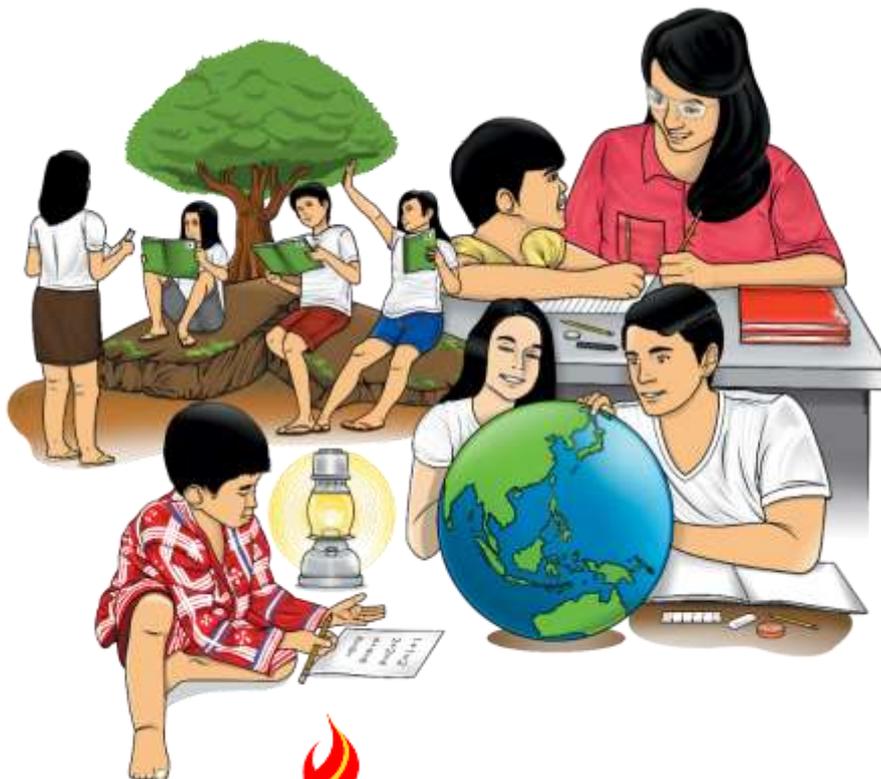


Mathematics

Quarter 1 – Module 8: “Illustrating the Slope of a Line”



Mathematics – Grade 8
Alternative Delivery Mode
Quarter 1 – Module 8: Illustrating the Slope of a Line
First Edition, 2020

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8

Mathematics

Quarter 1 – Module 8:

“Illustrating the Slope

of a Line”

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

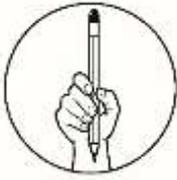
This module helps you understand how slope of a line can be used to describe the steepness of a line. It is here to guide you on how to find the rate of change or the slope of a line given two points, equation, and graph. The scope of this module enables you to use it in many different learning situations. 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 – Illustrating Slope of a Line Given Two Points, Equation and Graph

After going through this module, you are expected to:

1. describe the slope of a line;
2. determine the slope of a line given two points, equation, and graph; and
3. reflect on the relevance of the slope of a line in real-life setting.



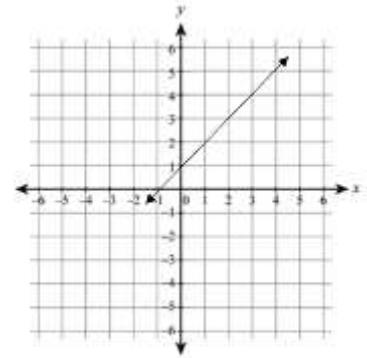
What I Know

Directions: Read the questions carefully and choose the letter of the correct answer. Write your answer on a separate sheet of paper.

- The steepness of the line also commonly known as rise over run is called _____.
 - linear equation
 - linear function
 - linear inequality
 - slope
- Which formula is used in finding the slope if two points of a line are given?
 - $m = \frac{y_2 - y_1}{x_2 - x_1}$
 - $m = \frac{y_2 - x_1}{x_2 - y_1}$
 - $m = \frac{x_2 - x_1}{y_2 - y_1}$
 - $m = \frac{y_2 - x_2}{y - x_1}$
- Which of the following statements DOES NOT describe a slope?
 - It can be found using a graph.
 - It can be determined using a point.
 - It is referred to as the rise over run.
 - It describes the steepness of a line.
- When can a slope of a line be equal to zero?
 - When the values of x vary.
 - When the values of y vary.
 - When the values of x are constant.
 - When the values of y are constant.
- When can a slope become undefined?
 - When the values of x vary.
 - When the values of y vary.
 - When the values of x are constant.
 - When the values of y are constant.
- What is the slope of a line that has coordinates (5, 18) and (5, -12)?
 - 0
 - 1
 - undefined
 - negative

7. What is the slope of a line illustrated in the graph at the right?

- A. -1
- B. 0
- C. 1
- D. undefined



8. What is the slope of a line that passes through the points (8,3) and (-3,3)?

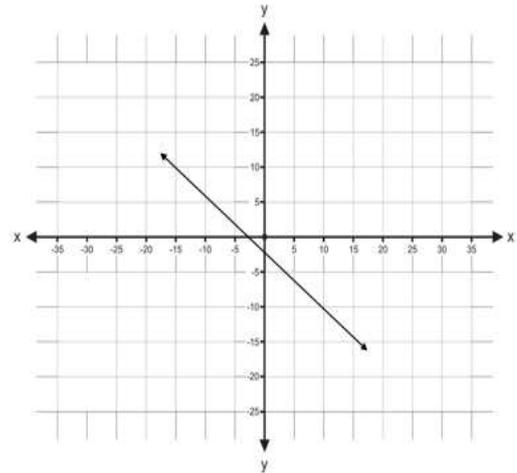
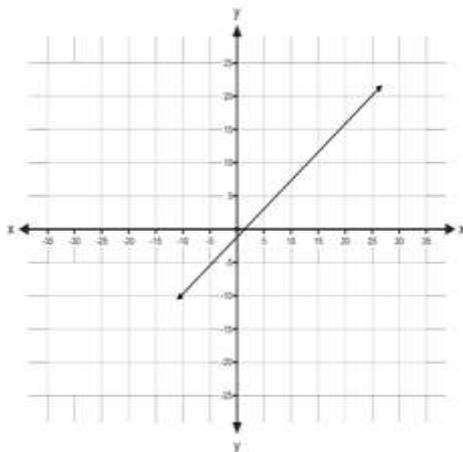
- A. -8
- B. 0
- C. 1
- D. undefined

