

Slope

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6.4 Slope

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[Figure 1]

Casey's family is trying new things on their adventure vacation. Casey is excited about riding a zipline for the very first time. The beginning point is 20 meters higher than the end point, and the length of the zipline is 200 meters. What is the slope of the line?

In this concept, you will learn about slopes and how to graph them.

Slope

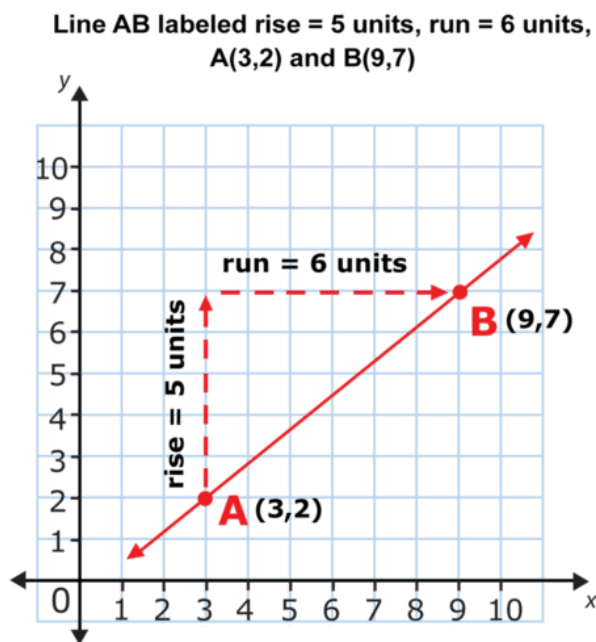
A **slope** can be defined as the steepness of a straight line. It is the ratio of the change in **vertical** measure to the change in horizontal measure. This is also referred to as the ratio of "rise" to "run" or the change in y to the change in x .

The Greek letter Delta, Δ , is used to show the changes in x and y .

Δy stands for the change in y .

Δx stands for the change in x .

Line AB on the **coordinate plane** below has a change of 5 units **vertically**, Δy .



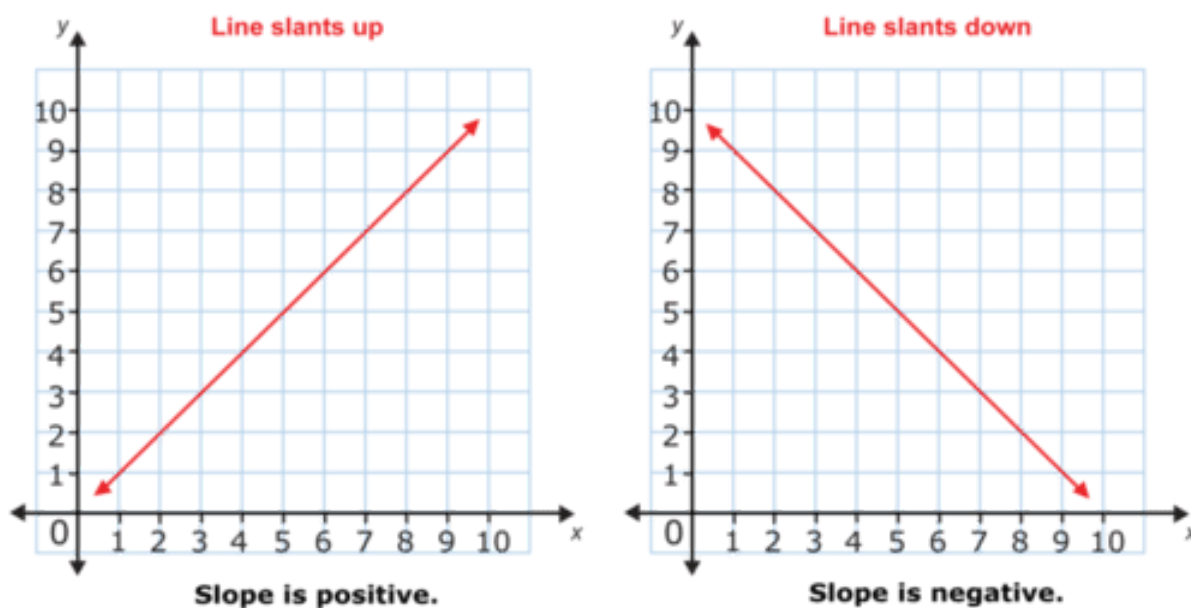
[Figure 2]

