Equations and their Graphs

3.1 Use the Rectangular Coordinate System
3.1 Exercise Set, page 312 (294): 1, 5, 7, 11, 15, 19, 25
3.2 Graph Linear Equations in Two Variables
3.2 Exercise Set, page 346 (328): 1, 3, 21, 25, 27, 33

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18 textbook and online sections remaining
6 class meetings before final exam
18/6=3
3 or 4 sections each class meeting to have time for review before final exam

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3.3 Graphs with Intercepts-optional (but required for us)
3.3 Exercise Set, page 373 (355): 10,16
3.4 Understand Slope of a Line-optional
3.4 Exercise Set, page 409 (391): 1, 3, 9, 10, 13, 19, 28
3.5 Use the Slope-Intercept Form of an Equation of a Line-optional
3.5 Exercise Set, page 451 (433): 1, 4, 7, 9, 25, 29, 37, 42, 44

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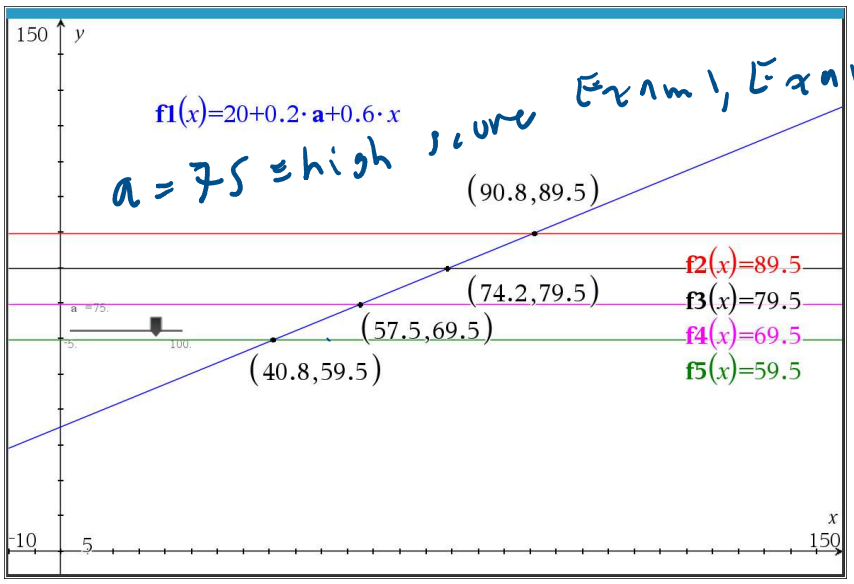
Exam 2		stem & leaf		
68.41176	mean	9	23	A-2
74	median	8	3489	B-4
21.63891	st. dev	7	44499	C-5
22	min	6	1	D-1
93	max	5	8	F- 5
17	count	4	4	
		3	36	
		2	2	

Exam 1		stem & leaf		
73.1875	mean			A-0
75	median	8	3334589	B-7
12.91423	st. dev	7	337	C-3
45	min	6	89	D-2
89	max	5	489	F- 4
16	count	4	5	