9. What is the slope of a line with the equation $8x - 12y = 6$?

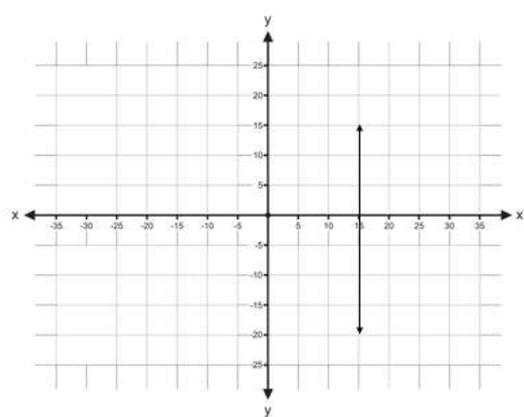
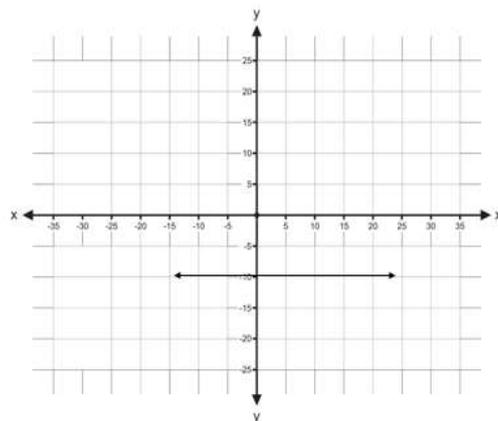
- A. $-\frac{2}{3}$
- B. $-\frac{3}{2}$
- C. $\frac{2}{3}$
- D. $\frac{3}{2}$

10. Which of the following graphs below describes a positive slope?

- A.
- C.



- B.
- D.



11. Which of the following pair of points have a slope 5?

- A. (2, -5), (3, -10)
- B. (-2, 5), (-3, 10)
- C. (2, 5), (3, 10)
- D. (-2, 5), (3, 10)

Lesson

1

Slope of a Line

(Given Two Points, Equation and Graph)

Have you experienced climbing a hill, a mountain, stairs, or ladders? How about pushing someone on a wheelchair down the ramp? Which do you think is difficult to climb, a very slanting ladder or a less slanting ladder? Do you think there would be difference in speed when you walk on a flat ground than walking down a hilly road? Would it be possible to walk on the wall? What danger would it cause?



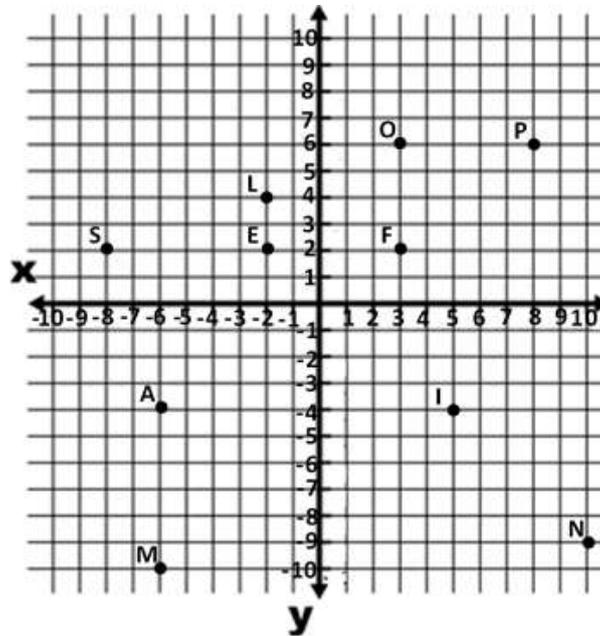
In this lesson, you will find out the answers to these questions and determine the importance of learning the slope of a line and its applications.



What's In

Let us start this module by refreshing our memories on determining the coordinates of the point and describing its location with respect to the origin.

Directions: Describe the location of the abscissa (x –coordinate) and the ordinate (y –coordinate) with respect to the origin and determine the coordinates of each point on the graph shown below. Write your answers on the table. Point S is provided as your guide. Then answer the questions that follow.



Point	Coordinates (x, y)	Location of Abscissa from the Origin (units left/right)	Location of Ordinate from the Origin (units above/below)
S	$(-8, 2)$	8 units to the left	2 units above
L			
O			
P			
E			
F			
A			
M			
I			
N			

Questions:

1. Did you find difficulty in describing the locations of the points?
2. Were you able to locate and describe the location of each point?
3. Looking back at the graph, are points A and M vertically aligned?
4. What is the distance between points A and M?

5. Name all pairs of vertically aligned points and determine the distance between the two vertically aligned points.
6. Are points A and I horizontally aligned?
7. What is the distance between points A and I?
8. Name all pairs of horizontally aligned points and determine the distance between the two horizontally aligned points.
9. What is the ratio of the vertical distance of points A and M to the horizontal distance of A and I?
10. If you connect points M and I, you will form a slant line. The slant of a line is referred to as the slope of a line. What is a slope of a line?

Let us deepen our understanding about slope of the line by doing the next activity.



What's New

Observe each situation below and answer the question/s that follow/s.

Situation 1: Teacher Carlo is travelling to two different hilly roads.

