

# LINEAR FUNCTION EXPLORATION

In order to complete this investigation, you will need to access the Excel file entitled LINEAR EQUATION EXPLORATION. This is the file LINEAR EQUATIONS found in the EXCEL-WKSHT folder. [See the DOWNLOADING EXCEL-WKSHT document for instructions in obtaining this file.]

*The file has some macros in it that need to be enabled for the file to work as needed. You may need to set the Macro security to Medium or below to allow Excel to open the file correctly (choose to enable macros if your computer asks). This file does seem to have issues on some versions of Microsoft Office running on Macs, so you may want to make sure you are running the file on a Windows PC.*

## **PART 1: SLOPE-INTERCEPT EQUATION OF A LINE**

Open the Excel file and select the worksheet entitled, **SLOPE-INTERCEPT**. Use the scroll bars on the worksheet to adjust the equation to the values needed.

1. Set  $m = 1$  and  $b = 0$ . This is the basic linear function  $y = x$ .
2. Keep the value of  $b$  constant and change the value of  $m$ .
  - (A) When  $m$  is positive, the line moves in what direction (up or down) as you follow the line from left to right?
  - (B) When  $m$  is negative, the line moves in what direction (up or down) as you follow the line from left to right?
  - (C) What type of line occurs when  $m = 0$ ? [You may want to adjust  $b$  at this point to verify your findings.]
3. Set  $m = 1$ .
  - (A) What happens to the line as you change the value of  $b$ ?
  - (B) Set  $b = -4$ . Where is the  $y$ -intercept of the line (that is, what is the value of  $y$  where the line crosses the  $y$ -axis)?
  - (C) Set  $b = 6$ . Where is the  $y$ -intercept of the line?
  - (D) Describe the relationship between the  $y$ -intercept and  $b$ .

4. Set  $b = 3$  and  $m = 1$ .

(A) Where is the  $y$ -intercept of this line?

(B) Does changing the value of  $m$  have any effect on the  $y$ -intercept? If so, how?

5. For each of the following, use the table on the worksheet to complete the listed coordinates for each of the given equations.

(A)  $y = -4x - 5$                       (i)  $(-2, \quad)$                       (ii)  $(5, \quad)$

(B)  $y = 6x + 1$                       (i)  $(-7, \quad)$                       (ii)  $(4, \quad)$

(C)  $y = 0.2x - 3$                       (i)  $(-5, \quad)$                       (ii)  $(8, \quad)$

(D)  $y = -0.5x + 6$                       (i)  $(-8, \quad)$                       (ii)  $(10, \quad)$

**Use the table on the worksheet or algebraic calculations to answer the following.**

6. What is the equation of the line that passes through  $(2, 5)$  and has a slope of  $-2$ ?

7. What is the equation of the line that passes through  $(-3, -5)$  and has a slope of  $5$ ?

8. What is the equation of the line that passes through  $(10, 6)$  and  $(-10, 4)$ ?

9. What is the equation of the line that passes through  $(2, -5)$  and  $(-4, 7)$ ?

## **PART 2: POINT-SLOPE EQUATION OF A LINE**

Select the worksheet entitled, **POINT-SLOPE**. Use the scroll bars on the worksheet to adjust the equation to the values needed.

1. Set  $m = 1$ ,  $h = 4$  and  $k = 5$ .

(A) What is the slope of the line?

(B) What is the point-slope equation of the line produced by these values?

(C) According to your textbook, the line should pass through  $(4, 5)$ . Verify that this occurs. Does changing the value of  $m$  change the fact that the line passes through  $(4, 5)$ ?

2. Set  $m = 1$ ,  $h = -4$  and  $k = -5$ .

(A) What is the slope of the line?

(B) What is the point-slope equation of the line produced by these values?

(C) According to your textbook, the line should pass through  $(-4, -5)$ . Verify that this occurs. Does changing the value of  $m$  change the fact that the line passes through  $(-4, -5)$ ?

3. Based on your findings from #1 and #2, list the coordinates that the line passes through and can be found by using the values of  $h$  and  $k$ . [You can use the worksheet to verify that you are correct.]

