

# Unit 4 Study Guide – Part I: Equations of Lines

Key

Write out the general equations for:

Point Slope Form:  $y - y_1 = m(x - x_1)$

Slope-Intercept Form:  $y = mx + b$

Standard Form:  $Ax + By = C$

1. Given the points: (3, -7) and (-2, 8)

a. Write an equation in **point-slope form** of the line that passes through the given points.

$$m = \frac{8 - (-7)}{-2 - 3} = \frac{15}{-5} = -3$$

$$\boxed{y + 7 = -3(x - 3) \text{ OR } y - 8 = -3(x + 2)}$$

b. Rewrite the equation in **slope-intercept form**.

$$\begin{aligned} y + 7 &= -3(x - 3) \\ y + 7 &= -3x + 9 \\ \boxed{y} &= -3x + 2 \end{aligned}$$

c. Now, rewrite the equation in **standard form**.

$$\boxed{3x + y = 2}$$

2. Write the equation of the graph to the right:

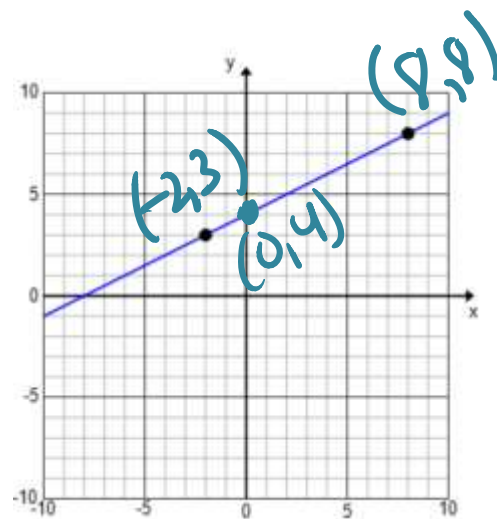
a. In **slope-intercept form**:

$$m = \frac{8 - 3}{8 - 2} = \frac{5}{6} = \frac{1}{2}$$

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

b. Now re-arrange into **standard form**. (A, B, and C must be integers)

$$\begin{aligned} 2\left(-\frac{1}{2}x + y\right) &= (4)2 \\ \boxed{-x + 2y} &= 8 \end{aligned}$$



3. Write 2 different possible equations of a line that contains (9, 8) and (-7, -8) in point slope form:

$$m = \frac{8 - (-8)}{9 - (-7)} = \frac{16}{16} = 1$$

$$\boxed{y - 8 = 1(x - 9) \text{ OR } y + 8 = 1(x + 7)}$$

4. Rewrite the equation of the line  $y - 2 = \frac{2}{5}(x - 5)$  in standard form. ( $A$ ,  $B$ , and  $C$  must be integers)

$$5(y - 2) = \left[\frac{2}{5}(x - 5)\right] 5$$

$$5y - 10 = 2(x - 5)$$

$$5y - 10 = 2x - 10$$

$$5y = 2x$$

$$-2x + 5y = 0$$

5. Write the equation of the line that passes through the points  $(3, 5)$  and  $(-4, 9)$  in **standard form**. ( $A$ ,  $B$ , and  $C$  must be integers)

$$m = \frac{9 - 5}{-4 - 3} = \frac{4}{-7}$$

$$7(y - 5) = \left[-\frac{4}{7}(x - 3)\right] 7$$

$$7y - 35 = -4(x - 3)$$

$$7y - 35 = -4x + 12$$

$$7y = -4x + 47$$

$$4x + 7y = 47$$

6. Determine if line a and line b are parallel, perpendicular, or neither.

Line a:  $3x - 4y = 33$

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

$$-4y = -3x + 33$$

$$y = \frac{3}{4}x + \frac{33}{4}$$

Parallel

7. Write the equation of the line that is perpendicular to  $y = -\frac{1}{4}x - 2$  and passes through the point  $(4, 3)$  in **slope intercept form**.

$$m = 4$$

$$(4, 3)$$

$$3 = 4(4) + b$$

$$3 = 16 + b$$

$$b = -13$$

$$y = 4x - 13$$

8. Which of the lines below is parallel to  $4x - 2y = 7$ ?

a)  $-2x - 4y = -7$   $-4y = 2x - 7$   $y = -\frac{1}{2}x + \frac{7}{4}$

b)  $7 - 4x = 2y$   $y = -2x + \frac{7}{2}$

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

d)  $2y = 4x + 7$   $y = 2x + \frac{7}{2}$

e)  $y = 4x + 2$

$$-2y = -4x + 7$$

$$y = 2x - \frac{7}{2}$$

## Unit 4 Study Guide – Part II: Applications of Lines

- 1) While on vacation you start keeping track of how far your family has traveled and how long it has taken. After 3 hrs you are 180 miles from home. After 7 hrs you are 420 miles from home.

a. Define your variables.