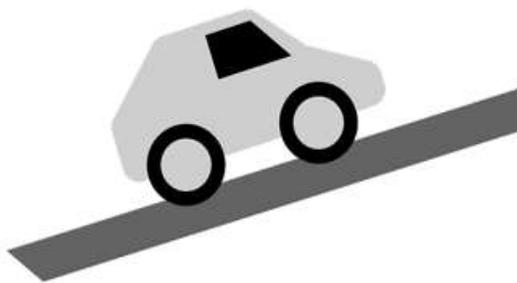


Fig. 1 Road 1

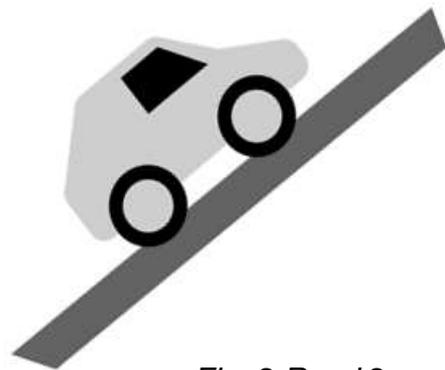


Fig. 2 Road 2

Which road is difficult to drive?

Situation 2: After reaching the top of the hilly roads, Teacher Carlo needs to drive down the hilly roads.

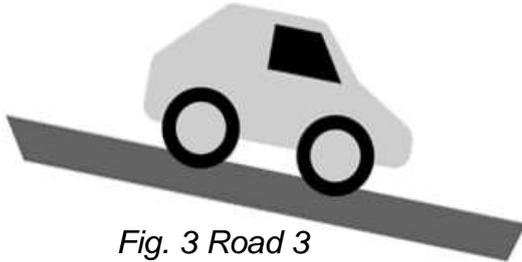


Fig. 3 Road 3

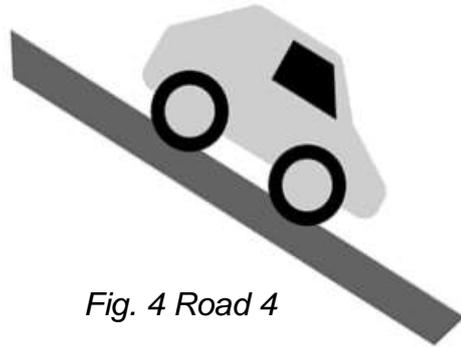


Fig. 4 Road 4

Which road will build up speed?

Situation 3. After moving down the hill, Teacher Carlo is now driving on a flat ground.

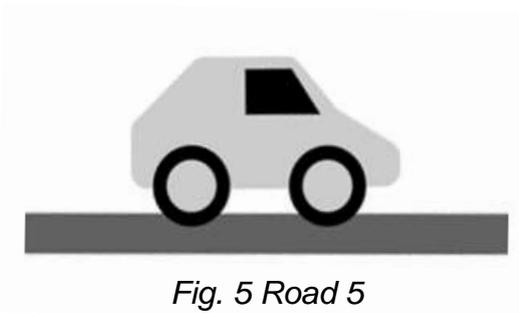


Fig. 5 Road 5

Do you think he can send text message to his friends? Why? Why not?

Situation 4. Is it possible for Teacher Carlo to drive like the illustrations below? Why?

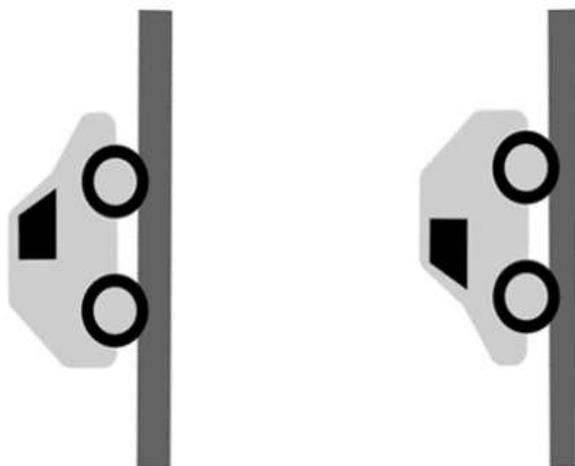


Fig. 6 Road 6



What Is It

The steepness of the hilly roads (represented by slightly slant road and more slant road) where Teacher Carlo drives up and down is called the **slope**.

The **slope**, represented by m , is defined as the *ratio of the vertical change between two points to the horizontal change between the same two points*. The vertical change is referred to as the rise and the horizontal change as the run. In symbol,

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

In situation 1 of the previous activity, Teacher Carlo is driving up the hilly roads, hence the *slope is positive*. Take note that *the steeper the hilly road that Teacher Carlo drives, the larger is the slope*.

