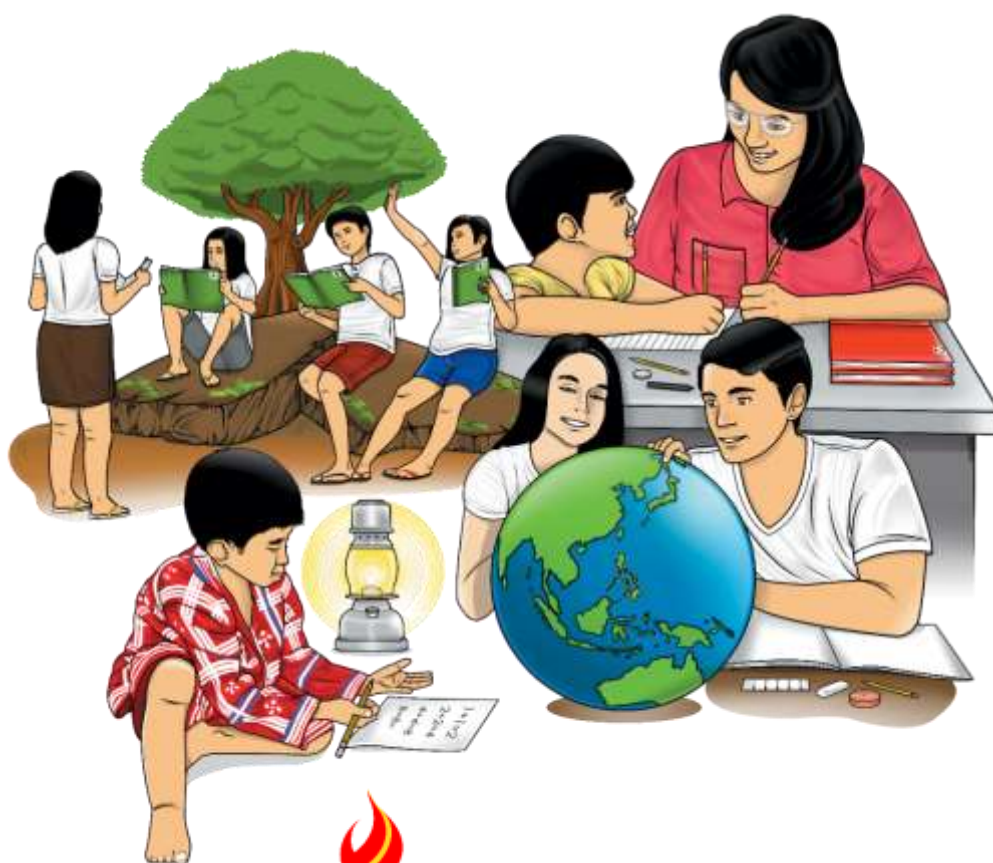


# Mathematics

## Quarter 2 – Module 1: “Differentiating Linear Inequalities and Linear Equations in Two Variables”



**Mathematics – Grade 8**

**Alternative Delivery Mode**

**Quarter 2 – Module 1: Differentiating Linear Inequalities and Linear Equations in Two Variables**

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# **Mathematics**

## **Quarter 2 – Module 1: “Differentiating Linear Inequalities and Linear Equations in Two Variables”**

## **Introductory Message**

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



## ***What I Need to Know***

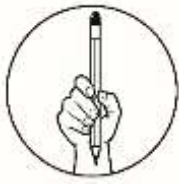
This module is designed to help you differentiate linear inequalities and linear equations in two variables. You are provided with varied activities to process the knowledge and skills learned and to deepen and transfer your understanding of the lesson. The scope of this module enables you to use it in many different learning situations. The lesson is arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

This module contains:

### Lesson 1: Linear Equations and Inequalities and Linear Equations in Two Variables

After going through this module, you are expected to:

1. distinguish the linear inequalities in two variables from linear equations in two variables;
2. translate mathematical phrases into mathematical statements of linear equations and inequalities in two variables; and
3. cite real life situations that can be represented by linear equations and inequalities in two variables.