The slope of line AB is the ratio $\frac{\text{rise}}{\text{run}}$ or $\frac{\Delta y}{\Delta x} = \frac{5}{6}$.

Line AB, with a slope of $\frac{5}{6}$, is a **positive slope**. The line slants upward from left to right.

Slopes can be positive or negative. Regardless of the **quadrant**, or point values, slopes are based on the change of y (increase or decrease) as the x value moves from left to right.

A line that slants up from left to right has a **positive slope**.



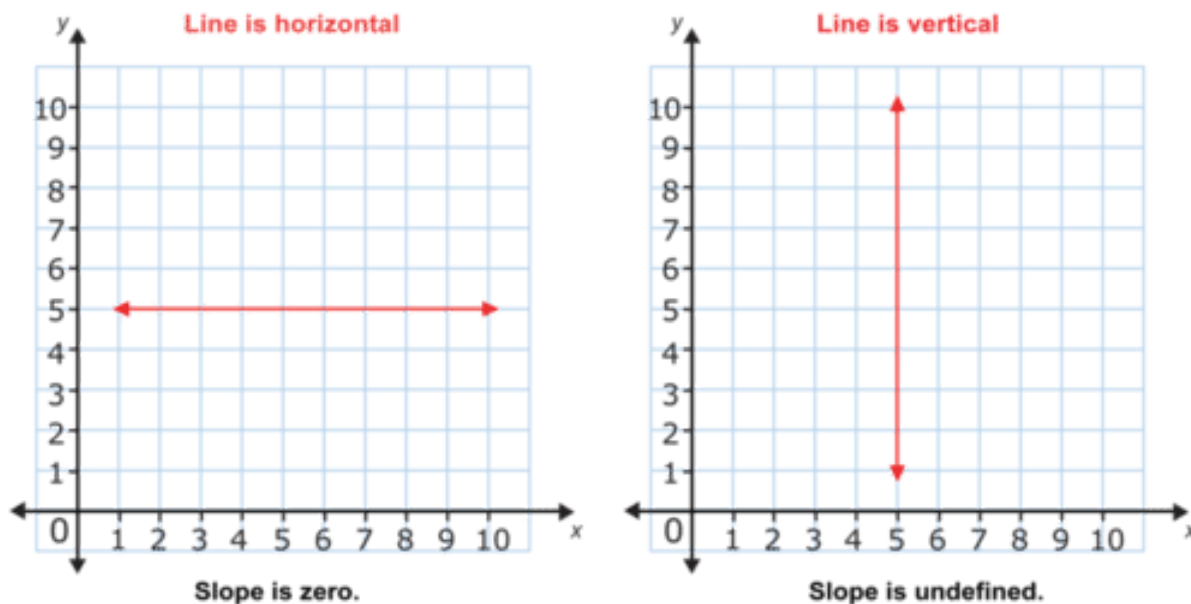
[Figure 3]

A line that slants down from left to right has a **negative slope**.

Horizontal and vertical lines also have a slope. A horizontal line has a change in x , but it does not have a change in y .

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{0}{\Delta x} = 0$$

The slope of a horizontal line is 0.



[Figure 4]

A vertical line has a change in y , but it does not have a change in x .

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{\Delta y}{0} = \text{undefined}$$

Division by zero is undefined.

The slope of a vertical line is undefined.

Examples

Example 1

Earlier, you were given a problem about Casey and the zip line.