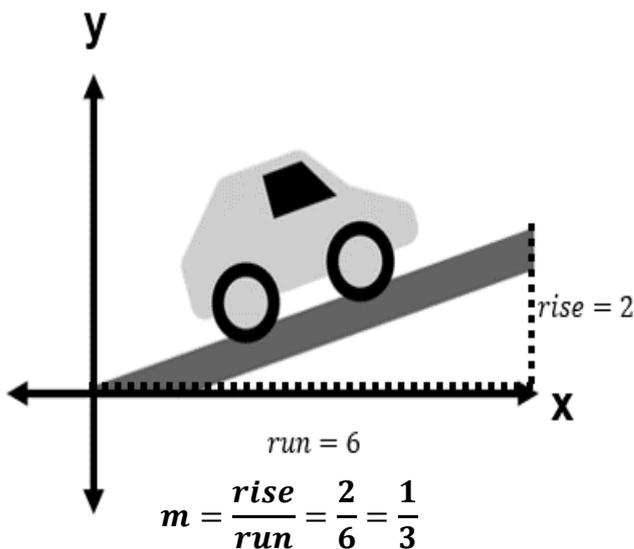


Fig. 1 Road 1

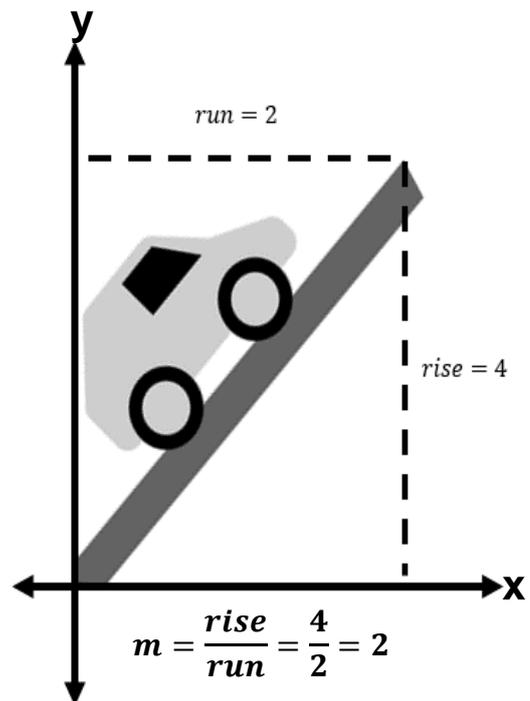


Fig. 2 Road 2

Looking back at situation number 2, Teacher Carlo is driving down the hilly roads. The *steeper the road*, the more the car builds up speed, and the *more the slope becomes negative*.

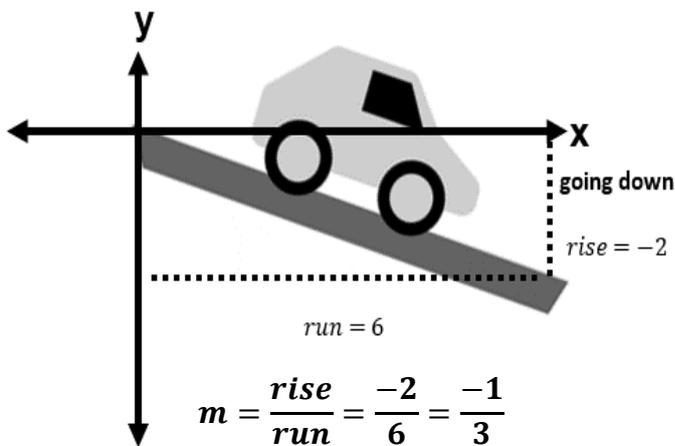


Fig. 3 Road 3

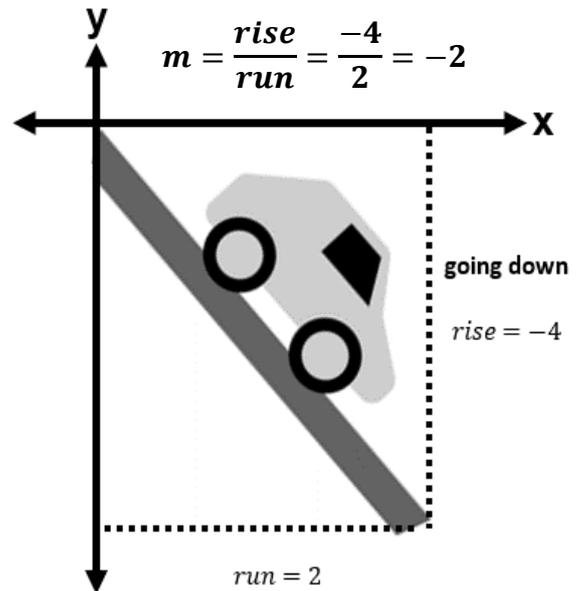


Fig. 4 Road 4

In situation 4, Teacher Carlo is driving on a flat ground. As you can see there is no vertical change. This means that the *slope is zero*.

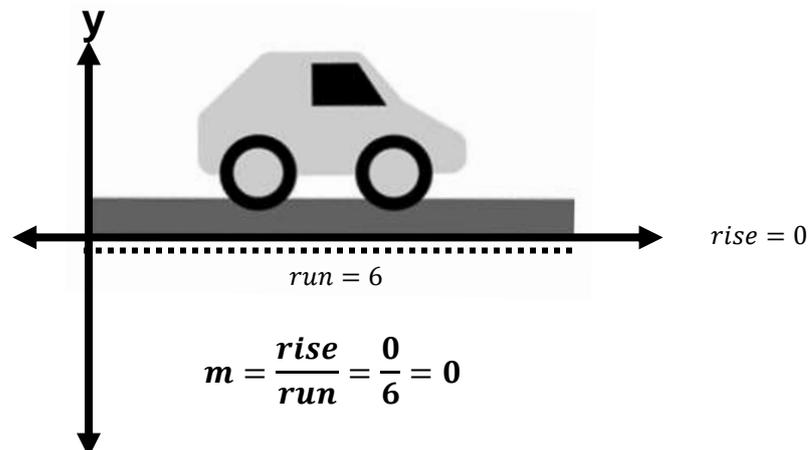


Fig. 5 Road 5

Is Teacher Carlo free to send text messages to anyone? The answer is **NO**.

Republic Act No. 10913 known as the Anti-Distracted Driving Act prohibits distracted driving by restricting and penalizing the use of mobile phones and other electronic devices while driving on any public thoroughfare, highway or street in the Philippines.

Driving like in Situation 4 is a **BIG NO**. It is not possible. What do you think is the slope in this situation?

