

## Sections 2.4 & 2.5 - Equations of Lines

**In class work:** Complete all statements. Solve all exercises.

### Linear Equation in Two Variables

Standard form:  $ax + by = c$

Slope –Intercept form:  $y = mx + b$ , where  $m$  is the slope of the line,  $b$  is the  $y$ -intercept

Slope –Point form:  $y - y_1 = m(x - x_1)$ , where  $m$  is the slope of the line and  $(x_1, y_1)$  is a point on the line.

Vertical Line:  $x = k$ , where  $k$  is a constant

Horizontal Line:  $y = k$ , where  $k$  is a constant.

### Slope of a Line

$m = \frac{\text{change in } y}{\text{change in } x}$  as we move from one point to another on the line.

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

The slope  $m$  is the rate of change of  $y$  with respect to  $x$ .

### Properties of Lines

Two distinct lines are parallel if and only if they have the same slope.

$$l_1 \parallel l_2 \Leftrightarrow m_1 = m_2$$

Two lines are perpendicular if and only if the product of their slopes is  $-1$ .

$$l_1 \perp l_2 \Leftrightarrow m_1 \cdot m_2 = -1 \Leftrightarrow m_1 = -\frac{1}{m_2}$$

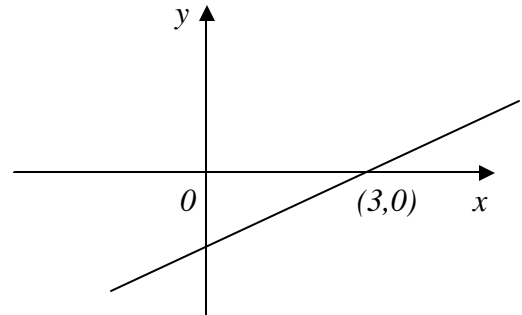
**Exercise #1** Complete the following ordered pairs to make solutions to the equation  $x + 2y = 8$ :  $(0, ?), (? , 0), (-\frac{4}{3}, ?)$

**Exercise #2** Complete the table for the equation  $y = \frac{2}{3}x$ :

$x$	$y$
0	
	2
-1	
	$\frac{3}{2}$

**Exercise #3** The graph of  $2x - 3y = 6$  is given .

- Is  $(0, 0)$  a solution?
  - Is  $(3, 0)$  a solution?
  - Is  $(-2, 1)$  a solution?
- Prove algebraically and graphically.



**Exercise #4** An equation for the concentration of toxic chemicals is  $C = 285 - 15t$ , where  $C$  is the concentration in part per milliliter (ppm), and  $t$  is the number of years from now.

- Find the intercepts of the graph and graph the equation using the intercepts.
- What is the significance of the intercepts ?

**Exercise #5** A computer store budgets \$12,000 to buy computers and laser printers. Each computer costs \$650 and each printer costs \$200.

- Write an equation that models the given situation.
- Sketch the graph. Be sure to label the axes clearly.
- What is the significance of the intercepts?
- If the store buys 4 computers, how many printers can they buy?

**Exercise #6** What is the equation of the

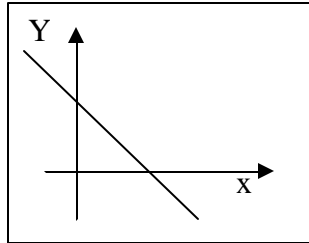
- horizontal line that passes through  $(2, 3)$  ?
- vertical line that passes through  $(4, -3)$  ?
- $x$ -axis?
- $y$ -axis?

**Exercise #7** The weight (in kilograms) of a pumpkin is measured as it grows over a particular month. After 2 days, the pumpkin weighed 3 kilograms while at 31 days, the pumpkin's weight was 9 kilograms.

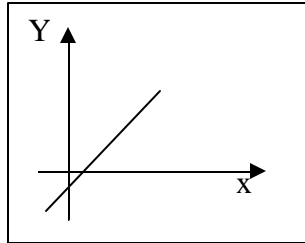
- Assuming the weight is growing at a linear rate, find a formula that gives the weight "W" (in kilograms) in terms of the number of days "D"
- What are the units of the slope and what does it mean in this problem.

**Exercise #8** Match the graphs (I) – (VI) with the equations given below. (You shouldn't need to graph each equation to determine which is which!) NOTE: The x and y scales may be unequal. Show all work.