$x = \# \text{ of hours}$       miles (3, 180) (7, 420)  
 $y = \# \text{ of miles from home}$

b. Write an equation in POINT-SLOPE form that represents this situation:

$$m = \frac{420 - 180}{7 - 3} = \frac{240}{4} = 60$$

$$\boxed{y - 180 = 60(x - 3)}$$

c. Change your equation to SLOPE-INTERCEPT form:

$$y - 180 = 60x - 180$$

$$y = 60x$$

d. Explain the meaning of the y-intercept.

At 0 hrs you are 0 miles from home.

e. Explain the meaning of the slope.

You are traveling 60 miles per hour.

f. How many hours have you travelled when you are 550 miles away?

$$550 = 60x$$

$$x \approx 9.2$$

← y

$$\boxed{9.2 \text{ hrs}}$$



- 2) The leaves on your tree are falling as the wind blows at a rate of 7 leaves per minute. After 60 minutes, there are only 30 leaves left.

a. Define your variables.

$x = \# \text{ of minutes}$       (min, leaves)  
 $y = \# \text{ of leaves}$

b. Write an equation in SLOPE INTERCEPT FORM that represents this situation.

$$m = -7$$

$$(60, 30)$$

$$y - 30 = -7(x - 60)$$

$$y - 30 = -7x + 420$$

$$\boxed{y = -7x + 450}$$

c. Explain the meaning of the y-intercept.

450 leaves are on the tree before they start falling

d. Explain the meaning of the slope.

the tree is losing 7 leaves per minute

e. When will there be no leaves left on the tree?

$$0 = -7x + 450$$

$$-450 = -7x$$

$$\boxed{x \approx 64.3 \text{ min}}$$

(a little more than an hour)



3) Your Club is trying to raise money for a summer trip. You look at the money in your account and you have \$220. As a group you start selling mittens. After selling 12 pairs of mittens you have \$280 dollars in your account!

- a. Define your variables.
- $m = \# \text{ of pairs of mittens}$   
 $d = \# \text{ of dollars}$

$(0, 220)$   $(12, 280)$   
 (mittens, dollars)

- b. Write an equation in **SLOPE INTERCEPT FORM** that represents this situation.

$$m = \frac{280 - 220}{12 - 0} = \frac{60}{12} = 5$$

$$y - 220 = 5(x - 0)$$

$$y - 220 = 5x$$

$$y = 5x + 220$$

- c. If you need to raise over \$3100 for the trip how many pairs of gloves will you have to sell?

$$3100 = 5x + 220$$

$$2880 = 5x$$

$$x = 576$$

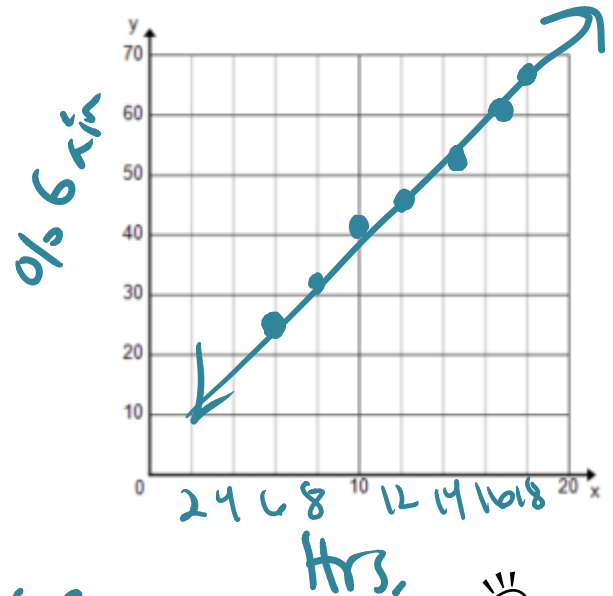
576 pairs



4) The data below shows hours spent researching the stock market per week and the percent gain for an investor. Find an equation of the line of best fit for gain with respect to hours of study. Label your axes and make a scatter plot.

Hours	6	8	10	12	14	16	18
% Gain	25	31.5	40.5	46	52.5	60.5	67

- a) Independent variable: # of hrs.
- Dependent variable: % gain



- b) Describe the correlation in words.