a = 75 = high score

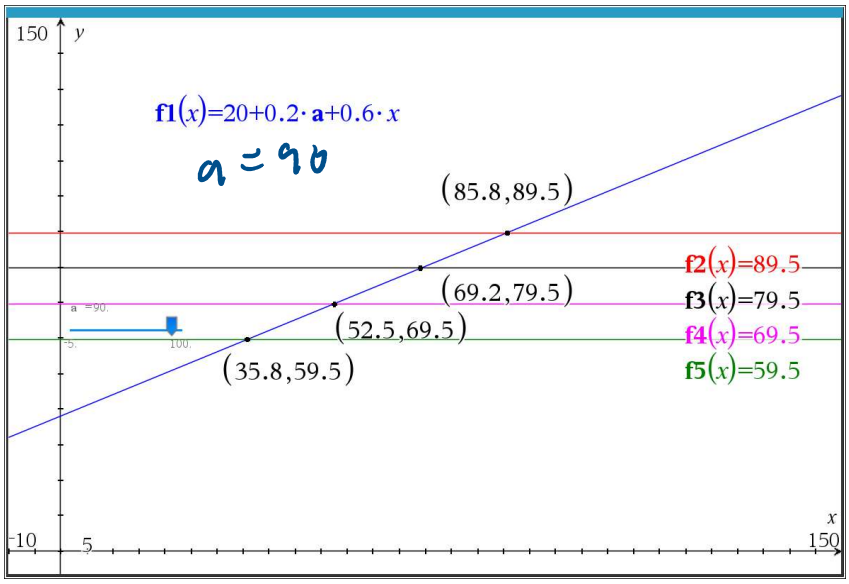
Exam 1, Exam 2

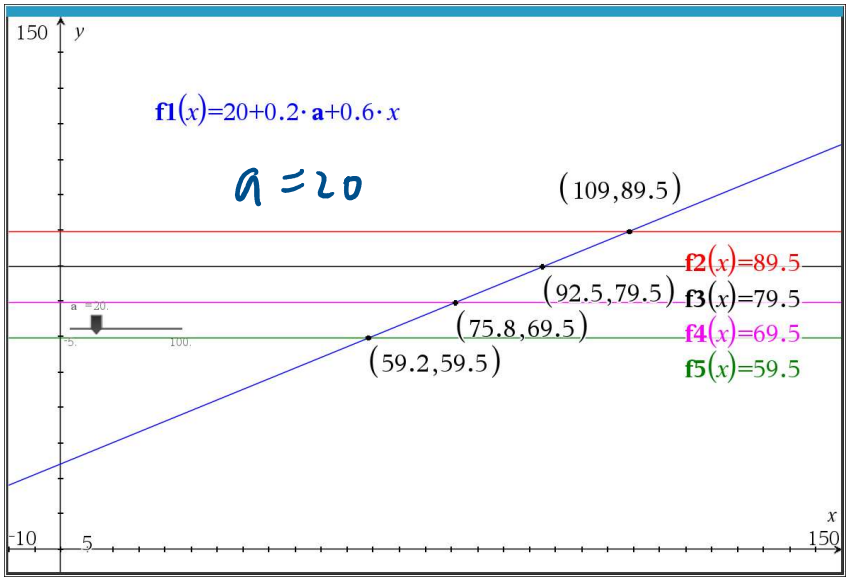
91 % A

75 % B

58 % C

41 % D





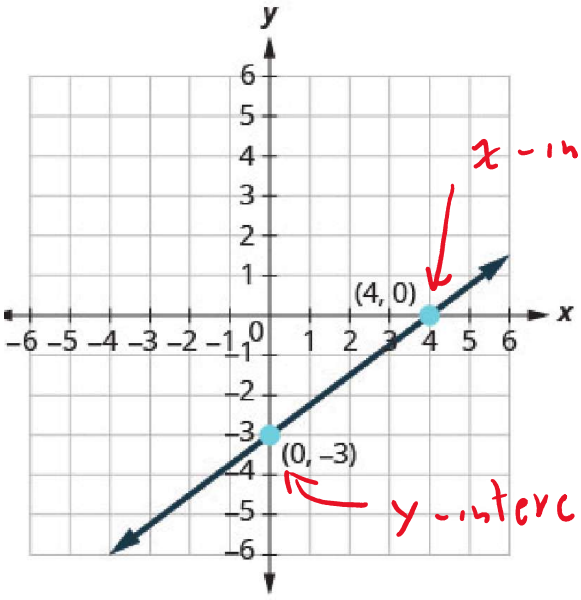
20+0.2·75+0.6·100	95.
20+0.2·75+0.6·90	89.
20+0.2·40+0.6·90	82.

20+0.2*88+0.6*88=90.4
20+0.2*88+0.6*87=89.8

3.3
Memorize

Intercepts of a line

The points where a line crosses the x– axis and the y– axis are called the intercepts of a line.