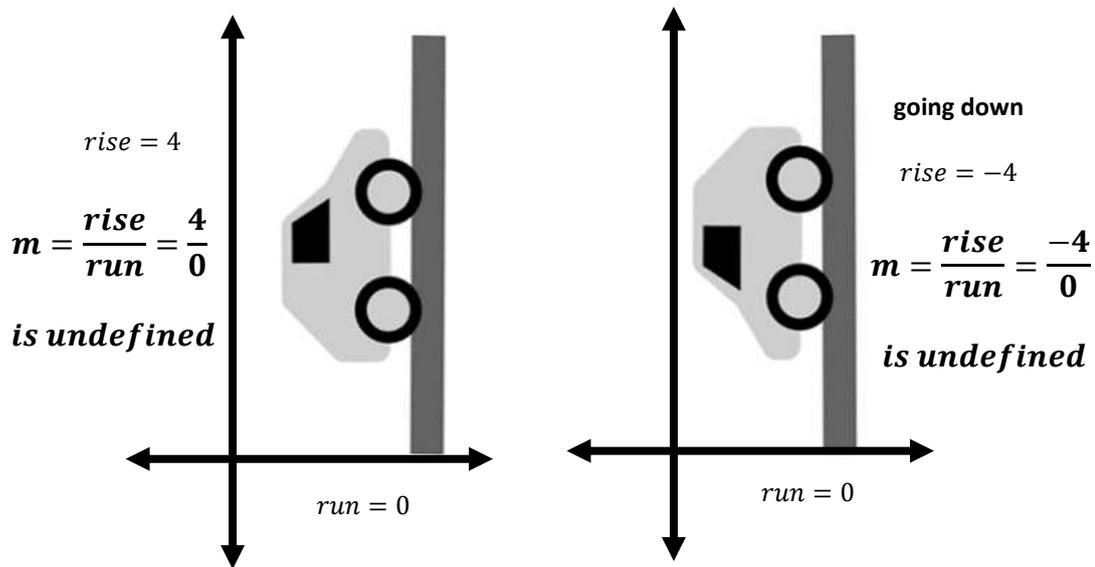


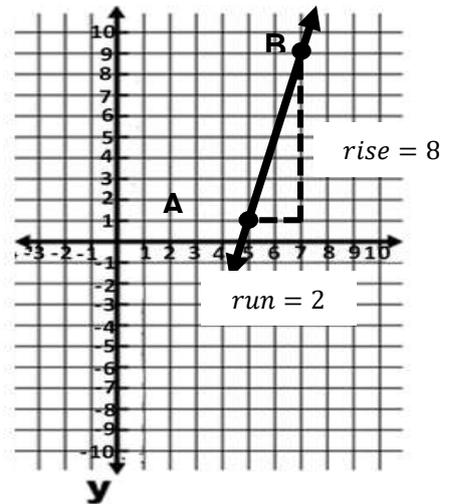
Fig. 6 Road 6

You have just learned about slope of the line which is related to the steepness of the line. When **given a graph**, we use the formula, $m = \frac{rise}{run}$ to find the slope of the line. Do you have another way of finding the slope?

Let us look at the other ways of finding the slope of a line with different given.

Finding the Slope of a Line Given Two Points

Consider the graph on the right and perform the following as instructed:



1. Assign any two points on the graph. Say points **A** and **B**. Find the coordinates of each point.

Solution:

$$A (5,1)$$

$$B (7,9)$$

2. If **A** is the first point, what is its abscissa (or x_1)? What about its ordinate (or y_1)?

Solution:

$$x_1 = 5$$

$$y_1 = 1$$

3. If **B** is the second point, what is its abscissa (or x_1)? What about its ordinate (or y_1)?

Solution:

$$x_2 = 7$$

$$y_2 = 9$$

4. What is the difference of the ordinates (or y-coordinates) of points **A** and **B**? What about the difference of the abscissas (or x-coordinates) of points **A** and **B**?

Solution:

$$y_2 - y_1 = 9 - 1 = 8$$

$$x_2 - x_1 = 7 - 5 = 2$$

5. Compare the difference of the values of y (the ordinates) to the rise on the graph. What have you observe?

Solution:

$$y_2 - y_1 = \text{rise}$$

6. Compare the difference of the values of x (the abscissas) to the run on the graph. What have you observe?

Solution:

$$x_2 - x_1 = run$$

7. Get the ratio of the differences in the y – values to the differences in the x – values. What is their ratio?

Solution:

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{8}{2} = 4$$

Hence, the slope of this line is 4.

Given two points, (x_1, y_1) and (x_2, y_2) the slope of the line can be solved using the formula:

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

Finding the Slope of a Line Given an Equation

The slope of a line can sometimes be quickly determined from its equation.

The equation of the line described by the graph on the previous page is $4x - y = 19$.

To find the slope of the line given the equation, answer the following questions.

1. Is the equation written in the form $Ax + By = C$?

The answer is **YES**.

2. What are the values of the coefficients **A** and **B**?

Solution:

$$A = 4$$

$$B = -1$$

3. What is the additive inverse of the coefficient A ?

Solution:

Since A is 4 then the $-A$ is -4 .

4. Get the ratio of the coefficient of the additive inverse A to the coefficient of B .

Solution:

$$\frac{-A}{B} = \frac{-4}{-1} = 4$$

5. What have you observed? Is the ratio of the rise to the run, the ratio of the differences in y – values to the differences in the x – values, the same with the ratio of the additive inverse of A to B ?

Solution:

$$m = \frac{\text{rise}}{\text{run}} = \frac{8}{2} = 4$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 1}{7 - 5} = \frac{8}{2} = 4$$

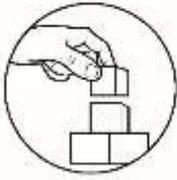
$$m = \frac{-A}{B} = \frac{-4}{-1} = 4$$

The answer is **YES**.

Given the equation of the line written in standard form ($Ax + By = C$), the slope is the ratio of the additive inverse of the coefficient A to coefficient B . In symbol,

$$m = \frac{-A}{B}$$

You are now ready to do the next activity. That slope can be positive, negative, zero, or undefined.



What's More

Activity 1: Rise Over Run

Given the following figures below:

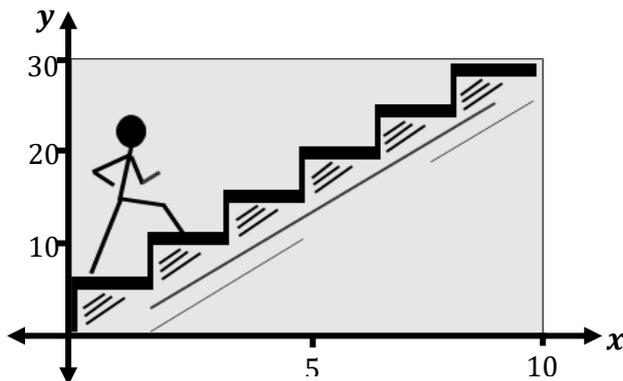


Figure 1

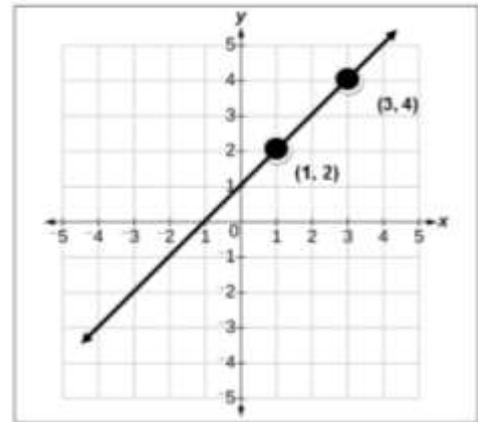


Figure 2

Find the following:

