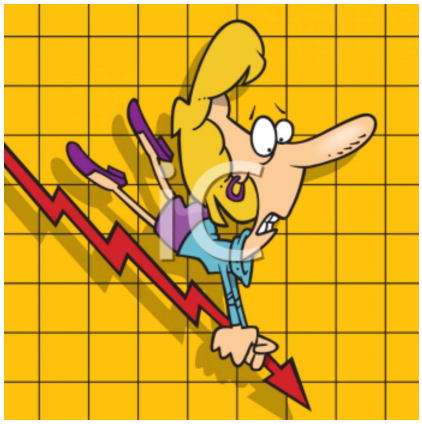
Unit 3 Notes
Lines and Linear Equations

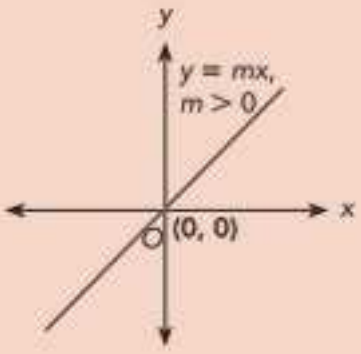


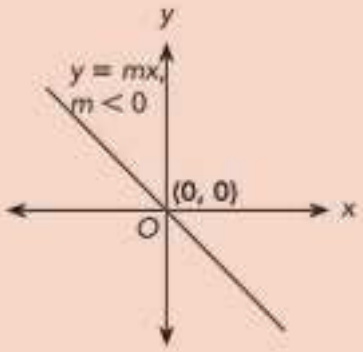
Tentative Schedule

Day	Date	Class Work	Assignment
	Wed. 10/1 (S) Thurs. 10/2 (R)	Quest #2	Watch Video #3.1 and Complete Notes Interpreting Slope
1	Fri. 10/3	P.S. #3.1	Watch Video #3.2 and Complete Notes Graphing Lines
2	Mon. 10/6 (S) Tues. 10/7 (R)	P.S. #3.2	Watch Video #3.3 and Complete Notes Finding Equations of Lines
3	Wed. 10/8	P.S. #3.3	Watch Video #3.4 and Complete Notes Real World Problems
3.5	Wed. 10/8 (R) Thurs. 10/9 (S)	Lab: Point-Slope Form	
4	Thurs. 10/9 Tues. 10/14	P.S. #3.4 **Quiz #3**	Correct and Complete all Problem Sets
5	Wed. 10/15	Review for Test #3	Review for Test #3
6	Thurs. 10/16 Fri. 10/17	**Test #3**	Watch Video #4.1 and Complete Notes

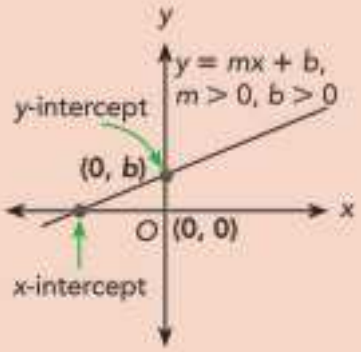
Name: _____

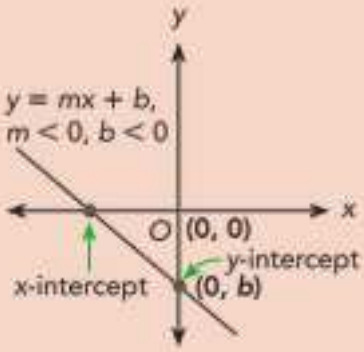
An equation of a line that passes through the origin, O (0, 0) is $y = mx$.



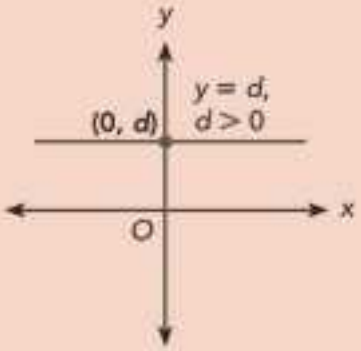


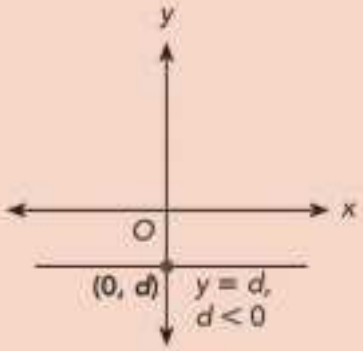
The equation of a line that intersects the y-axis at (0, b) is $y = mx + b$.