## ***What I Know***

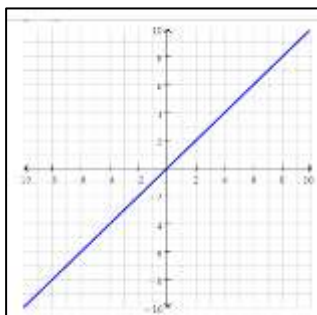
### **Pre-Assessment**

**Directions:** Choose the letter that corresponds to your answer. Write your answer on a separate sheet of paper. After taking the test, take note of the item that you were not able to answer correctly. Find the answer as you go through this module.

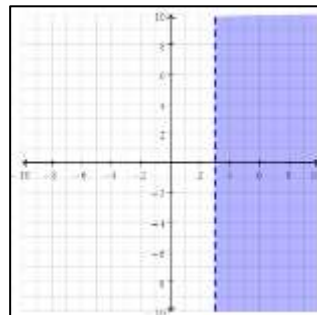
1. The following expressions are examples of linear inequalities in two variables EXCEPT:  
A.  $-x > 2y + 7$   
B.  $9x + 3y \geq 24$   
C.  $13x - 4y = 21$   
D.  $13x - 24y < 32$
2. Which of the following mathematical expressions is written in standard form?  
A.  $x < y + 5$   
B.  $2x + 3y < 12$   
C.  $2y + 6 > 3x$   
D.  $2x + 5 \leq x - 3y - 7$
3. The mathematical statements below are all linear inequalities in two variables EXCEPT:  
A.  $\frac{3}{y} < 10 - 2x$   
B.  $2x - y > 6$   
C.  $3x + 5y \geq 15$   
D.  $23 \leq 3x + 2y$
4. Which of the following verbal phrases DOES NOT represent a linear inequality in two variables?  
A. "the total number of male and female students in the learning center is 20"  
B. "the total number of male and female students in the learning center is at most 20"  
C. "the total number of male and female students in the learning center is greater than 20"  
D. "the total number of male and female students in the learning center is less than or equal to 20"
5. Which of the following is a linear inequality in two variables?  
A.  $4a - 3b > 5$   
B.  $7c + 4 < 12 - 3d^2$   
C.  $3xy \leq 16 + x$   
D.  $11 + 2t \geq 3t - 11$
6. Which inequality represents "the sum of x and y is at most 15"?  
A.  $x + y \geq 15$   
B.  $x + y > 15$   
C.  $x + y \leq 15$   
D.  $x + y < 15$

7. Which of the following is true about the graphical solutions of a linear inequality in two variables?
- It is a line.
  - It is a curve.
  - It is region of points bounded by a curve.
  - It is a region of points bounded by a line.
8. The statement “the sum of two numbers is at least 29” can be expressed as:
- $x + y > 29$
  - $x + y < 29$
  - $x + y \geq 29$
  - $x + y \leq 29$
9. By which condition does the symbol of a linear inequality in two variables reverses its directions?
- adding or subtracting negative real numbers
  - adding or subtracting positive real numbers
  - multiplying or dividing positive real numbers
  - multiplying or dividing negative real numbers
10. Which of the following is true about the graph of linear inequalities?
- It is a line.
  - It is a curve.
  - It is a parabola.
  - It is a half-plane.
11. Which of the following represents the graph of linear inequality in two variables?

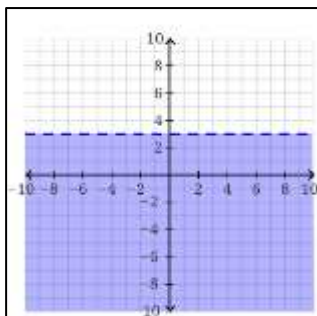
A.



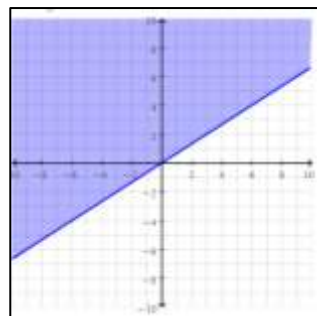
C.



B.



D.