1. rise
2. run
3. slope

Activity 2: Ratio of My Changes

Find the slope of the line given the following pair of points:

1. $(0, 2)$ & $(1, 8)$
2. $(-1, 8)$ & $(-2, -5)$
3. $(4, 7)$ & $(9, 7)$
4. $(-11, 5)$ & $(4, 5)$
5. $(-5, 15)$ & $(9, -12)$

Activity 3: Slope in the Equation!

Find the slope of the following linear equations.

1. $2x - 3y = 6$
2. $5x = 8 + 5y$
3. $7 - 4y - 20x = 0$
4. $-9x = -3y$
5. $15 = x + 11y$

When given linear equation, do not forget to write first in standard form which is $Ax + By = C$. Then get the ratio of the coefficient B to the additive inverse of coefficient A.



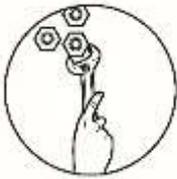
What I Have Learned

Complete the following sentences below by filling in the blanks with correct word/s or figure/s which you can choose from the box. Each word or figure may be used repeatedly. Write your answer on a separate sheet.

(x_2, y_2)	A and B	$Ax + By = C$	General form	$\frac{\text{rise}}{\text{run}}$
$m = \frac{-A}{B}$	slope	denominator	$Ax + By + C$	negative
	standard form	zero	run	
$\frac{y_2 - y_1}{x_2 - x_1}$	(x_1, y_1)	m	$Ax + By + C = 0$	
	x and y	positive	undefined	

1. A line can be described by its steepness. The steepness of the line is referred to as _____.
2. When given a graph, the slope is obtained by finding the _____ of the rise over the run.
3. When two points on the line are given, then the formula in finding the slope is _____.

4. Slope can be determined even if the equation of the line is given. First you will write the equation in the form _____.
5. When the equation is written in standard form, the slope of the line can be solved by using the formula _____.
6. Slope of a line can be _____, _____, _____, or _____.
7. Climbing up a ladder gives you a _____ slope.
8. Walking down a wheelchair ramp gives you a _____ slope.
9. When the rise is zero, the slope is _____.
10. When the run is zero, the slope is _____.

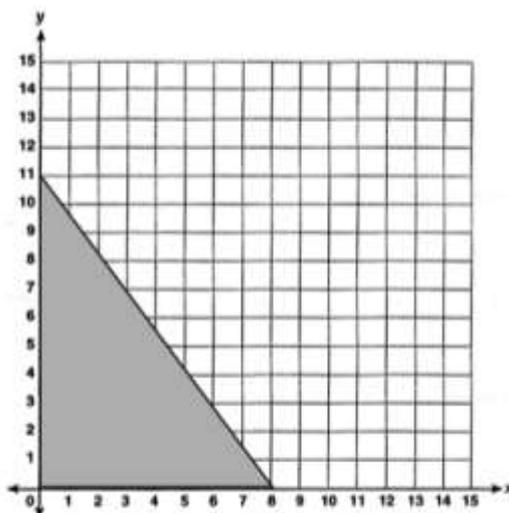


What I Can Do

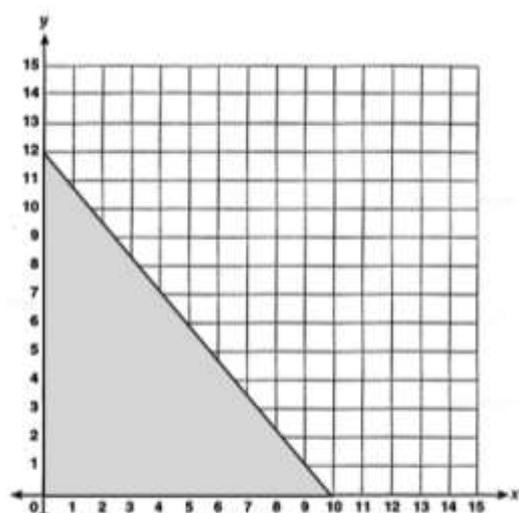
Let's get this REAL!

Read the problem below and answer the questions that follow/

Shammy wanted to try mountain climbing for the first time. It is one thing that she has been wanting to do ever since, but her having asthma hinders her from doing it for it might risk her health. She has two options. Mountain 1 and Mountain 2 are both popular in their province for their beautiful sceneries, but she has to choose only one that would less risk her health; the one that is less inclined. She knew that the steeper the mountain, the riskier it is, so she gathered information of the two mountains. She drew them as shown below.



Mountain 1



Mountain 2

1. By just looking at the illustration, which mountain do you think is steeper?
2. Identify the rise and run of (a) Mountain 1; (b) Mountain 2.
3. Identify the slope of (a) Mountain 1; (b) Mountain 2.
4. Which of these Mountains would Shammy most likely want to try climbing? Why do you think it is?
5. If you were Shammy, would you try doing new things even if it's meant risking your health? Why? Why not?



Assessment

Directions: Read the questions carefully and choose the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following equations is to be used in finding for the slope of a given linear equation in standard form?