$2x + 3y = 6$

Find the intercepts and use them to graph the line

x-intercept

set $y = 0$ and solve for x

$2x + (3)(0) = 6$

$2x + 0 = 6$

$2x = 6$

$x = \frac{6}{2}$

$\boxed{x = 3}$ or the point $(3, 0)$

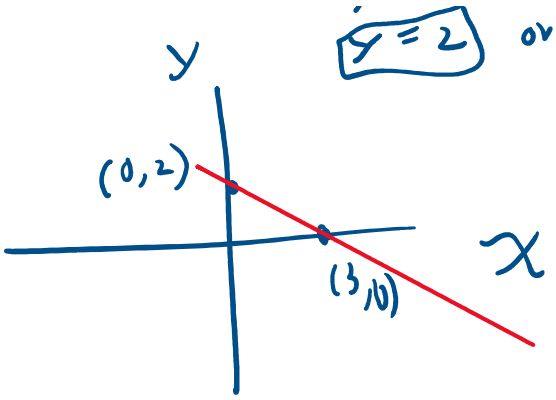
y-intercept

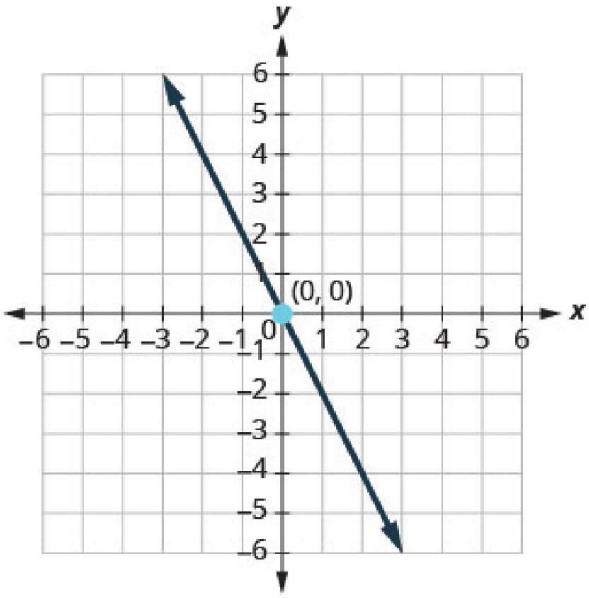
set $x = 0$ and solve for y

$(2)(0) + 3y = 6$

$3y = 6$

$\boxed{y = 2}$ or the point $(0, 2)$





(d) $y = -2x$

x-intercept, set $y = 0$, solve for x

$0 = -2x$

$x = 0$ or the point $(0,0)$

y-intercept

set $x = 0$, solve for y

$y = (-2)(0)$

$y = 0$ or the point $(0,0)$

Memorize

x– intercept and y– intercept of a line

The x– intercept is the point $(a, 0)$ where the line crosses the x– axis.
The y– intercept is the point $(0, b)$ where the line crosses the y– axis.

HOW TO: Graph a linear equation using the intercepts

The steps to graph a linear equation using the intercepts are summarized below.

1. Find the x– and y– intercepts of the line.
   - Let $y = 0$ and solve for x
   - Let $x = 0$ and solve for y.
2. Find a third solution to the equation.
3. Plot the three points and check that they line up.
4. Draw the line.

3.4

Memorize

Slope of a line

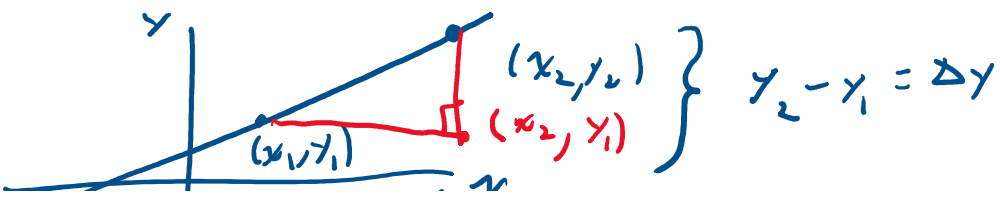
The slope of a line of a line is $m = \frac{\text{rise}}{\text{run}}$.

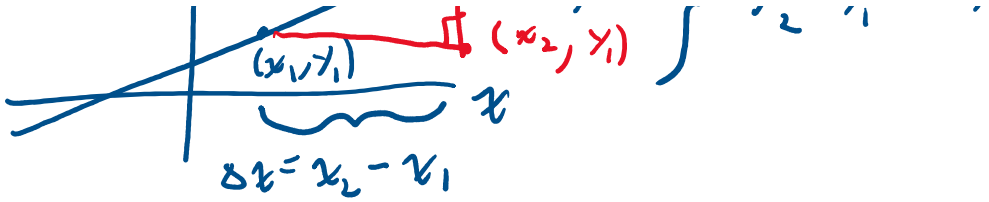
The rise measures the vertical change and the run measures the horizontal change between two points on the line.