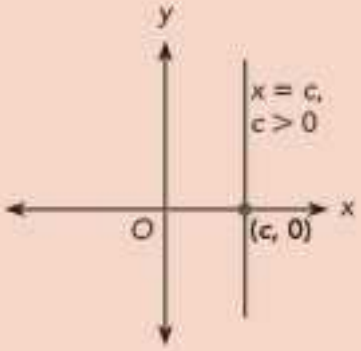


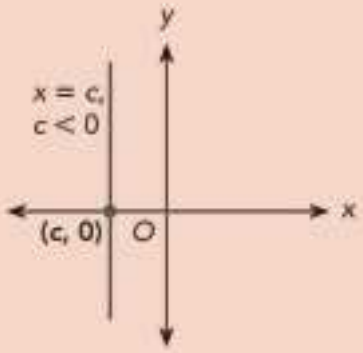
An equation of a straight line parallel to the x-axis and passing through the point (0, d) is $y = d$, where d is the y-intercept.





An equation of a straight line parallel to the y-axis and passing through the point (c, 0) is $x = c$, where c is the x-intercept.





Notes 3.1 – Interpreting Slope

1.) If you leave home and walk in a given direction at a steady pace, your distance, *d* feet, from home is directly proportional to the time, *x* minutes, you walk. You can use a table and a graph to represent this proportional relationship.

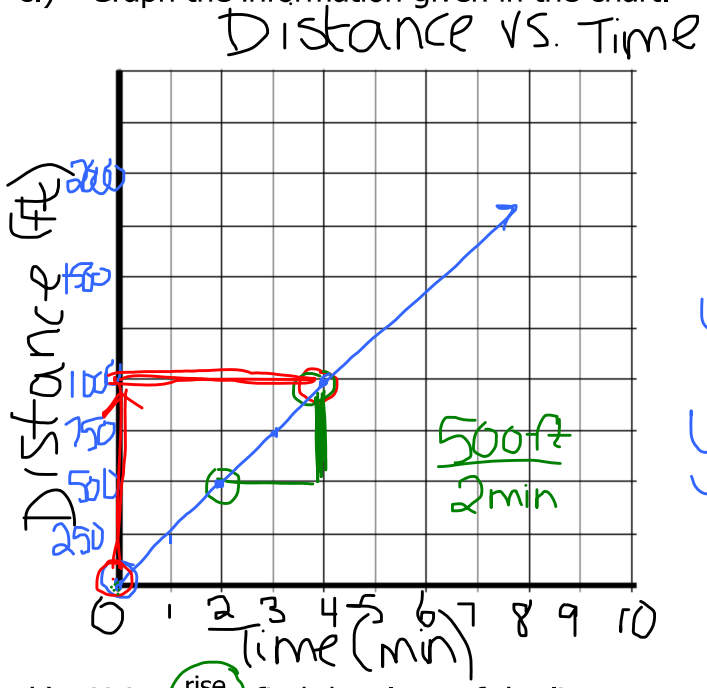
Time (*x* minutes)	1	2	3	4	5
Distance from Home (*d* feet)	250	500	750	1000	1250

a.) Fill in the rest of the chart.

b.) What is the constant of proportionality?

$\frac{250 \text{ ft}}{1 \text{ min}} = 250 \text{ ft/min}$ $\frac{750}{3}$

c.) Graph the information given in the chart.



$y = kx$

$y = 250x$ (+0)

d.) Using $\frac{\text{rise}}{\text{run}}$, find the slope of the line.

$\frac{1000 \text{ ft}}{4 \text{ min}} = 250 \text{ ft/min}$

e.) Is the relationship linear, quadratic, or exponential?

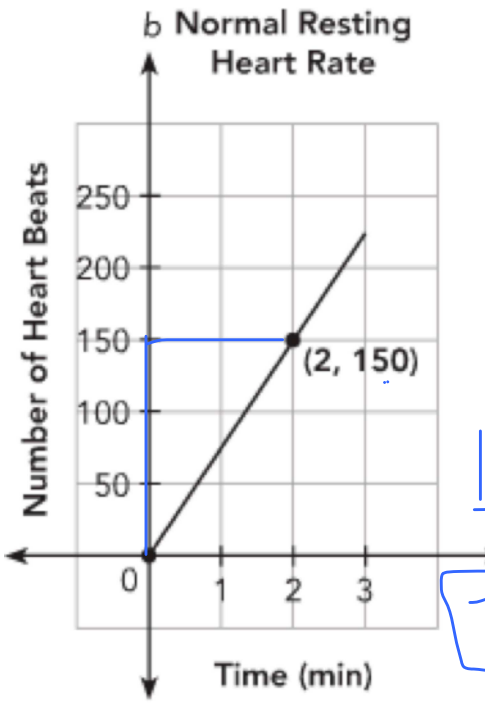
A function is linear if the rate of change (slope) is constant.