As the # of hrs. increase, the % gain increases.

- c) Write the equation of the L.O.B.F:

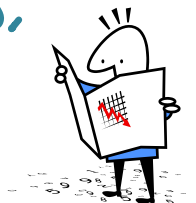
$$y = 3.5x + 4.14$$

- d) Explain the meaning of the y-intercept.

The stock was worth 4.14% when the investor started researching.

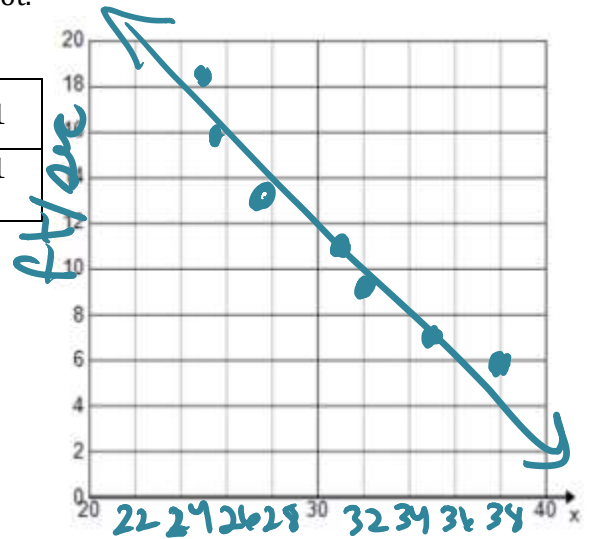
- e) Explain the meaning of the slope.

The investor gains 3.5% every hour.



5) You are collecting data on reaction speed of people in their 20's and 30's as they get older. The Table shows the data that you have collected. Label your axes and make a scatter plot.

$y$	SPEED(ft/sec)	18	7	15	16	9	6	11
$x$	AGE (years)	25	35	27	25	32	38	31



a) Independent variable: Age (yrs.)  
 Dependent variables: Reaction Speed (ft/sec)

b) Describe the correlation in words.

As a person's age increases their reaction speed decreases yrs.

c) Write the equation of the L.O.B.F.:

$$y = -.91x + 39.42$$



d) Explain the meaning of the y-intercept.

Nothing, the y-int. has no meaning in this problem.

e) Explain the meaning of the slope.

A person's reaction speed decreases  $-.91$  ft/sec every yr. they are alive.

f) What would you predict the reaction time of a 36 year old to be?

$$y = -.91(36) + 39.42$$

$$y = 6.66 \text{ ft/sec}$$

g) What would be the reaction time of a 72 year old. Why might you *not* want to use this regression equation to make this prediction?

$$y = -.91(72) + 39.42$$

$$y = -26.1 \leftarrow \text{what?!}$$

This would be an example of linear extrapolation. The data we are trying to predict is so far out of the trend of data that it is not a good prediction.

Extra Examples if you need them ☺

6. You want to start a paper route so you borrow some money from your parents to buy a new bike. After 8 weeks of deliveries you still owe your parents \$10. After 13 weeks of deliveries you have made \$140.



A) Define your variables: x

$w = \# \text{ of weeks}$

$m = \text{amt. of \$ you have}$

$(8, -10) \quad (13, 140)$

B) Write an equation in **SLOPE INTERCEPT FORM** that represents this situations.

$$m = \frac{140 - (-10)}{13 - 8} = \frac{150}{5} = 30$$

$$-10 = 30(8) + b$$

$$-10 = 240 + b$$

$$-250 = b \quad \boxed{y = 30x - 250}$$

C) How much did your bike cost?

D) What does the slope of your equation represent?

\$250

This is the \$ you borrowed from your parents in the beginning.

you are making \$30 per week on your route.

7. You and a few buddies start a website that becomes popular overnight. 550 people new people per day are opening accounts on your site. After 3 days there are already 1657 signed up for the site.



A) Define your variables

$x = \# \text{ of days}$

$y = \# \text{ of accounts}$

B) Write an equation in **SLOPE INTERCEPT FORM** that represents this situation.

$$y = 550x + b$$

$$1657 = 550(3) + b$$

$$1657 = 1650 + b$$

$$b = 7$$

$$\boxed{y = 550x + 7}$$

C) If your website can only support 20,000 users, how long will it be before you have to stop adding users?

$$20,000 = 550x + 7$$

$$19,993 = 550x$$

$$x \approx 36.4$$

After 36 days