(A)  $y - 4 = 2(x + 3)$

(B)  $y + 1 = -3(x + 5)$

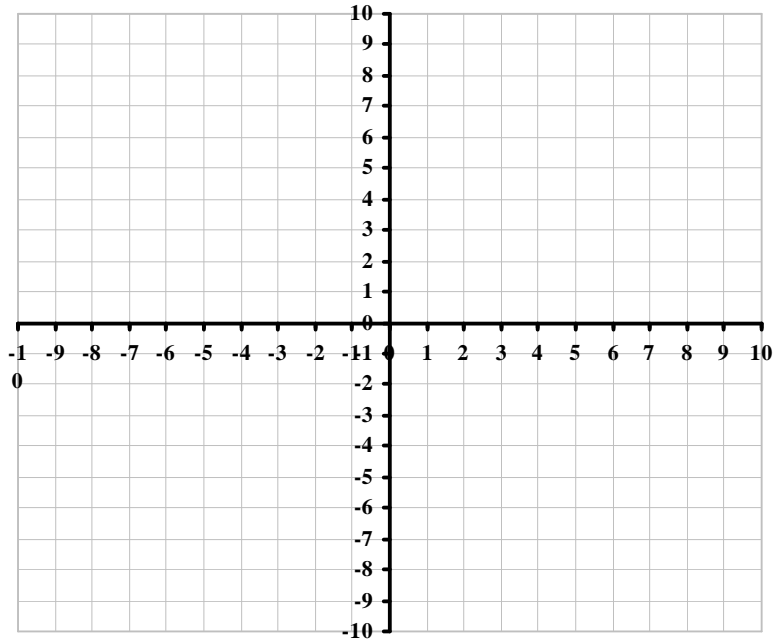
(C)  $y - 4 = 5(x - 6)$

(D)  $y + 7 = -6(x - 4)$

4. For each of the following, complete the table and sketch the graph of the line.

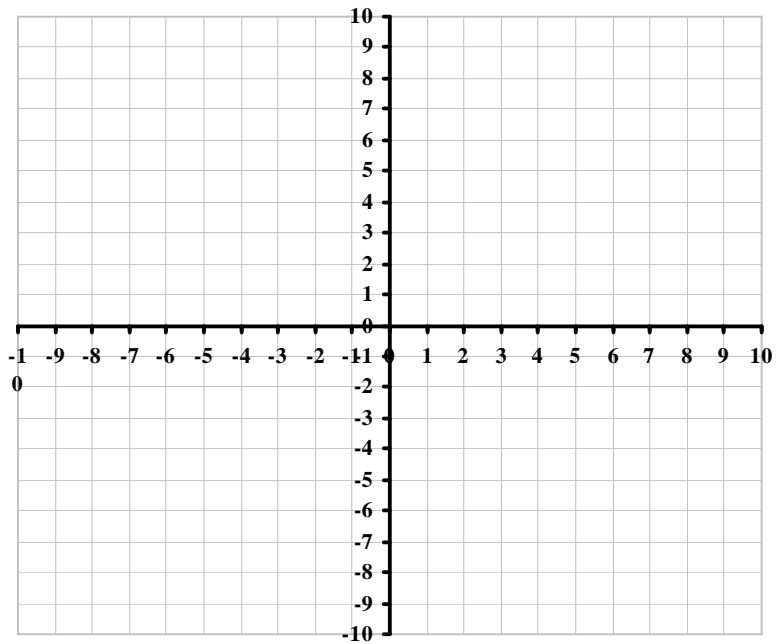
(A)  $y + 1 = 3(x - 2)$

$x$	$y$
-10	
-9	
-8	
-7	
-6	
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