12. Which statement best describes the graph of a linear equation in two variables?
- A. It is a line.
  - B. It is a curve.
  - C. It is region of points bounded by a curve.
  - D. It is a region of points bounded by a line.
13. James is asked what inequality symbol to be used to translate **at most** in the mathematical sentence *5 times a number y plus 2 times a number x is at most 15*. His answer is  $<$ . Is he correct?
- A. Yes, because the symbol for at most is  $<$ .
  - B. Yes, because the symbol for at most is  $>$ .
  - C. No, because the symbol for at most is  $\geq$ .
  - D. No, because the symbol for at most is  $\leq$ .
14. How does the graph of a linear inequality in two variables look like?
- A. It is a line.
  - B. It is a curve.
  - C. It is region of points bounded by a curve.
  - D. It is a region of points bounded by a line.
15. John is multiplying the  $-2$  to the linear inequality of two variables,  $2x - 3y \geq 5$  and his answer is  $-4x + 6y \leq -10$ . Is he correct?
- A. Yes, because the product of the terms is correct, and the direction of the inequality symbol is reversed.
  - B. Yes, because the product of the terms is correct, and the direction of the inequality symbol does not change.
  - C. No, because multiplying a negative integer reverses only the direction of the inequality symbol.
  - D. No, because multiplying a negative integer does not reverse the direction of the inequality symbol.



**Lesson****1****Differentiating Linear Inequalities and Linear Equations in Two Variables**

Let's start this module by recalling how to transform linear equations in two variables in its standard form.

***What's In*****Activity: Express Me**

**Directions:** Express the following linear equations in two variables into its standard form  $Ax + By = C$ . Write your answer in a separate sheet.

Given	Standard Form
1. $2x = y - 3$	
2. $y = -4x + 7$	
3. $2y = 8x - 9$	
4. $x = 2y + 4$	
5. $x - 3y - 7 = 0$	

Questions:

1. How did you find the activity?
2. How did you transform the given equation into its standard form?



## ***What's New***

### **Activity: Be my partner!**

**Directions:** Match the verbal statement in column A to the mathematical statement in Column B. Write your answers on a separate sheet of paper.

#### **A**

- \_\_\_\_\_ 1. Fourteen more than a number  $x$  is greater than 24
- \_\_\_\_\_ 2. Seven increased by a number  $x$  is equal to  $y$
- \_\_\_\_\_ 3. Twice the sum of a number  $x$  and seven is 9
- \_\_\_\_\_ 4. Seven more than the product of fourteen and a number  $x$  is less than or equal to 18
- \_\_\_\_\_ 5. A number  $x$  subtracted from fourteen is less than  $y$

#### **B**

- A.  $14 - x < y$
- B.  $2(x + 7) = 9$
- C.  $14 + x > 24$
- D.  $7 + x = y$
- E.  $14x + 7 \leq 18$
- F.  $7 + x > y$

#### Questions:

- a. How did you find the activity?
- b. What did you observe with the symbols used in each mathematical statement?
- c. What is the difference between symbol “=” from the symbol “≥”?
- d. When shall you use the symbols  $\geq$  and  $\leq$ ? How about symbols “>” and “<”?
- e. When do you use symbol “=”?
- f. What do you call mathematical statements a and d? How about b, c, e?



## What is It

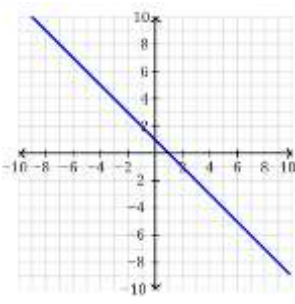
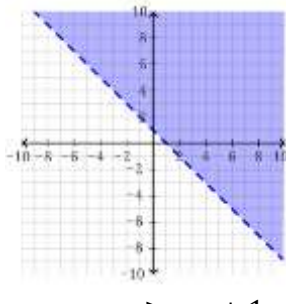
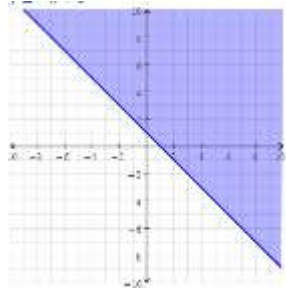
Equations and inequalities are two significant concepts in mathematics that are related but are different in some ways. **Inequality** is a mathematical statement where one expression is not equal to another. It uses the symbols  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ , or  $\neq$ .

While **equation** uses the symbol “=” indicating that the value of the expressions from both sides are equal.

The table below defines Linear Equations and Linear Inequalities in two variables. See how these two differ from each other under several conditions.