Slope Formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \frac{\Delta y}{\Delta x}$$

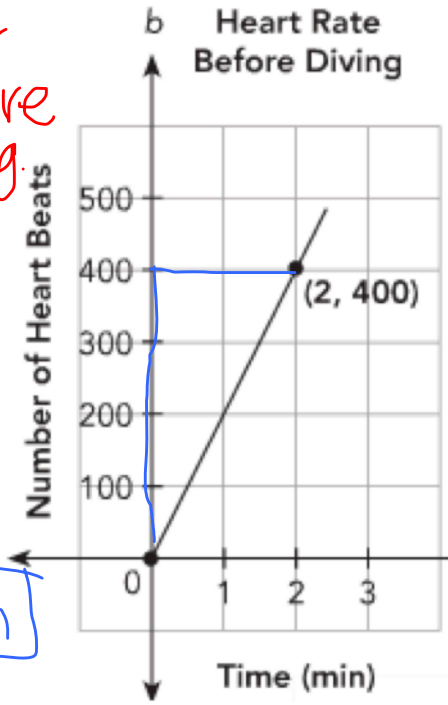
2.) The graphs give information about a penguin's number of heartbeats, *b*, over time, *t* minutes, during normal resting and just before diving. When is the penguin's heart rate greater, during normal resting, or just before diving?

The penguin's heart rate is higher just before diving.



150 beats / 2 min

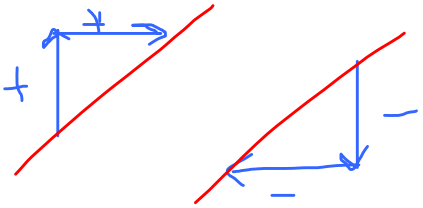
75 beats/min



400 b / 2 min.

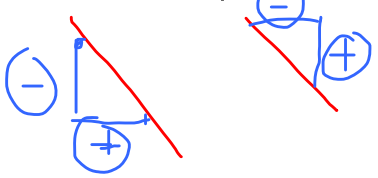
200 bpm

3.) When will the slope of a line be positive?



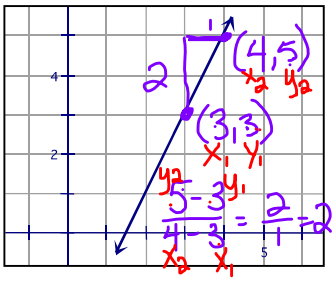
rise and the run need to be the same sign

4.) When will the slope of a line be negative?



rise and run have opposite signs.

5.) Find the slope of each line.

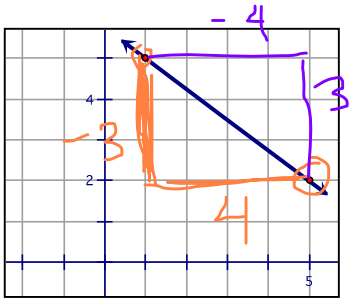


$\frac{4}{2} = 2$

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

$m = \frac{5-3}{4-3} = \frac{2}{1} = 2$

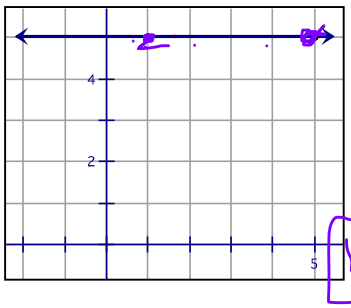
$m = \frac{\text{rise}}{\text{run}} = \frac{2}{1} = 2$



$m = \frac{\text{rise}}{\text{run}}$ $\frac{3}{4}$

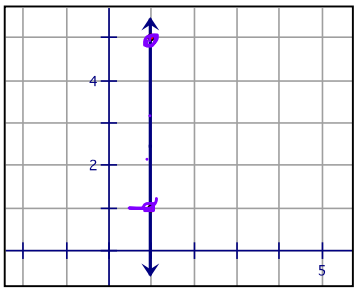
$m = \frac{-3}{4}$

$m = -\frac{3}{4}$



$m = \frac{0}{4}$

$m = 0$



$m = \frac{4}{0}$

$m = \text{undefined}$

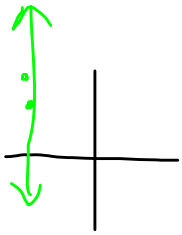
6.) Determine the slope of the line that passes through (2,-5) and (7,-10).

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-10 - -5}{7-2} = \frac{-5}{5} = -1$

x_1 y_1 x_2 y_2

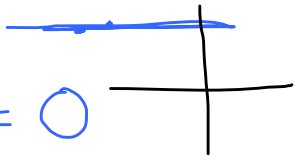
7.) Determine the slope of the line that passes through (-5,7) and (-5,9).