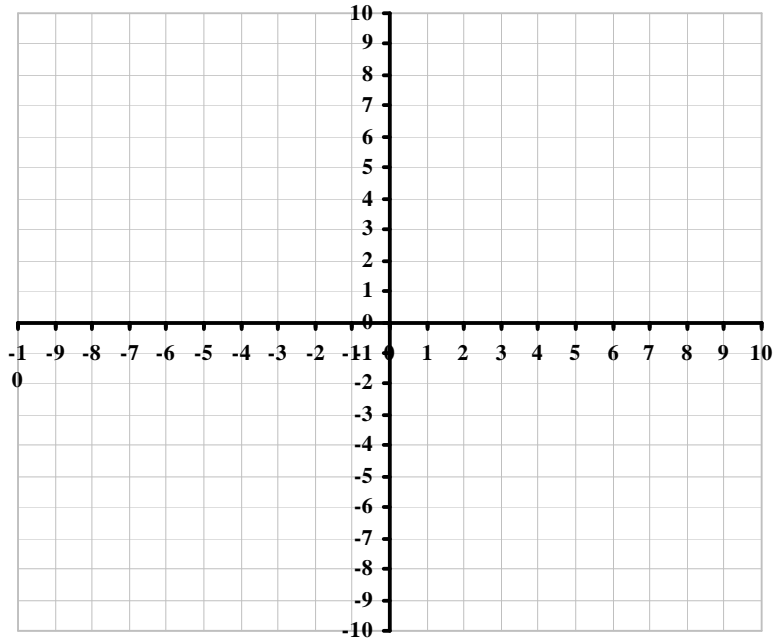
(B)  $y - 5 = 3(x - 4)$

$x$	$y$
-10	
-9	
-8	
-7	
-6	
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



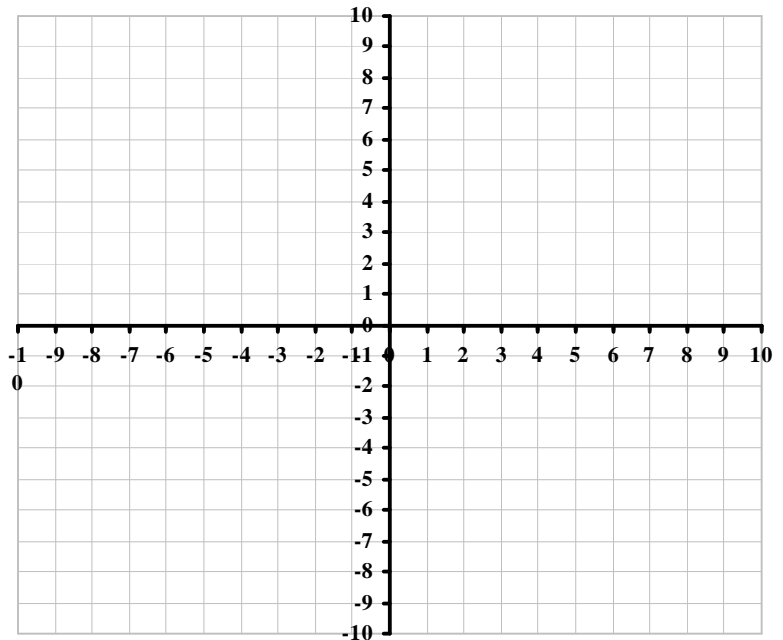
(C)  $y+10=3(x+1)$

$x$	$y$
-10	
-9	
-8	
-7	
-6	
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



(D)  $y-2=3(x-3)$

$x$	$y$
-10	
-9	
-8	
-7	
-6	
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



5. What do the lines in #4 have in common?
6. Use algebraic calculations to convert each of the point-slope equations in #4 to slope-intercept form. What occurs when you do this? Does this occurrence explain results you discussed in #5?

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**PART 3: SLOPE-INTERCEPT VS. POINT-SLOPE**

Select the worksheet entitled, **SI vs PS**. Use the scroll bars on the worksheet to adjust the equations to the values needed to answer the following.