Point of Differences	Linear Equation		Linear Inequality	
Definition	A linear equation in two variables is written in the standard form of $Ax + By + C = 0$ , where $A, B$ , and $C$ are real numbers and the coefficients of $x$ and $y$ , represented by $A$ and $B$ respectively, are not equal to zero.		A linear inequality in two variables is formed when symbols other than equal to, such as greater than or less than are used to relate two expressions, and two variables are involved.	
Standard Form	$Ax + By = C$		$Ax + By < C$ $Ax + By > C$ $Ax + By \geq C$ $Ax + By \neq C$ $Ax + By \leq C$	
Symbols Used	Symbol	“Read as”	Symbol	“Read as”
	=	“is equal to”, “equals to”, “is”, “equals”	$<$	“is less than”, “is below”, “is smaller than”
			$>$	“is greater than”, “is above”, “is more than”
			$\leq$	“is less than or equal to”, “is at most”, “is not to exceed”, “is maximum”,

			$\geq$	“is greater than or equal to”, “is at least”, “is minimum”
			$\neq$	“is not equal to”
Translating Verbal Statements to Mathematical Statements	1. The sum of a number $x$ and a number $y$ is 24.		1. The sum of a number $x$ and a number $y$ is greater than 24.	
	$x + y = 24$		$x + y > 24$	
	2. A number $x$ decreased by $y$ is 24.		2. A number $x$ decreased by a number $y$ is less than 24.	
	$x - y = 24$		$x - y < 24$	
	3. The sum of twice a number $x$ and thrice a number $y$ is 30.		3. The sum of twice a number $x$ and thrice a number $y$ is at least 30.	
	$2x + 3y = 30$		$2x + 3y \geq 30$	
	4. Twice a number $x$ decreased by thrice a number $y$ is 30.		4. Twice a number $x$ decreased by thrice a number $y$ is at most 30.	
	$2x - 3y = 30$		$2x - 3y \leq 30$	
Characteristics of the graph	Straight line		Plane or half-plane	

Sample graphs	$y = -x + 1$ 	$y > -x + 1$  $y \geq -x + 1$ 
Graphical solutions	set of points on the line	region of points bounded by a line
Effects when multiplied or divided by a negative integer	Equality symbol is not changed	Direction of the inequality symbol is reversed

Example:

### 1. Multiplying with a Negative Integer

Linear Equation:  $3x - 2y = 6$

$$3x - 2y = 6$$

Given.

$$3x + (-3x) - 2y = (-3x) + 6$$

Add both sides with  $-3x$

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

$$-2y = -3x + 6$$

$$\left(-\frac{1}{2}\right)(-2y) = (-3x + 6)\left(-\frac{1}{2}\right)$$

Multiply both sides by  $-\frac{1}{2}$

$$\left(-\frac{1}{2}\right)(-2y) = (-3x)\left(-\frac{1}{2}\right) + (6)\left(-\frac{1}{2}\right)$$

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

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

Simplify.  
Equality symbol does not change

Linear Inequality:  $3x - 2y > 6$

$$3x - 2y > 6$$

Given.

$$3x + (-3x) - 2y > (-3x) + 6$$

Add both sides  
with  $-3x$

$$0 - 2y > (-3x) + 6$$

$$-2y > -3x + 6$$

$$\left(-\frac{1}{2}\right)(-2y) > (-3x + 6)\left(-\frac{1}{2}\right)$$

Multiply both  
sides by  $-\frac{1}{2}$

$$\left(-\frac{1}{2}\right)(-2y) > (-3x)\left(-\frac{1}{2}\right) + (6)\left(-\frac{1}{2}\right)$$

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

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

Simplify.  
*Direction of the  
inequality  
symbol is  
reversed*

## 2. Dividing with a Negative Integer

Linear Inequality:  $3x - 2y > 6$

$$3x - 2y > 6$$

Given.

$$3x + (-3x) - 2y > (-3x) + 6$$

Add both sides  
with  $-3x$

$$0 - 2y > (-3x) + 6$$

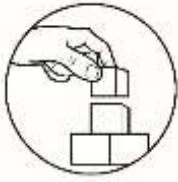
$$-2y > -3x + 6$$

$$\left(\frac{-2y}{-2}\right) > \frac{-3x}{-2} + \frac{6}{-2}$$

Divide both sides  
by  $-2$

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

Simplify.  
*Direction of the  
inequality  
symbol is  
reversed*



## What's More

### Activity 1: Sort me well!

**Directions:** Below are mathematical statements. Classify these statements in the column where they belong. Write your answer in a separate sheet.