The change in elevation, vertical **distance**, was 20m, and the change in horizontal distance was 200m. What is the slope?

First, write the **equation**.

$$\text{slope} = \frac{\Delta y}{\Delta x}$$

Next, **substitute** in the given values.

$$\frac{\Delta y}{\Delta x} = \frac{20}{200}$$

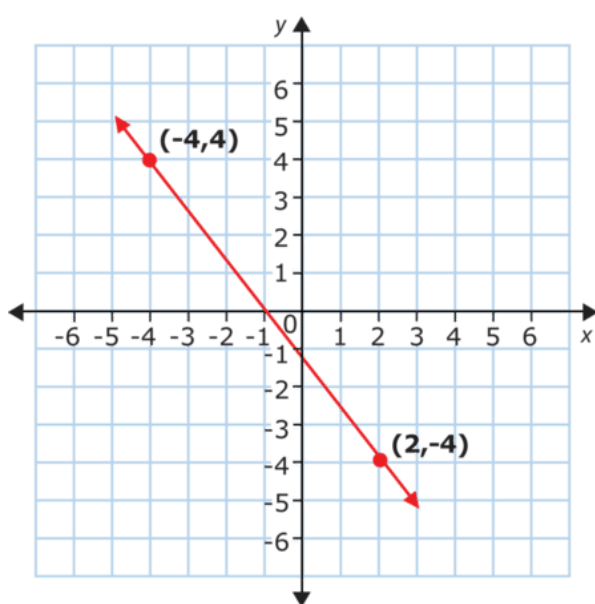
Then, reduce.

The answer is that the slope equals $\frac{1}{10}$

Example 2

Determine if the slope of the line below is positive or negative. What is its value?

Line through (-4,4) and (2,-4)



[Figure 5]

First, determine if the line rises or falls as it moves from left to right.

The line falls as it moves from left to right. The slope is negative.

Next, use the equation to find the value of the slope.

$$\text{slope} = \frac{\Delta y}{\Delta x}$$

total change in y = -8 units

total change in x = 6 units

$$\frac{\Delta y}{\Delta x} = \frac{-8}{6}$$

Then, reduce to lowest **terms**.

$$\frac{-8}{6} = -1.33$$

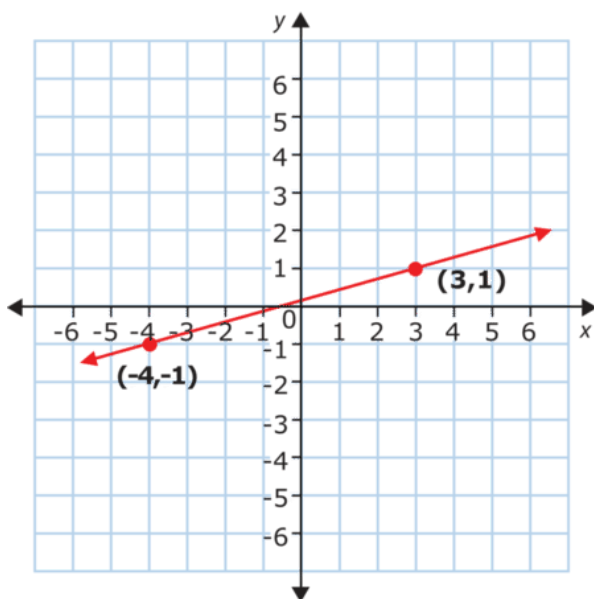
Next, remember that the slope is negative.

The answer is the slope equals -1.33

Example 3

Determine the slope:

Line through (-4,-1) and (3,1)



[Figure 6]

First, determine if the slope is positive or negative.

The line rises as it moves from left to right. The slope is positive.

