = -\frac{4}{1} = \frac{4}{-1} = \frac{-4}{1}$

$= \frac{\text{rise}}{\text{run}} = \frac{\text{up/down}}{\text{left/right}} = \frac{-4}{1} = \frac{4}{-1}$

Describe the Transformations

Vertical Reflection

Vertical Stretch by 4

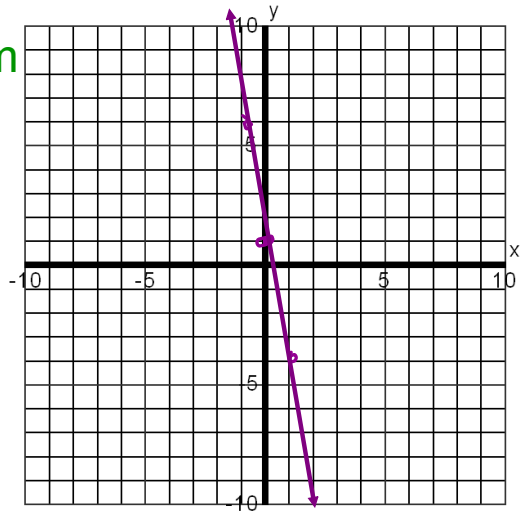
Vertical Shift down 3

Graph the line using b and m

$y = -5x + 1$

b = 1 y-int: (0 , 1)

$m = -\frac{5}{1} = \frac{-5}{1} = \frac{5}{-1}$



Describe the Transformations

Vertical Reflection

Vertical Stretch by 5

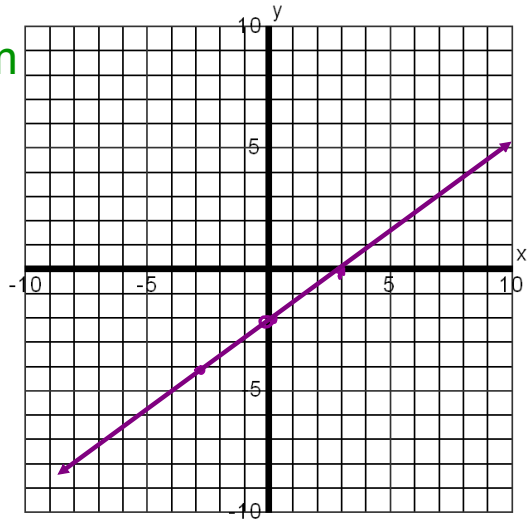
Vertical Shift up 1

Graph the line using b and m

$y = \frac{2}{3}x - 2$

b = -2 y-int: (0,-2)

$m = \frac{2}{3} = \frac{-2}{-3}$



Describe the Transformations

Vertical Shrink by 2/3

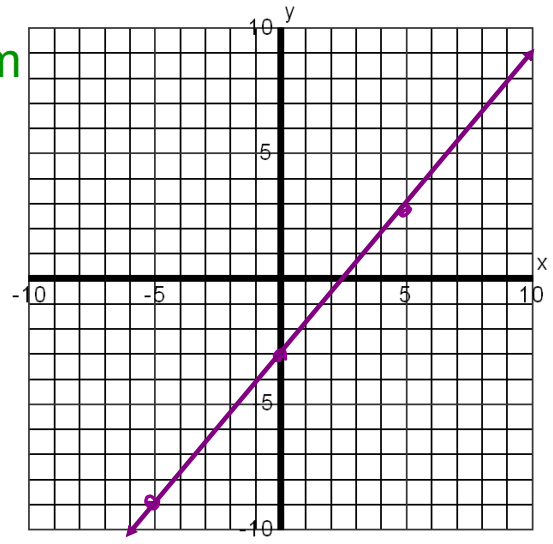
Vertical Shift down 2

Graph the line using b and m

$y = \frac{6}{5}x - 3$

b = -3 y-int: (0, -3)

$m = \frac{6}{5} = \frac{-6}{-5}$



Describe the Transformations

Vertical Shrink by 6/5

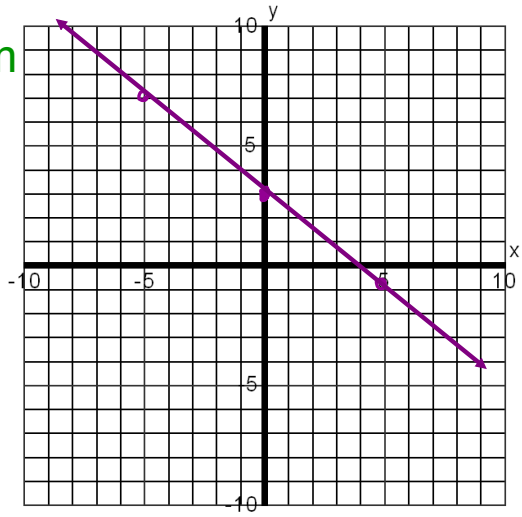
Vertical Shift down 3

Graph the line using b and m

$y = -\frac{4}{5}x + 3$

b = 3 y-int: (0, 3)

$m = -\frac{4}{5} = \frac{-4}{5} = \frac{4}{-5}$



Describe the Transformations

Vertical Reflection

Vertical Shrink by 4/5

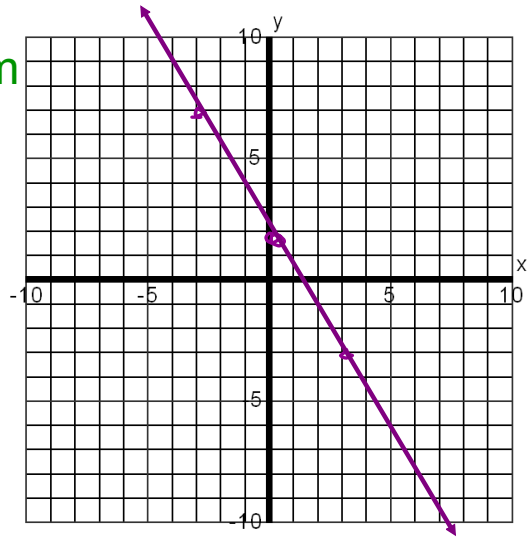
Vertical Shift up 3

Graph the line using b and m

$$y = -\frac{5}{3}x + 2$$

b = 2 y-int: (0, 2)

$$m = -\frac{5}{3} = \frac{-5}{3} = \frac{5}{-3}$$



Describe the Transformations

Vertical Reflection

Vertical Stretch by 5/3

Vertical Shift up 2