$y = 7x + 21$	$y \leq 7x + 21$	$3y - 7 = 5x$
$3y - 7 < 5x$	$10 - 5y = 7x$	$10 - 5y \geq 7x$
$y = 5x + 20$	$3x + 4y < 15$	$3x + 4y = 15$
	$y > 5x + 20$	

Linear Inequality in two variables	Linear equations in two variables

Questions:

- Which mathematical statements are linear inequalities in two variables? Linear equations in two variables?
- How did you identify linear inequalities in two variables and linear equations in two variables?
- In what way does  $y \leq 7x + 21$  different from  $y = 7x + 21$ ? How about  $3y - 7 < 5x$  and  $3y - 7 = 5x$ ?
- How do you differentiate linear inequalities in two variables from linear equations in two variables?

## Activity 2: Name Me!

**Directions:** Identify whether the situation represents a linear inequality in two variables or not. Write **LI** if it is, otherwise write **NLI**. Write your answer in separate sheet of paper.

1. The difference of the number of a 50 –peso tickets ( $t$ ) and 75 –peso tickets ( $s$ ) is not equal to 200.
2. The price of a refrigerator ( $r$ ) is greater than the price of a washing machine ( $w$ ) increased by Php850.
3. The number of girls ( $g$ ) in the theater arts club is 3 more than twice the number of boys ( $b$ ).
4. A dozen of oranges ( $o$ ) added to two dozen of apples ( $a$ ) has a total cost of at most Php 1, 950.
5. The number of red marbles ( $r$ ) is more than twice the number of yellow marbles ( $y$ ).

Questions:

1. Which of the statements represent linear equations in two variables? Which statements represent linear inequalities in two variables?
2. How did you identify if the statement represents a linear equation in two variables? How about the statement of linear inequalities in two variables?

## Activity 3: What am I?

**Directions:** Translate mathematical statements into mathematical sentences of linear equations and linear inequalities in two variables. Write your answer on a separate sheet.

Mathematical Statements	Mathematical Sentences
1. $20 - 2x < y$	
2. $15 + 3x = 2y$	
3. $2(x + 9) = 2y$	
4. $3y + 5 > y$	
5. $2y + 3x \leq 75$	

Questions:

1. Which of the statements represent linear equations in two variables? Which statements represent linear inequalities?
2. How did you translate mathematical statements into mathematical sentences?



## Activity 4. Shall I Stay or Be the Other Way?

**Directions:** Write the resulting mathematical statements after applying the condition specified in each item. Write your answers on a separate sheet.

Mathematical Statements	Condition	Resulting Mathematical Statements
1. $-y = -x - 3$	Multiply both sides by $-1$	
2. $-2y < -4x - 6$	Multiply both sides by $-1/2$	
3. $-3y > x + 5$	Multiply both by $-1/3$	
4. $-3y \leq -x - 3$	Divide both sides by $-3$	
5. $-4y \geq 3x + 11$	Divide both sides by $-4$	



## *What I Have Learned*

### Remember Me!

**Directions:** Fill in the blank with an appropriate word or phrase. Write your answer in a separate sheet of paper.

A mathematical statement where one expression is not equal to another expression is called an 1\_\_\_\_\_. The usual symbols of inequality are  $>$  (greater than),  $<$  (2\_\_\_\_\_),  $\geq$  (3\_\_\_\_\_),  $\leq$  (is less than or equal to), and  $\neq$  (is not equal to). On the other hand,  $=$  (equal) is the symbol used for linear equations in two variables.

A Linear 4\_\_\_\_\_ in two variables can be written in one of the following forms:

$$Ax + By < C$$

$$Ax + By \leq C$$

$$Ax + By > C$$

$$Ax + By \geq C$$

Both linear equations and linear inequality in two variables can also be presented through graph. The graph of linear inequality is a 5\_\_\_\_\_ or a 6\_\_\_\_\_. On the other hand, the graph of a linear equation is a 7\_\_\_\_\_.