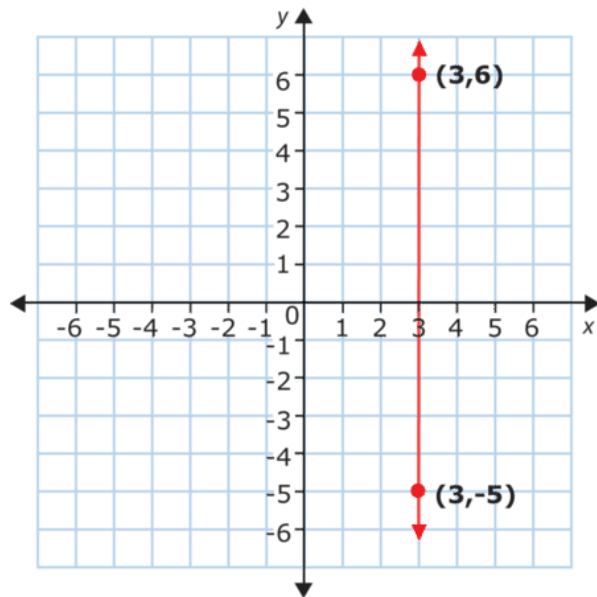
Next, use the formula.

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{2}{7}$$

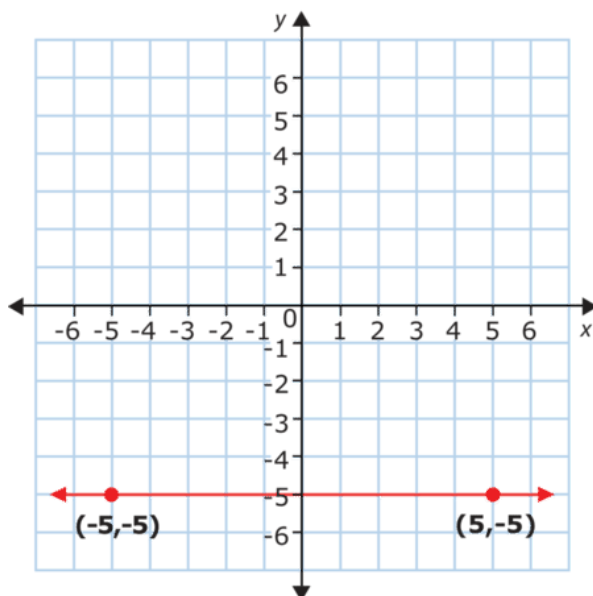
The answer is the slope equals $\frac{2}{7}$

Example 4

Identify the slope of each line shown below.

Line through $(3,6)$ and $(3,-5)$ 

a. [Figure 7]

Line through $(-5,-5)$ and $(5,-5)$ 

b. [Figure 8]

First, consider the line in **a**.

The line is vertical.

Next, remember that a vertical line has a slope that is undefined.

The answer is that the slope of line a is undefined.

Then, consider the line in **b**.

The line is horizontal.

Next, remember that a horizontal line has a slope equal to zero.

The answer is that the slope of line b equals 0.

Example 5

Murray broke his arm and could not use the rope to climb into his treehouse. Instead, he got a ladder from the garage and set it up against the structure. The treehouse is 15 feet off the ground, and Murray set it 3 feet away from the side. What is the slope of the ladder? Is it positive or negative?

First write the formula.

$$\text{slope} = \frac{\Delta y}{\Delta x}$$

Next, substitute in what is known.

$$\frac{\Delta y}{\Delta x} = \frac{15}{3}$$

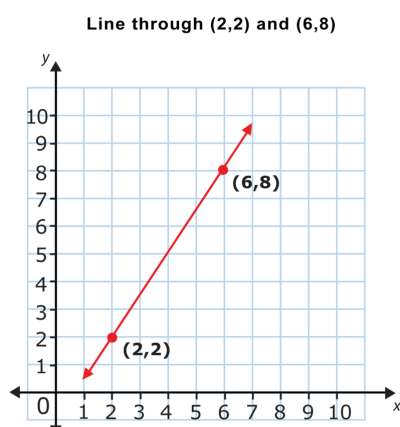
Then, reduce to lowest terms.