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9-7}{-5--5} = \frac{2}{0} = \text{undefined}$



8.) Determine the slope of the line that passes through (-7,8) and (-9,8).

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-8}{-9--7} = \frac{0}{-2} = 0$



9.) Determine the value of r so the line that passes through (5,7) and (9,*r*) has a slope of -2.

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$-2 = \frac{r-7}{9-5}$

$4 \cdot -2 = \frac{r-7}{4} \cdot 4$

$-8 = r - 7$

$+7 \quad +7$

$-1 = r$

Notes 3.2 – Graphing Lines

Graph the line.

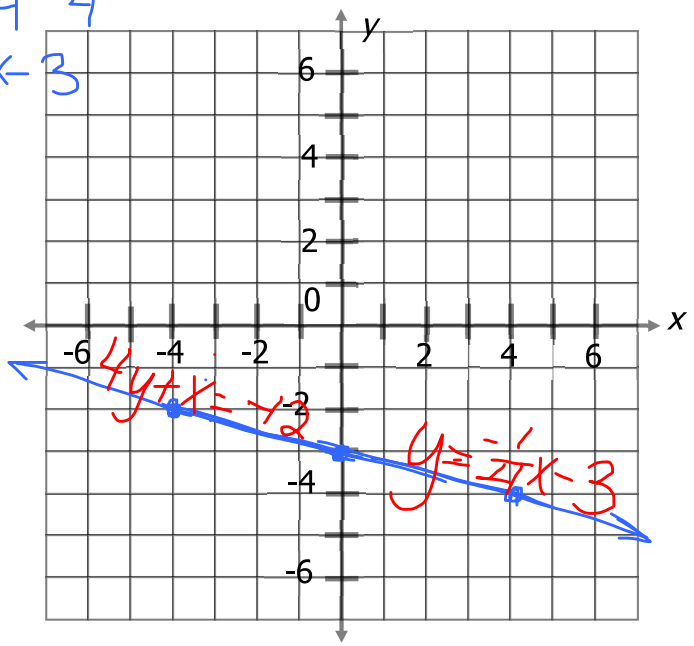
$4y+x=-12$

$\frac{4y}{4}=-\frac{1}{4}x-\frac{12}{4}$

$y=-\frac{1}{4}x-3$

1.) $4y + x = -12$

x	$y=-\frac{1}{4}x-3$	y	Coordinate
-4	$y=-\frac{1}{4}(-4)-3$ $y=1-3$	-2	(-4,-2)
0	$y=-\frac{1}{4}(0)-3$ $0-3$	-3	(0,-3)
4	$-\frac{1}{4}(4)-3$	-4	(4,-4)
8	$-\frac{1}{4}(8)-3$	-5	(8,-5)
12	$-\frac{1}{4}(12)-3$ $-3-3$	-6	(12,-6)



$m=0$

$y=0x+4$

Look at the equations of the lines that are shown to you.

Write down some observations.

Slope-Intercept Form	Point-Slope Form
$y=mx+b$ m: slope b: y-int.	

$y = mx + b$

Graph the following lines on the set of axes below.

1.) ~~$3y - 12x = 20$~~

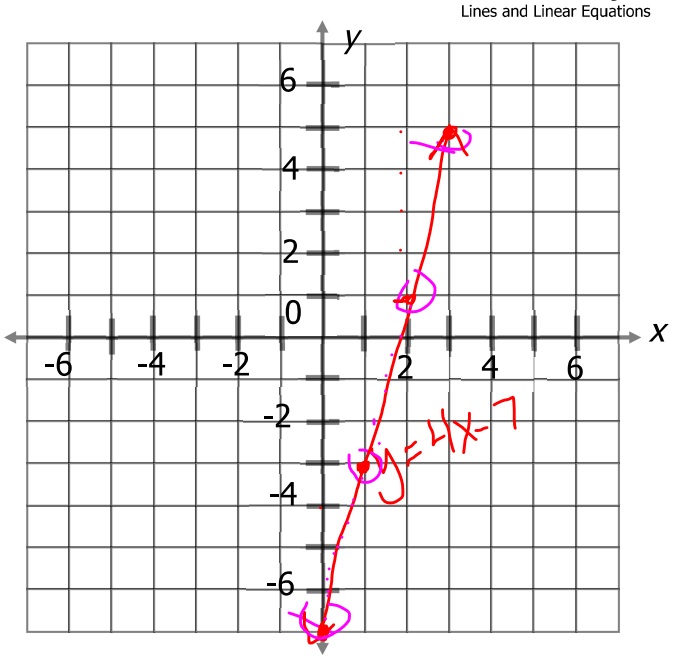
$\frac{3y}{3} = \frac{12x}{3} - \frac{21}{3}$