When a linear 8\_\_\_\_\_ in two variables is multiplied or divided by a negative integer, the equality symbol does not change. However, when a linear inequality in two variables is 9\_\_\_\_\_ or 10\_\_\_\_\_ by a negative integer, the direction of the inequality symbol changes.



## ***What I Can Do***

### **Words Are All I Have**

**Directions:** Write a poem/spoken poetry describing the differences of linear equations and inequalities in two variables.

#### **Rubric: Poem/Spoken Poetry Piece**

<b>10</b>	<b>8</b>	<b>6</b>	<b>4</b>
The literary piece contains at least 5 differences of linear equations and linear inequalities in two variables.	The literary piece contains at least 3 differences of linear equations and linear inequalities in two variables.	The literary piece contains at least 2 differences of linear equations and linear inequalities in two variables	The literary piece contains only 1 difference of linear equations and linear inequalities in two variables.



## Assessment

### Post Assessment

**Directions:** Read the following questions carefully and choose the letter that corresponds to your answer. Write your answers on a separate sheet of paper.

1. Which of the following is NOT a symbol of linear inequality?  
A.  $=$  C.  $\neq$   
B.  $\geq$  D.  $<$
2. What is the graph of linear inequality?  
A. a half plane C. parabola  
B. half of parabola D. straight line
3. Which is true about the graphical solution of inequalities in two variables?  
A. region of points C. sets of planes  
B. sets of points D. region of plane
4. Which of the following shows linear inequality in two variables?  
A.  $6a - 3a = 9$  C.  $3p \leq 4 + p$   
B.  $k + 4 < 8 + 2k$  D.  $21m \geq 2n - 15$
5. Which of the following inequalities is the same as “the sum of  $2x$  and  $y$  is at least 20”?  
A.  $2x + y \geq 20$  C.  $2x + y \leq 20$   
B.  $2x + y > 20$  D.  $2x + y < 20$
6. Which of the following is true about the graphical solutions of a linear equation in two variables?  
A. It has no solution.  
B. It has only two solutions.  
C. It is a set of points on a line.  
D. It is a region of points bounded by a line.
7. The mathematical statements below are all linear inequalities in two variables EXCEPT:  
A.  $2x - y > 6$  C.  $3x < 2y + 10$   
B.  $x + 5x \geq 15$  D.  $53 \leq 5m + 2n$

8. Which of the following is true about the graph of linear equation in two variables?

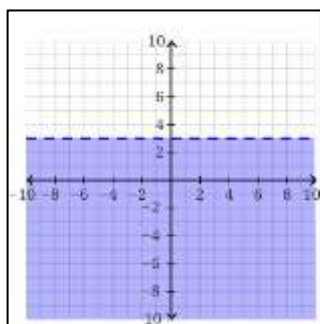
- A. It is a plane.
- B. It is half of parabola.
- C. It is a parabola.
- D. It is a straight line.

9. The following linear inequalities in two variables are in standard form EXCEPT

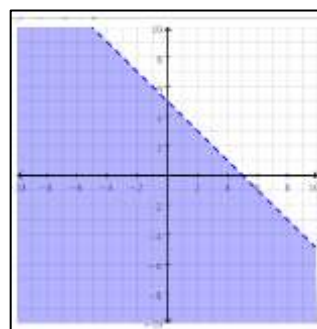
- A.  $y > 2x + 25$
- B.  $x - 2y < 25$
- C.  $2x - 3y \leq 25$
- D.  $5x + 2y \geq 25$

10. The following represent the graph of linear inequality in two variables EXCEPT

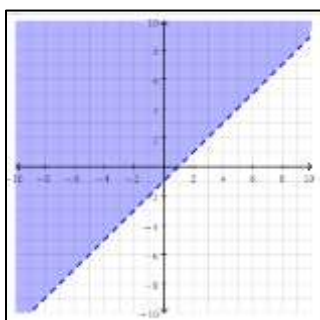
A.



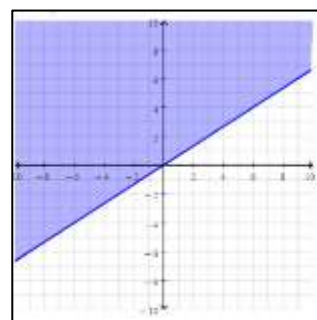
C.



B.