The answer is that the slope equals 5.

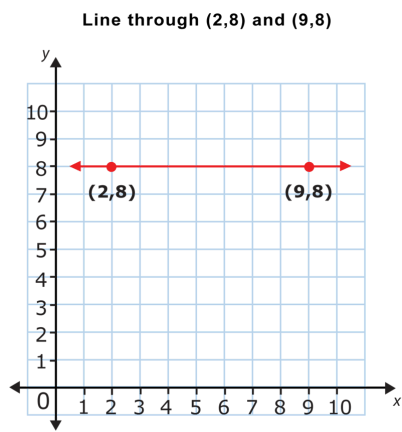
Whether the slope is positive or negative can only be determined if there is a diagram or graphing coordinates given.

Review

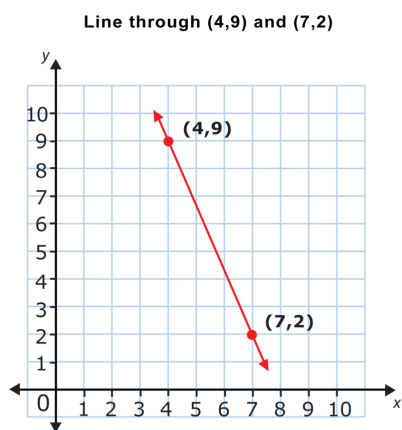
For each graph, tell if the slope of the line shown is positive, negative, zero, or undefined.



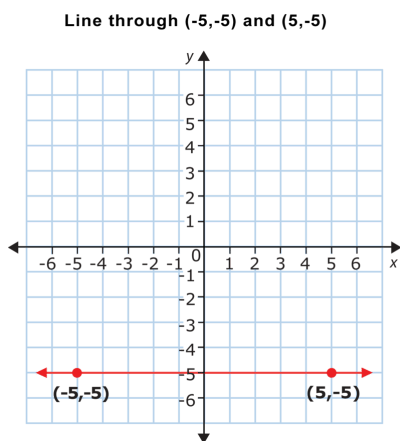
1. [Figure 9]



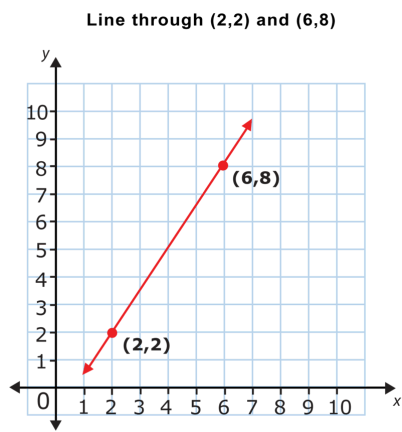
2. [Figure 10]



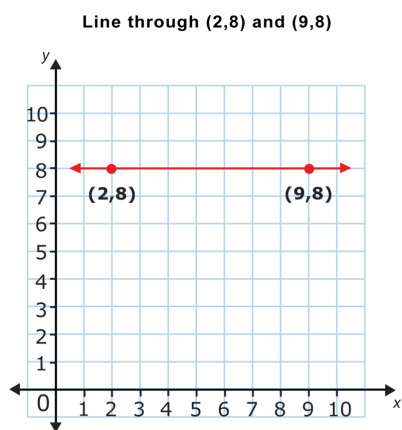
3. [Figure 11]



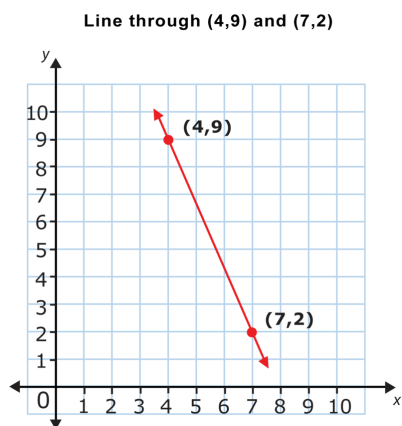
4. [Figure 12]