$y = 4x - 7$

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

$b = -7$

starting amount



2.) ~~$2x - 8y = 24$~~

$-2x - 8y = -24$

$-2x - 8y = -24$

$+2x \quad +2x$

$-8y = 2x - 24$

$\frac{-8y}{-8} = \frac{2x}{-8} - \frac{24}{-8}$

$y = -\frac{1}{4}x + 3$

$m = -\frac{1}{4} \quad b = 3$

$-2x - 8y = -24$

$+8y \quad +8y$

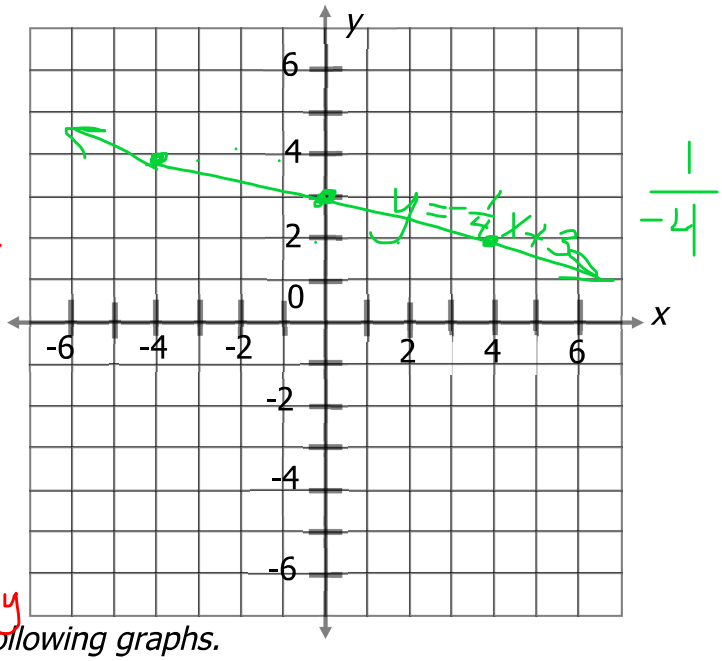
$-2x = 8y - 24$

$+24 \quad +24$

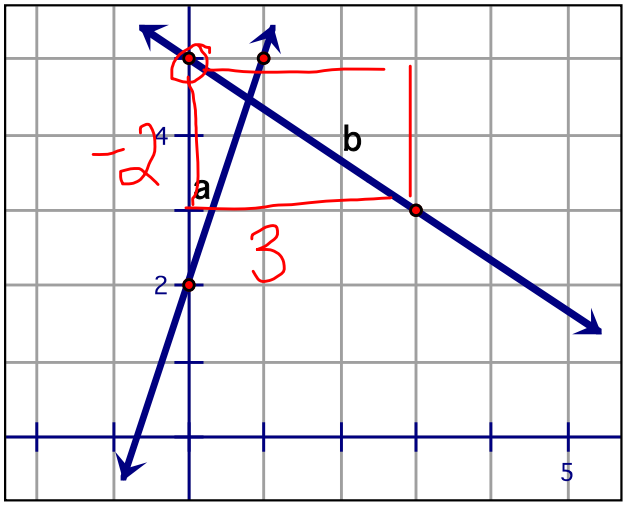
$-2x + 24 = 8y$

$\frac{-2x}{8} + \frac{24}{8} = \frac{8y}{8}$

$-\frac{1}{4}x + 3 = y$



Determine the equations of the lines shown in the following graphs.



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

$b = 2$

$y = mx + b$

$y = 3x + 2$

b) $m = -\frac{2}{3} \quad b = 5$

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

Notes 3.3 - Finding Equations of Lines

Slope-Intercept Form

$y = mx + b$ m: slope b: y-int.

1.) Find the equation of a line that has a slope of -5 and a y-intercept of 7.

$m = -5$
$b = 7$

$y = -5x + 7$

2.) Find the equation of a line that has a slope of 7 and passes through the point (3,8) using slope-intercept form.

x y

$m = 7$
$b = ? = -13$

$y = 7x - 13$

$y = mx + b$
$y = 7x + b$
$8 = 7(3) + b$
$8 = 21 + b$
$-13 = b$

3.) Find the equation of a line that has a slope of $\frac{2}{3}$ and passes through the point (12,3).

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

$b = ? = -5$

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

$y = mx + b$
$y = \frac{2}{3}x + b$
$3 = \frac{2}{3}(12) + b$
$3 = 8 + b$
$-5 = b$

4.) Find the equation of a line that passes through the points (6,1) and (7,-4) using the slope-intercept form.