D.



11. What condition/s reverses the direction of the inequality symbol in a linear inequality?

- A. adding negative integers to both sides of the expression
- B. subtracting negative integers to both sides of the expression
- C. multiplying or dividing positive integers to both sides of the expression
- D. multiplying or dividing negative integers to both sides of the expression

12. How does the graph of a linear inequality in two variables look like?

- A. It is a line.
- B. It is a curve.
- C. It is a region of points bounded by a line.
- D. It is a region of points bounded by a curve.

13. Peter is multiplying  $-3$  to the linear inequality in two variables,  $4x - 6y \geq 5$  his answer is  $-12x + 18y \leq -15$ . Is he right?
- Yes, because the product of the terms is correct and the direction of the inequality symbol is reversed.
  - Yes, because the product of the terms is correct and the direction of the inequality symbol does not change.
  - No, because multiplying a negative integer reverses only the direction of the inequality symbol.
  - No, because multiplying a negative integer does not change the direction of the inequality symbol.
14. Which of the following statements best describe a linear inequality in two variables?
- The graph is a set of points or a line
  - It involves the following symbols  $<, >, \geq, \leq, \neq$
  - The direction of the inequality symbol reverses when multiplied by a negative integer
- I & II
  - I & III
  - II & III
  - I, II & III
15. Kim is asked what inequality symbol to be used to translate at least in the mathematical sentence *8 times a number y minus 3 times a number x is at least 30*. Her answer is  $>$ . Is she correct?
- Yes, because the symbol for at least is  $<$ .
  - Yes, because the symbol for at least is  $>$ .
  - No, because the symbol for at least is  $\geq$ .
  - No, because the symbol for at least is  $\leq$ .



## Additional Activities

**Direction:** Cite real-life situations in your community that represent linear equations and inequalities in two variables.

**Rubric:**

10	8	6	4
At least 6 real- life situations are cited.	4-5 real- life situations are cited.	2-3 real- life situations are cited.	Only 1 real- life situation is cited.



## Answer Key

### What I Know

1. C
2. B
3. A
4. A
5. A
6. C
7. D
8. C
9. D
10. D
11. D
12. A
13. D
14. D
15. A

### What's New

1. C
2. D
3. B
4. E
5. A

### What's In

1.  $2x - y = -3$
2.  $4x + y = 7$
3.  $8x - 2y = 9$
4.  $x - 2y = 4$
5.  $x - 3y = 7$

### What's More

#### Activity 1

1. $y = 7x + 21$	1. $y \geq 7x + 21$
2. $y = 5x + 20$	2. $y > 5x + 20$
3. $3y - 7 = 5x$	3. $3y - 7 < 5x$
4. $10 - 5y = 7x$	4. $10 - 5y \geq 7x$
5. $3x + 4y = 15$	5. $3x + 4y < 15$

#### Activity 2

1. LI
2. LI
3. NLI
4. LI
5. LI

#### Activity 3

1. Twice the number x subtracted from 20 is less than y.	1.
2. Fifteen increased by thrice the number x is equal to twice the number y.	2.
3. Twice the sum of a number x and 9 is twice a number y.	3.
4. Five more than 3 times a number x is less than a number y.	4.
5. Thrice a number x increased by twice a number y is at most 75.	5.

#### Activity 4

Mathematical Expressions	Condition	Resulting mathematical expressions
$1. -y = -x - 3$	Multiply both sides by -1	$y = x + 3$
$2. -2y < -4x - 6$	Multiply both sides by -1/2	$y > 2x + 3$
$3. -3y > x + 5$	Multiply both sides by -1/3	$y < -\frac{x}{3} - \frac{5}{3}$
$4. -3y \leq -x - 3$	Divide both sides by -3	$y \geq \frac{x}{3} + 1$
$5. -4y \geq 3x + 11$	Divide both sides by -4	$y \leq -\frac{3x}{4} - \frac{11}{4}$

### What I Have Learned

1. Inequality
2. less than
3. greater than
- or equal to
4. inequality
5. plane
6. half-plane
7. line
8. equation
9. multiplied
10. divided

### Assessment

1. A
2. A
3. A
4. D
5. A
6. C
7. B
8. D
9. A
10. A
11. D
12. C
13. A
14. C
15. C

## ***References***

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