5. [Figure 13]

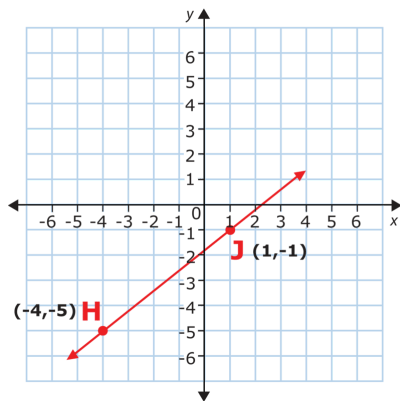


6. [Figure 14]



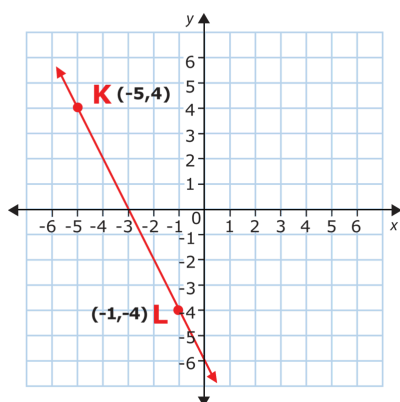
7. [Figure 15]

Line HJ with slope of $\frac{4}{5}$, through $(-4,-5)$ and $(1,-1)$



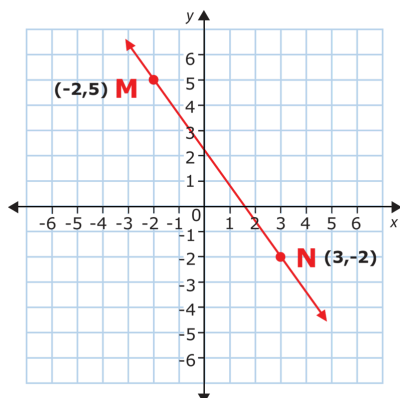
8. [Figure 16]

Line KL with slope of -2 , through $(-5,4)$ and $(-1,-4)$



9. [Figure 17]

Line MN with slope of $-\frac{7}{5}$, through $(-2,5)$ and $(3,-2)$



10. [Figure 18]

Answer each question.

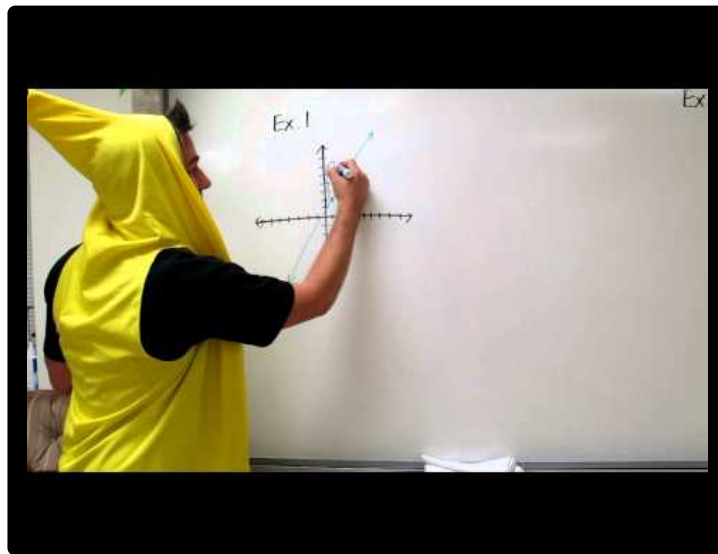
11. Does a positive slope have to contain positive numbers?
12. True or false. A horizontal line is undefined.
13. True or false. A negative slope goes down from right to left.
14. True or false. A vertical line has an undefined slope.

15. True or false. You can figure out any slope as long as the line has some slant to it.

Review (Answers)

To see the review answers, return to the [Table of Contents](#) and select 'Other Versions' or 'Resources'.

Resources



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