A. $m = \frac{A}{B}$

C. $m = \frac{B}{-A}$

B. $m = \frac{-A}{B}$

D. $m = \frac{-B}{A}$

2. The following are formulae used in finding the slope of a line EXCEPT ONE.

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

C. $m = \frac{-A}{B}$

B. $m = \frac{\text{rise}}{\text{run}}$

D. $m = \frac{Ax}{By}$

3. The vertical change between two points is called _____.

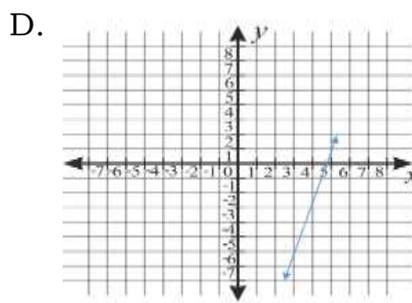
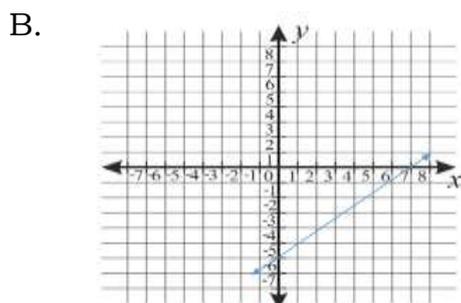
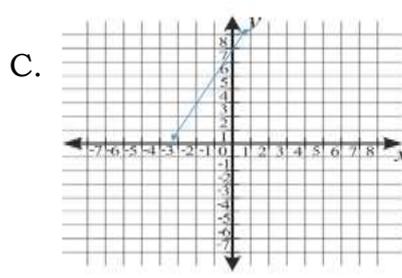
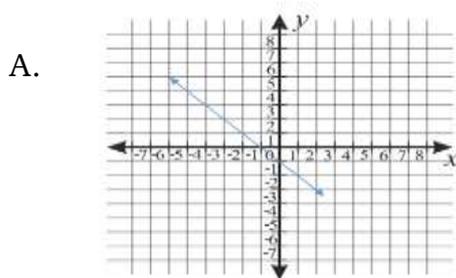
A. up

C. down

B. run

D. rise

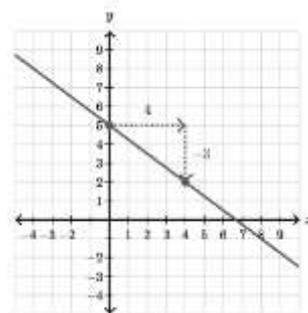
4. Which of the following graphs below has a negative slope?



5. What is the slope of the line on the graph at the right?

- A. $-\frac{3}{4}$
- B. $\frac{4}{-3}$

- C. $\frac{3}{4}$
- D. $\frac{4}{3}$



6. What is the slope of a line that passes through points $(3, 8)$ and $(3, -4)$?

- A. one
- B. zero

- C. negative
- D. undefined

7. Given the points $(3, 2)$ and $(-5, 2)$, find the slope of the line.

- A. -8
- B. 0

- C. 1
- D. undefined

8. Given the points $(-4, 3)$ and $(-4, 5)$, find the slope of the line.

- A. -8
- B. 0

- C. 1
- D. undefined

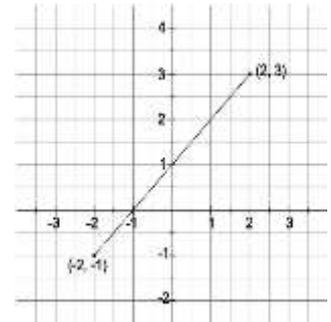
9. Determine the slope of the line $3x - 4y = 24$.

- A. $\frac{3}{4}$
- B. $-\frac{3}{4}$

- C. $\frac{4}{-3}$
- D. $\frac{4}{3}$

10. On the right side is the graph of a linear equation.
What is its slope?

- A. 1
B. -1
C. 4
D. -2



11. Which of the following pairs of points have the same slope?

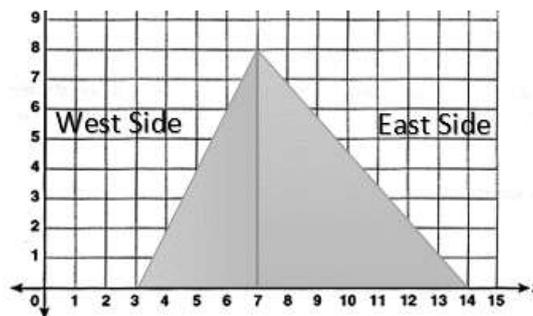
- A. $(2, 4), (1, 10)$ and $(-2, -2), (-2, 10)$ C. $(-2, 4), (21, 10)$ and $(2, 2), (-2, 10)$
B. $(2, 4), (-1, 10)$ and $(2, 2), (-2, 8)$ D. $(2, 4), (-1, 10)$ and $(2, 2), (-2, 10)$

12. Which of the following statement/s is/are true about the slope of a line?

- i. Slope describes the steepness of the line.
ii. Slope is the change in the values of x and y.
iii. Slope can be positive, negative, zero or undefined.
iv. Slope is the movement of the line.

- A. i and ii only C. ii and iii only
B. i and iii only D. iii and iv only

13. Janna and Skylar are both trying to climb a mountain located in their hometown. Janna chose to start at the east side, while Skylar chose to start at the west side. The sides of the mountain are asymmetric in form as shown in the illustration below.



What is the slope of each side of the mountain which Janna and Skylar would climb to? (Since both are climbing the mountain, express slope as positive.)