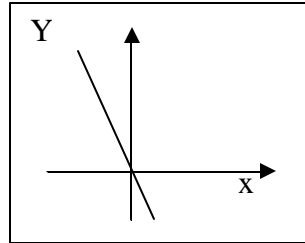
- a.  $y = .005x + .009$    b.  $x = -py$    c.  $y = \frac{5}{2} - \frac{3}{4}x$    d.  $x - \sqrt{1000} = 0$    e.  $3x + 4y + 10 = 0$   
 f.  $y = 351x - 140$



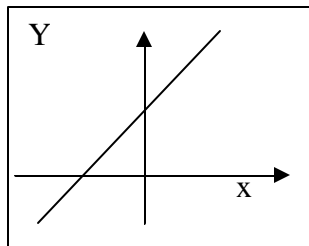
(I)



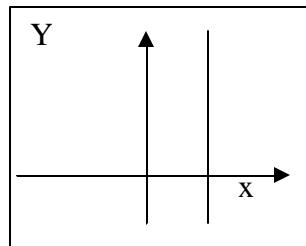
(II)



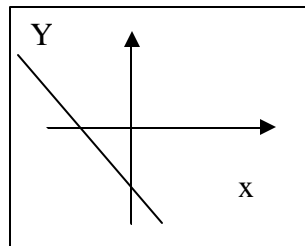
(III)



(IV)



(V)



(VI)

**Exercise #9** At a University, campus food services decides to sell gourmet coffee from a cart in front of the library. The table below is a projection of the cost to the university of selling various amounts of coffee.

Total cost to serve  $x$  cups of coffee in a day

x (cups)	0	5	10	50	100	200
C (dollars)	50.00	51.25	52.50	62.50	75.00	100.00

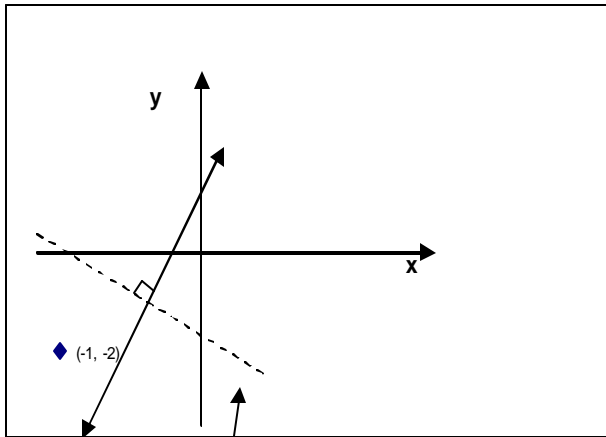
- Using the table, show that the relationship is linear.
- Plot the data found in the table.
- Find the slope of the line. Explain what this means in the context of the given situation.
- What will it cost to serve 13 cups of coffee in a day?

**Exercise #10** Are the lines given by these equations parallel, perpendicular or neither?

$$y - \frac{2}{3}x = 0; \quad 3y = 2x + 1.$$

**Exercise #11** Find an equation of the line that passes through the point  $(-1, 2)$  and is perpendicular to  $\frac{5}{18}x + \frac{1}{6}y = \frac{2}{3}$ .

**Exercise #12** Find the equation of the solid line graphed below.



$$\frac{1}{2}x + \frac{5}{4}y + 2 = 0$$

**Exercise #13** (2.4 - # 62, 64) Find the slope of the line passing through each pair of points or state that the slope is undefined. Assume that all variables represent positive real numbers.

a)  $(-a, 0)$  and  $(0, -b)$

b)  $(a - b, c)$  and  $(a, a + c)$

**Exercise #14** Write the slope-intercept equation of a function  $f$  whose graph passes through  $(-5, 6)$  and is perpendicular to the line that has an  $x$ -intercept of 3 and a  $y$ -intercept of  $-9$ .

**Exercise #15** (2.4 - #75) A linear function that models data is described. Find the slope of each model and its meaning.

a)  $f(x) = 0.01x + 57.7$  models the global average temperature of Earth,  $f(x)$ , in degrees Fahrenheit,  $x$  years after 1995.

**Exercise #16** (2.4 - # 82) The scatter plot shows the number of college students in the United States, in thousands, enrolled exclusively in online education from 2002 through 2007. Also shown is a line that passes through or near the six data points.

- Use the coordinates of the two points to compute the slope of the line. Describe the meaning of the slope.
- Write a linear function that models the number of college students enrolled exclusively in online education, in thousands,  $x$  years after 2002.
- Predict the number of college students who will be enrolled exclusively in online education in 2010.