$m = \frac{\Delta y}{\Delta x} = \frac{\text{change in } y}{\text{change in } x}$

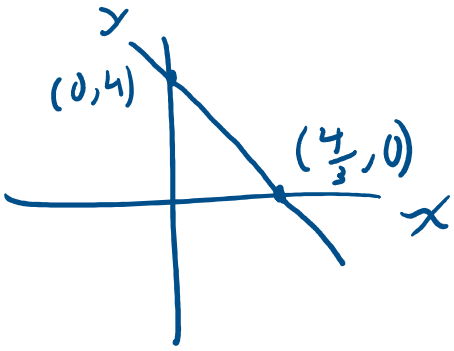
Δ = delta = change

$m = \frac{y_2 - y_1}{x_2 - x_1}$ where (x_1, y_1) and (x_2, y_2) are 2 points on a line





Let $y = -3x + 4$



y-intercept

x-intercept
set $y = 0$, solve for x

$0 = -3x + 4$

$3x = 4$

$x = \frac{4}{3}$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-4}{\frac{4}{3}-0} = \frac{-4}{\frac{4}{3}} = \frac{-4}{\frac{4}{1}} = \left(-\frac{4}{1}\right)\left(\frac{3}{4}\right) = -3$$

$$m = \frac{4-0}{0-\frac{4}{3}} = \frac{4}{-\frac{4}{3}} = \frac{\frac{4}{1}}{-\frac{4}{3}} = \left(\frac{4}{1}\right)\left(-\frac{3}{4}\right) = -3$$

Memorize

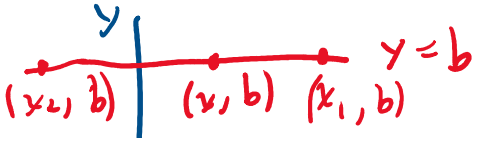
Positive and negative slopes

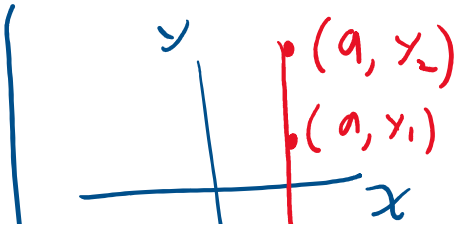
We 'read' a line from left to right just like we read words in English. As you read from left to right, the line is going up; it has positive slope. The line is going down; it has negative slope.

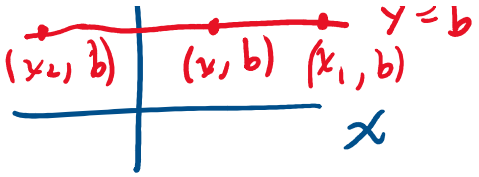
Horizontal line $y = b$ **Vertical line** $x = a$

y-coordinates are the same. x-coordinates are the same.

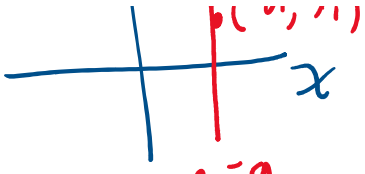
x can take any value





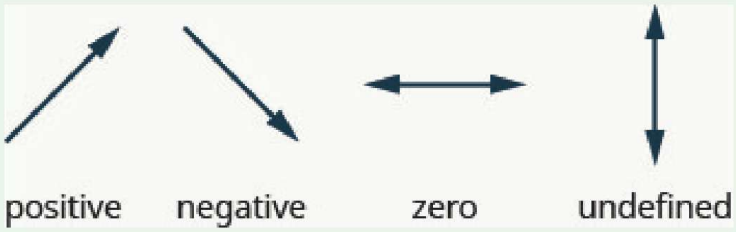


slope $= \frac{b-b}{x_1-x_2} = \frac{0}{x_1-x_2} = 0$ when $x_1 \neq x_2$



$m = \frac{y_2-y_1}{a-a} = \frac{y_2-y_1}{0}$ not defined

Quick guide to the slopes of lines



Remember, we 'read' a line from left to right, just like we read written words in English.