$y = mx + b$

$m = ? = -5$

$b = ? = 31$

$y = -5x + 31$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4-1}{7-6} = \frac{-5}{1} = -5$

$y = -5x + b$

$1 = -5(6) + b$

$1 = -30 + b$

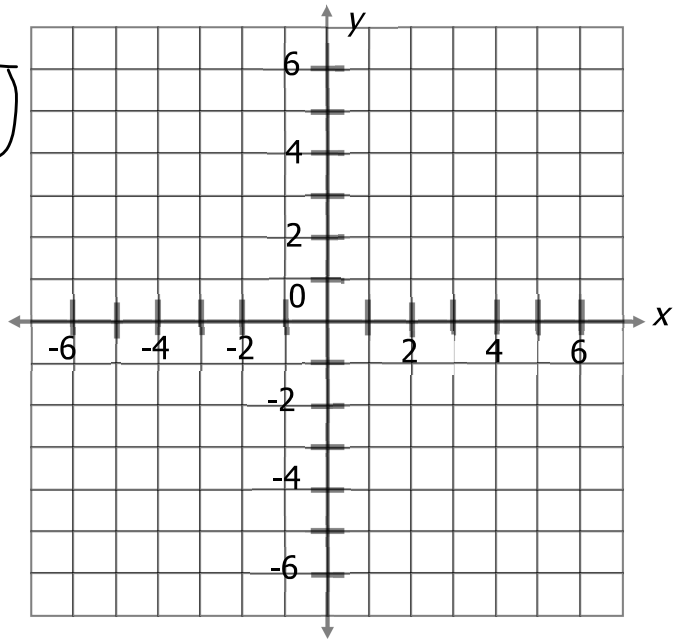
$31 = b$

$y = -5x + b$

$-4 = -5(7) + b$

$-4 = -35 + b$

$31 = b$



5.) How can you tell if two lines are parallel? Use your calculators to test your conjectures.

6.) An equation of a line is $2y = 6 - 3x$. Write an equation of a line parallel to this given line that has a y-intercept of 6.

ORIGINAL

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

$b = 3$

NEW

$m_{||} = \frac{-3}{2}$

$b_{||} = 6$

$\frac{2y}{2} = \frac{6}{2} - \frac{3x}{2}$

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

ORIGINAL

NEW ||

$y = -\frac{3}{2}x + 6$

7.) Write an equation of the line that passes through (5,8) and (-9,8).

$m = ? = 0$

$b = ? = 8$

$m = \frac{8-8}{-9-5} = \frac{0}{-14} = 0$

horizontal

$y = 0x + b$

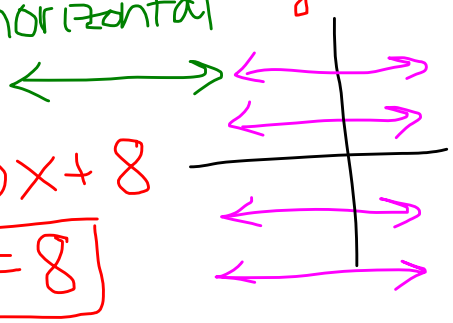
$8 = 0(5) + b$

$8 = 0 + b$

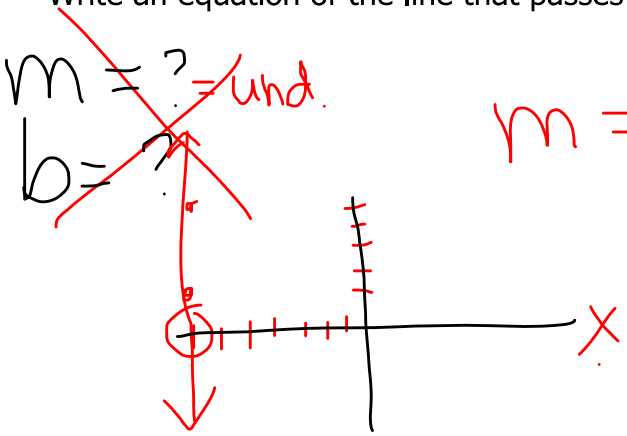
$8 = b$

$y = 0x + 8$

$y = 8$



8.) Write an equation of the line that passes through (–7,1) and (–7,5).