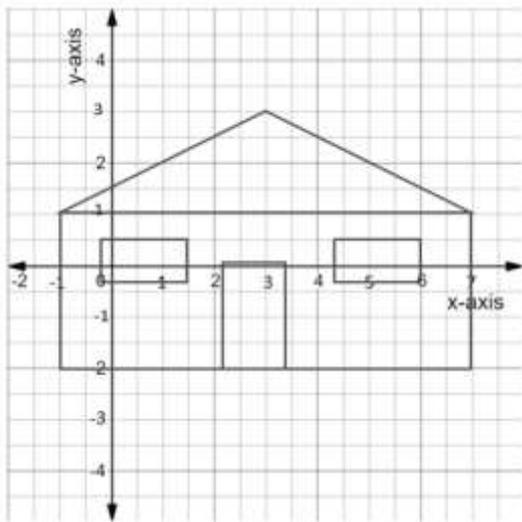
- A. East = 2, West = $\frac{8}{7}$ C. East = 4, West = 1
B. East = $\frac{8}{7}$, West = 2 D. East = 2, West = $\frac{7}{8}$

14. From the above situation, what could possibly be done so that Janna and Skylar would have the same slope to climb to?
- A. Move Janna's side of the mountain two grids to left.
 - B. Move Skylar's side of the mountain two grids to the left.
 - C. Climb Skylar's side of the mountain twice to have the same slope as Sofia's.
 - D. Climb any side of the mountain together so they could climb the same slope.
15. Maria on her way to work has to walk the main staircase of their building to reach their office in the 3rd floor. During rush hours, Maria would use the staircase in the emergency exit to avoid being late. By this, she found out that whenever she uses the emergency exit staircase, she would always feel exhausted than in the main staircase. What statement below would prove Maria's experience as to the steepness of the staircases?
- A. The main staircase is steeper than the emergency exit staircase, thus it exhausts Maria.
 - B. The emergency exit staircase is steeper than the main staircase, thus it exhausts Maria.
 - C. The main staircase and the emergency exit staircase are just the same in slope, Maria is just weak.
 - D. The steepness of both staircases does not affect as to how Maria gets exhausted, she is just over acting.

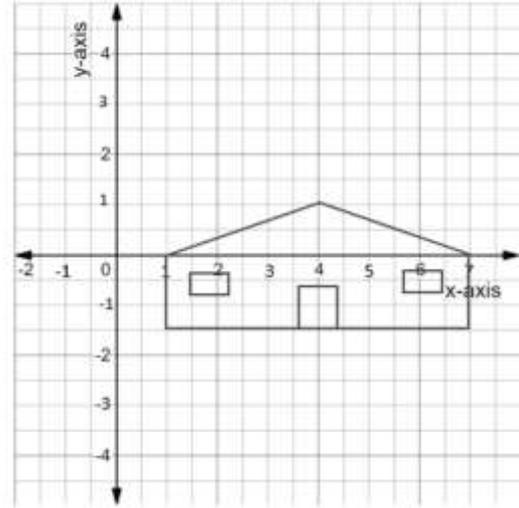


Additional Activities

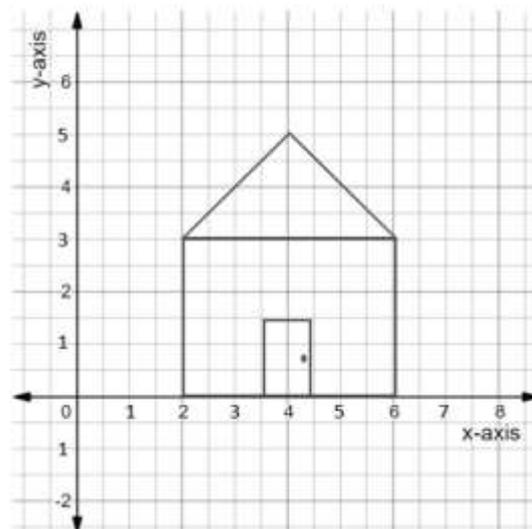
This fun activity contains houses with roofs of various sizes. Find the slope of the roof of each house. (*Express answers as positive slopes.*)



1. _____



2. _____



3. _____



Answer Key

What's In

Point	Coordinates from the Origin (units left/right) (units above/below)	Location of Abscissa from the Origin (units above)	Location of Ordinate from the Origin (units below)
S	(-6, 2)	6 units to the left	2 units above
L	(-2, 4)	2 units to the left	4 units above
O	(3, 6)	3 units to the right	6 units above
P	(6, 6)	6 units to the right	6 units above
E	(-2, 2)	2 units to the left	2 units above
F	(2, 2)	2 units to the right	2 units above
A	(-6, -4)	6 units to the left	4 units down
M	(-6, -10)	6 units to the left	10 units down
I	(5, -4)	5 units to the right	4 units down
N	(10, -9)	10 units to the right	9 units down

Questions:

- Answer varies
- Answer varies
- Yes
- 6
- A & M; 6
- L & E; 2
- O & F; 4
- Yes
- A & I; 11
- E & F; 5
- O & P; 5
- $\frac{11}{6}$
- The slope of a line describes the steepness of the line. It is the ratio of the vertical change to the horizontal change.

What I Can Do!

- Answer Varies
- a. rise = 11, run = 8
b. rise = 12, run = 10
- a. $\frac{8}{6}$ b. $\frac{5}{5}$
- Mountain 2 because it's less steeped than Mountain 1.
- Answer varies

What I Have Learned

- slope
- $\frac{\text{rise}}{\text{run}}$
- $\frac{y_2 - y_1}{x_2 - x_1}$
- $Ax + By = C$
- $m = \frac{-A}{B}$
- (In any order)
- positive, negative, zero, undefined
- positive
- negative
- zero
- undefined

Additional Activities!

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

What's More!

Activity 1: Rise Over Run
Figure 1: Figure 2:

1.	30	1.	2
2.	10	2.	2
3.	3	3.	1

Activity 2: Get My Ratio

1.	6	4.	undefined
2.	13	5.	$-\frac{14}{27}$
3.	0		

Activity 3: Slope in the Equation

1.	$\frac{3}{2}$	4.	3
2.	1	5.	$-\frac{1}{11}$
3.	-5		

What I Know!

- D
- A
- B
- D
- C
- C
- C
- C
- B
- A
10. A
11. A
12. D
13. A
14. B
15. D

ASSESSMENT

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

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What I Know!

- D
- A
- B
- D
- C
- C
- C
- C
- B
- A
10. A
11. A
12. D
13. A
14. B
15. D

ASSESSMENT

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

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1.	$\frac{3}{2}$	4.	3
2.	1	5.	$-\frac{1}{11}$
3.	-5		

What I Know!

- D
- A
- B
- D
- C
- C
- C
- C
- B
- A
10. A
11. A
12. D
13. A
14. B
15. D

ASSESSMENT

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

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