3.5

Slope-intercept form of an equation of a line

The slope–intercept form of an equation of a line with slope m and y-intercept, $(0, b)$ is,

$y = mx + b$

3.5

EXAMPLE 1

Use the graph to find the slope and y-intercept of the line, $y = 2x + 1$.

Compare these values to the equation $y = mx + b$.

↖ y-intercept

Solution

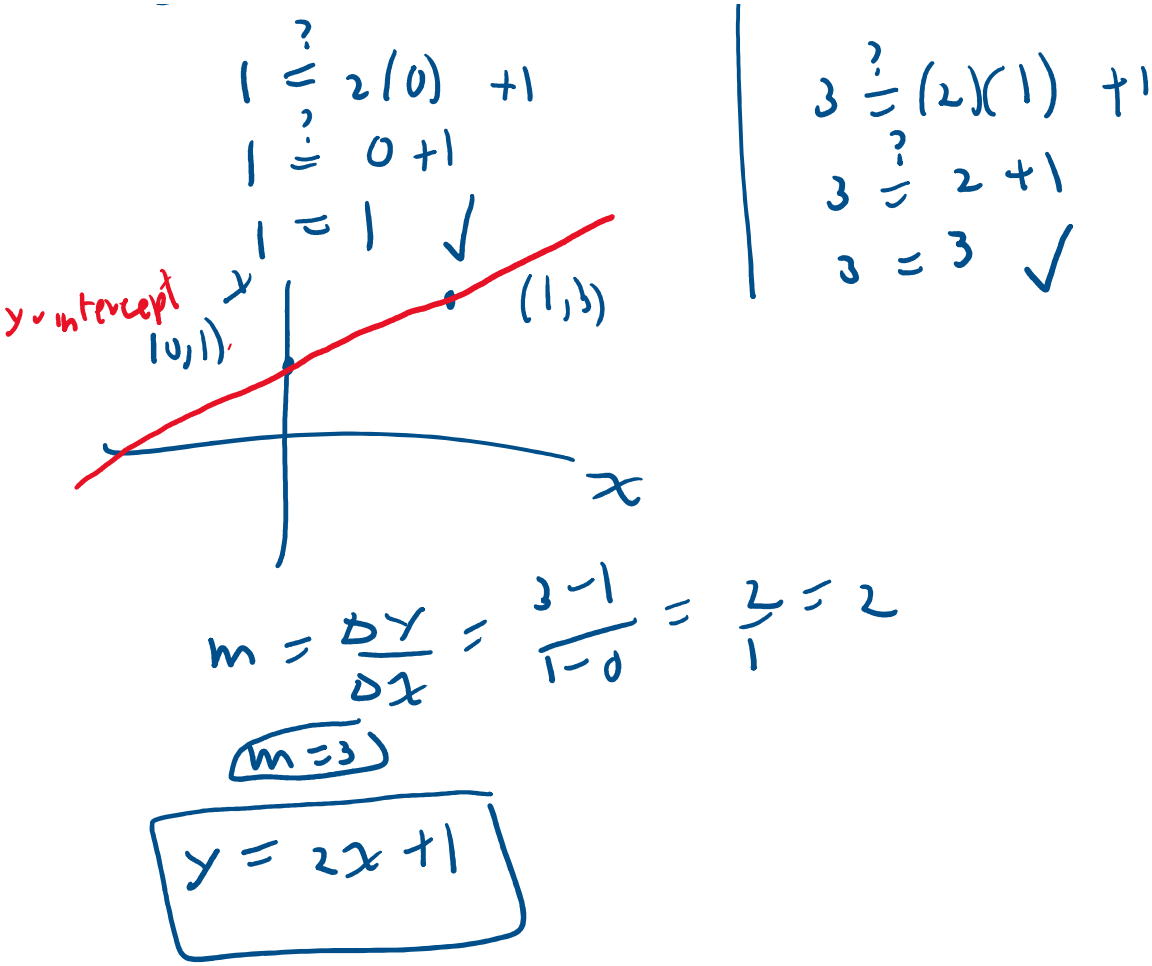
To find the slope of the line, we need to choose two points on the line. We'll use the points $(0, 1)$ and $(1, 3)$.