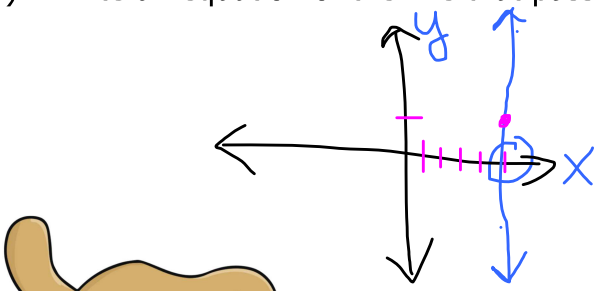


$m = \frac{5-1}{-7-7} = \frac{4}{0}$ = undefined

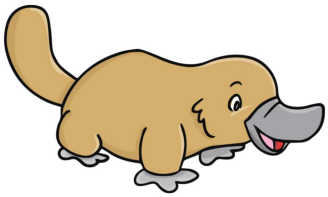
vertical

$x = -7$

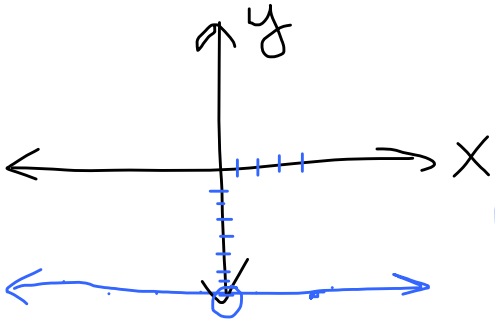
9.) Write an equation of the line that passes through (5,1) and is parallel to the *y*-axis.



$x = 5$



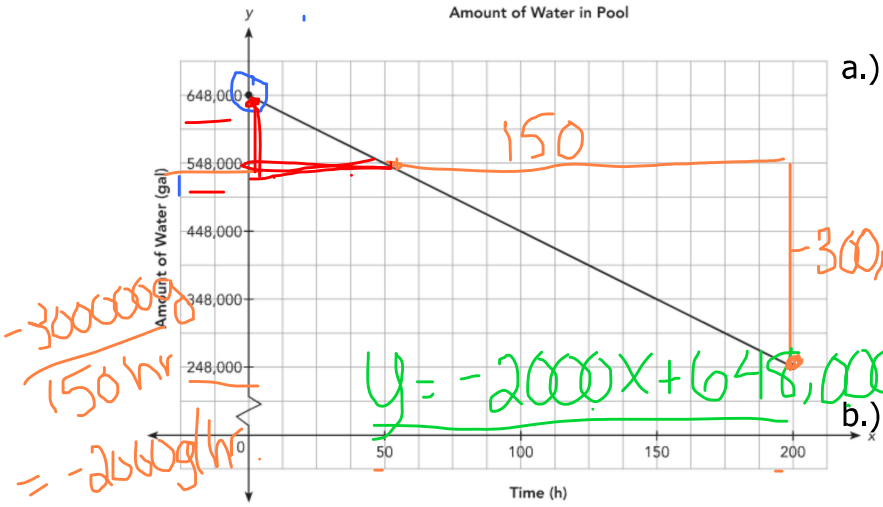
10.) Write an equation of the line that passes through (4,-8) and is parallel to the *x*-axis.



$y = -8$

Notes 3.4 – Real-World Applications: Linear Equations

1.) A swimming pool when full holds a certain amount of water. When the drain is opened, the amount of water in the pool drains out at a constant rate. The graph shows the amount of water, *W* gallons, in the pool *h* hours after the drain is opened.



a.) Find the vertical intercept of the graph and explain what information it gives about the situation.

The pool initially had 648,000 g. of H_2O in it

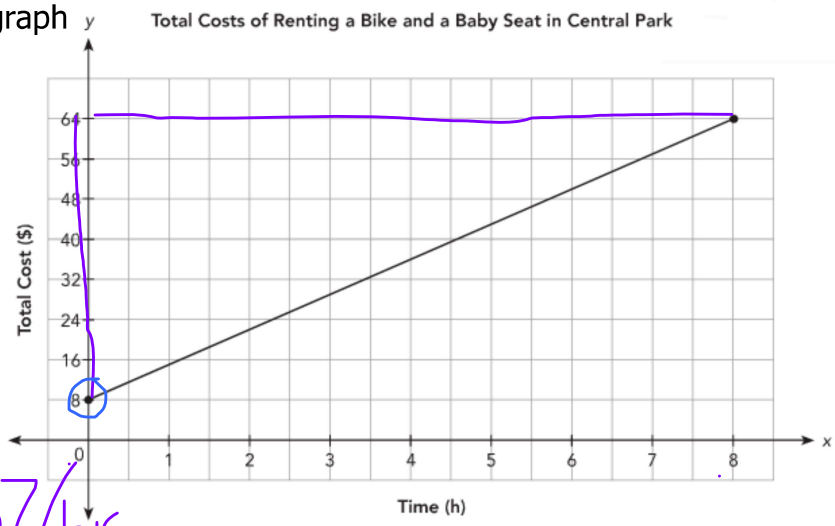
b.) Find the slope of the graph and explain what information it gives about the situation.

$m = \frac{\text{rise}}{\text{run}} = \frac{-100{,}000\text{ g}}{50\text{ hrs.}} = -2000\text{ g/hr.}$

The pool is emptying at a rate of 2000 g/hr.