1. Determine if the 2 equations given are of the same line.

	Slope-Intercept	Point-Slope
(A)	$y = 3x - 4$	$y - 2 = -3(x - 2)$
(B)	$y = -2x + 7$	$y - 5 = -2(x - 1)$
(C)	$y = 0.4x - 6$	$y - 4 = 0.4(x - 5)$
(D)	$y = -0.6x + 5$	$y - 8 = -0.6(x + 5)$
(E)	$y = 5x - 2$	$y + 7 = 5(x + 1)$
(F)	$y = 6x + 5$	$y + 6 = 6(x + 2)$
(G)	$y = -4x - 3$	$y - 5 = -4(x + 3)$
(H)	$y = 0.2x + 5$	$y - 7 = 0.2(x - 10)$
(I)	$y = -0.8x - 5$	$y + 9 = -0.8(x - 5)$
(J)	$y = x - 4$	$y - 3 = x - 7$

2. Write 2 point-slope equations that produce the same line as the equation given.

(A)  $y = -3x + 4$

(B)  $y = 2x - 3$

(C)  $y = 0.5x + 3$

(D)  $y = -0.2x - 6$

(E)  $y + 1 = -2(x - 3)$

(F)  $y - 4 = 3(x + 2)$

#### **PART 4: STANDARD EQUATION OF A LINE**

Select the worksheet entitled, **STANDARD**. Use the scroll bars on the worksheet to adjust the equations to the values needed to answer the following.

1. Set  $A = 0$ ,  $B = 2$ ,  $C = 1$ .

(A) What kind of line is produced with these settings?

(B) What is the slope of this line?

(C) What happens to the line when you change the value of  $C$ ?

(D) What happens to the line as the value of  $B$  is changed (as long as  $B \neq 0$ )?

2. Set  $A = 3$ ,  $B = 0$ ,  $C = 1$ .
- (A) What kind of line is produced with these settings?
- (B) What is the slope of this line?
- (C) What happens to the line when you change the value of  $C$ ?
- (D) What happens to the line as the value of  $A$  is changed (as long as  $A \neq 0$ )?
3. Find the slopes,  $x$ -intercepts and  $y$ -intercepts of the lines produced by the following equations.
- (A)  $3x - 4y = 12$
- (B)  $4x + 5y = 40$
- (C)  $-6x + 7y = -42$
- (D)  $-5x - 6y = -60$
- (E)  $8x - 3y = 48$
4. Use algebraic calculations to confirm your findings from #3. [Remember: An  $x$ -intercept has coordinates with a format  $(x, 0)$ . A  $y$ -intercept has coordinates with a format  $(0, y)$ .]

5. Which of the following standard equations are of the same line?
- (A)  $3x - 4y = 12$
  - (B)  $3x + 2y = 12$
  - (C)  $5x + 7y = 35$
  - (D)  $6x + 4y = 24$
  - (E)  $-9x - 6y = -36$
  - (F)  $4x - 9y = 36$
6. For the equations you chose in #5, convert them into slope-intercept format to confirm that they are the same line.

### **PART 5: SLOPE-INTERCEPT VS. STANDARD**

Select the worksheet entitled, **SI vs STANDARD**. Use the scroll bars on the worksheet to adjust the equations to the values needed to answer the following.

1. Write the slope-intercept equation of the line that is the same as those listed below.
- (A)  $6x + 4y = -12$
  - (B)  $3x - 5y = 15$
  - (C)  $-5x + 2y = 12$
  - (D)  $4x + 5y = 10$
  - (E)  $-3x - 10y = 60$

2. Convert the equations given in #1 to slope-intercept algebraically to verify that your findings are correct.

3. Write a standard equation that gives the same line as the following. [Note: There is more than one possible answer.]

(A)  $y = -3x + 4$

(B)  $y = 0.1x - 5$

(C)  $y = -0.4x - 2$

(D)  $y = 2x - 7$

(E)  $y = 4x + 5$

4. Use algebraic calculations to convert the standard equations that you found in #3 to slope-intercept to verify your answers from #3 are correct.

## **PART 6: FINAL SUMMARY**

**Write an answer to the following. Explain your answers.**

1. Based on what you have seen throughout this investigation, what are the advantages and disadvantages of using each type of format.

SLOPE-INTERCEPT:

ADVANTAGES:

DISADVANTAGES:

POINT-SLOPE:

ADVANTAGES:

DISADVANTAGES:

STANDARD:

ADVANTAGES:

DISADVANTAGES:

2. Slope-intercept is the most widely-used format in textbooks and even graphing calculators. From your work in this investigation, do you see any reasons as to why this is the case?