Is (0,1) on the line?

$1 \stackrel{?}{=} 2(0) + 1$

Is (1,3) on the line?

$3 \stackrel{?}{=} 2(1) + 1$



To find the equation of a line, we need two points on the line or one point and the slope.

Here are six equations we graphed in this chapter, and the method we used to graph each of them.

	Equation	**Method**
#1	$x = 2$	Vertical line
#2	$y = 4$	Horizontal line
#3	$-x + 2y = 6$	Intercepts
#4	$4x - 3y = 12$	Intercepts
#5	$y = 4x - 2$	Slope-intercept
#6	$y = -x + 4$	Slope-intercept

Copilot

Shoe sizes vary by region, but the units are typically numerical measurements that correspond to the length of the shoe. For example:

- **United States and Canada**: Use a numerical system for men's, women's, and children's sizes, typically ranging from small numbers like 1 to larger ones like 14+.
- **Europe**: Uses a system based on the length of the shoe last in Paris points (roughly 2/3 of a centimeter).
- **United Kingdom**: Uses a different numerical system from the U.S., which starts at slightly smaller numbers.
- **Japan**: Measures shoe size in centimeters directly, which can make it more intuitive.

If you're shopping internationally, it's always a good idea to consult a conversion chart, as the units and sizing systems can differ quite significantly! Anything specific you're curious about regarding shoe sizes?

TRY IT 11

Sam drives a delivery van. The equation $C = 0.5m + 60$ models the relation between his weekly cost, C, in dollars and the number of miles, m, that he drives.

Insert units to balance the equation

$C(m) = (0.5\ m)\left(\frac{\$}{mi}\right) + \$60$

what is the cost of driving 10 miles?

$C(10\ mi) = \$.5\left(\frac{10\ mi}{mi}\right) + \$60$

$= \$(.5)(10) + \$60$

$= \$5 + \$60$

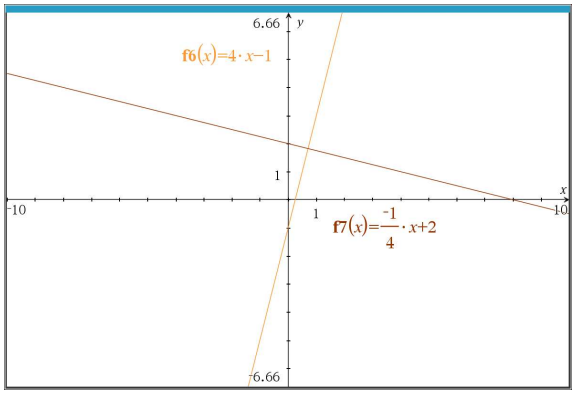
$= \boxed{\$65}$

It costs $65 to drive 10 miles

- **Parallel lines are lines in the same plane that do not intersect.**
  - Parallel lines have the same slope and different y-intercepts.
  - If m_1 and m_2 are the slopes of two parallel lines then $m_1 = m_2$.
  - Parallel vertical lines have different x-intercepts.
- **Perpendicular lines are lines in the same plane that form a right angle.**
  - If m_1 and m_2 are the slopes of two perpendicular lines, then $m_1 m_2 = -1$ and $m_1 = \frac{-1}{m_2}$.
  - Vertical lines and horizontal lines are always perpendicular to each other.

memorize

supplied



Your Name MTH 111 bonus quiz 2

Write each problem. Show calculations.

1. Find the slope of the line passing through the points $(0,5)$ and $(8,15)$.

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{15-5}{8-0} = \frac{10}{8} = \boxed{\frac{5}{4}}$$

2. Is the point $(2,4)$ on the line given by $y = x + 1$? Why or why not?

$4 \stackrel{?}{=} 2+1$

$4 \neq 3$

$\therefore (2,4)$ is not on the line

3. Find the x-intercept and y-intercept of the line given by $5x - 2y = 3$.

x-intercept

$5x - (2)(0) = 3$

$5x = 3$

$\boxed{x = \frac{3}{5}}$ or $(\frac{3}{5}, 0)$

y-int.

$(5)(0) - 2y = 3$

$-2y = 3$

$\boxed{y = -\frac{3}{2}}$ or $(0, -\frac{3}{2})$

4. Graph the line from #3.