2.) Jeanette rents a bike while visiting a city. She pays $7 per hour to rent the bike. She also pays $8 to rent a baby seat for the bike. She pays this amount for the baby seat no matter how many hours she rents the bike. The graph shows her total cost, *C* dollars, after *h* hours.

a.) Find the vertical intercept of the graph and explain what information it gives about the situation.



She initially spends $8 to rent a baby seat.

b.) Find the slope of the graph and explain what information it gives about the situation.

$m = \frac{\text{rise}}{\text{run}} = \frac{\$56}{8\text{hr}} = \$7/\text{hr}$

She pays a rate of $7/hr.

3.) Anna and Michael are salespeople. Each of them earns a fixed monthly salary plus an additional percent of the amount, in dollars, that he or she sells that month. So, the total monthly amount, *E* dollars, a salesperson earns depends on how much, in *s* dollars, he or she sells.

a.) Find the fixed monthly salary for each person.

Anna: $2500 Michael: $1500

b.) Both Anna and Michael earn a percent commission. Who earns more commission?

Michael does because he has a higher slope

c.) Find each person's commission.

$m = \frac{\text{rise}}{\text{run}} = \frac{\$250}{\$5000} = 0.05$

Anna makes 5% commission

$m = \frac{\text{rise}}{\text{run}} = \frac{\$500}{\$2500} = 0.20$

Michael makes 20% commission.

Lab Notes - Point-Slope Form

Slope-Intercept Form	Point-Slope Form	Two-Point Form
$y = mx + b$	$y - y_1 = m(x - x_1)$	$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$

1.) Find the equation of a line that has a slope of 7 and passes through the point (3,8) using slope-intercept form.

$y = 7x + b$
$8 = 7(3) + b$
$8 = 21 + b$
$-13 = b$

$\boxed{y = 7x - 13}$

2.) Solve question #1 using point-slope form.

$y - y_1 = 7(x - x_1)$
$y - 8 = 7(x - 3)$
$y - 8 = 7x - 21$
$\boxed{y = 7x - 13}$

3.) Find the equation of a line that has a slope of $\frac{2}{3}$ and passes through the point (12,3) using point-slope form.

$y - 3 = \frac{2}{3}(x - 12)$
$y - 3 = \frac{2}{3}x - 8$
$\boxed{y = \frac{2}{3}x - 5}$

4.) Write an equation of the line that passes through (1,3) and (2,-4) using slope-intercept form.

$m = \frac{-4-3}{2-1} = \frac{-7}{1} = -7$

$y = -7x + b$

$3 = -7(1) + b$

$3 = -7 + b$

$10 = b$

$y = -7x + 10$

5.) Write an equation of the line that passes through (1,3) and (2,-4) using two-point form.

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

$y - 3 = \frac{-7}{1}(x-1)$

$y - 3 = -7(x-1)$

$y - 3 = -7x + 7$

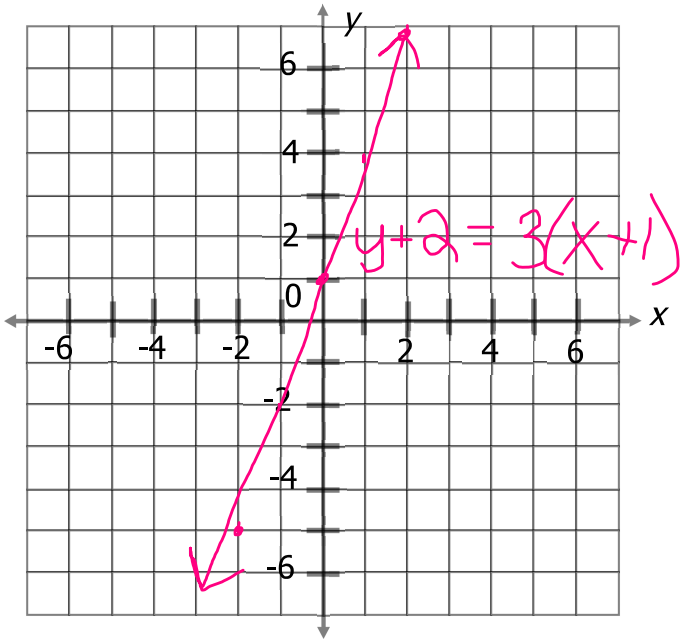
$y = -7x + 10$

Graph each equation from point-slope form, then put the equation in slope-intercept form.

6.) $y + 2 = 3(x+1)$

$m = 3$

point: $(-1,-2)$



7.) $y + 4 = -\frac{1}{4}(x-5)$

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

point: $(5,-4)$