

## 6.5 Slope

3. Demonstrate an understanding of slope with respect to:

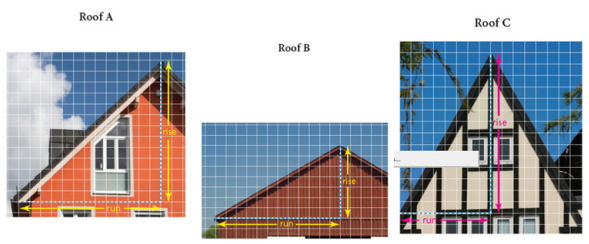
- rise and run
- line segments and lines
- rate of change
- parallel lines
- perpendicular lines.

Nov 14-4:00 PM

The national, provincial, and territorial parks of western and northern Canada feature some of the most beautiful back country in the world. To safely enjoy mountain adventures, specialized skills and knowledge, such as avalanche awareness, are essential. Though avalanches occur mostly in winter, they can happen at any time of the year. It is important to understand the many conditions that cause avalanches. The steepness, or slope, of a mountainside is one of them.

Nov 14-4:00 PM

Some roofs are steeper than others. Steeper roofs are more expensive to shingle.



The steepness of a roof is measured by calculating its pitch or slope.

$$\text{slope} = \frac{\text{Vertical change}}{\text{Horizontal change}} \qquad \text{slope} = \frac{\text{rise}}{\text{run}} \qquad \text{slope} = \frac{\Delta y}{\Delta x}$$

The **rise** is the vertical distance from the bottom of the edge of the roof to the top.  
The **run** is the corresponding horizontal distance.

For each roof above, we count units to determine the rise and the run.

For Roof A	For Roof B	For Roof C
$\text{slope} = \frac{\text{rise}}{\text{run}}$	$\text{slope} = \frac{\text{rise}}{\text{run}}$	$\text{slope} = \frac{\text{rise}}{\text{run}}$
$\text{slope} = \frac{13}{13}$	$\text{slope} = \frac{7}{12}$	$\text{slope} = \frac{14}{8}$
$\text{slope} = 1$	$\text{slope} = 0.58\bar{3}$	$\text{slope} = 1.75$

Roof C is the steepest because its slope is the greatest.  
Roof B is the least steep because its slope is the least.

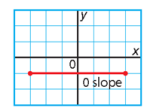
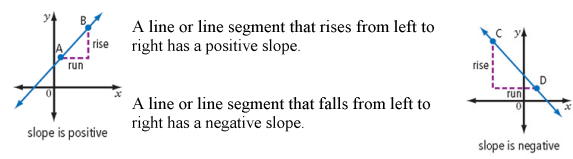
Nov 14-4:01 PM

**Slope**

- the ratio of the vertical change, or rise, to the horizontal change, or run, of a line or line segment
- not expressed with units

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

*m* is the variable used for slope and  $\Delta$  is a symbol used to indicate change. The expression  $\Delta y$  is read as "delta y."

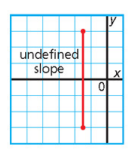


Slope =  $\frac{\text{rise}}{\text{run}}$

Slope =  $\frac{0}{\text{run}}$

Slope = 0

So, any horizontal line segment has slope 0.



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

Slope =  $\frac{\text{rise}}{0}$

A fraction with denominator 0 is not defined.

So, any vertical line segment has a slope that is undefined.

Nov 14-4:05 PM

Chapter 6
Slope

Match the description of the slope to the proper graph.

Undefined

Positive

Negative

0

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Jun 4-11:59 AM

Developing a formula to determine the slope of a line

Notice how the coordinates of this point are related to the coordinates of the two points on the line.

Slope formula  
 $m = \frac{\text{rise}}{\text{run}}$   
 $m = \frac{3}{2}$

Slope formula  
 $m = \frac{y_2 - y_1}{x_2 - x_1}, x_2 \neq x_1$

Nov 14-4:08 PM

Example 1 Classify the Slope of a Line



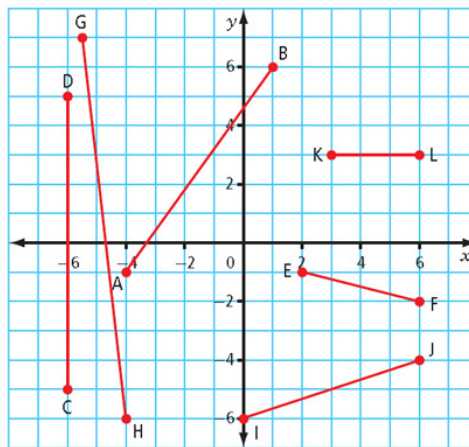
The North Shore in Vancouver is popular for hiking and biking. Bridges and stunt structures on trails are complex and often extremely challenging. They have a huge variety of slopes. Classify each slope marked on the photographs as either positive or negative.

Nov 14-4:09 PM

Your Turn

Classify the slope of each line segment as positive, negative, zero or undefined.

$\overline{AB}$  Positive  
 $\overline{CD}$  undefined  
 $\overline{EF}$  negative  
 $\overline{GH}$  negative  
 $\overline{IJ}$  positive  $\overline{KL}$  - zero



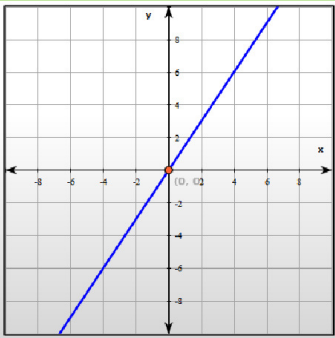
Nov 14-4:10 PM

Chapter

6

## Slope

Change the slope ( $m$ ) of the line using the + and - buttons. How does the sign of the slope relate to the orientation of the line?



Slope of a Line

$f(x) = 1.5x$

**m**

**c**

More

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Jun 4-11:59 AM

Example 3 Determine the Slope of a Line Segment

What is the slope,  $m$ , of each line segment with the given end points?

a) S(-3, 6) and T(5, 2)  
 b) H(4, 3) and K(4, 8)  
 c) M(-9, -7) and N(-1, -7)

Solution

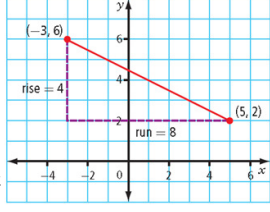
Method 1: Use a Graph

Plot the points on grid paper. Count the rise and run.

a) Plot the points (-3, 6) and (5, 2).

Recall that a line that falls from left to right has a negative slope.

$$-\frac{4}{8} = -\frac{1}{2}$$



Method 2: Use the Slope Formula

Label the points and substitute into the formula  $x_1, y_1, x_2, y_2$

a) S(-3, 6) T(5, 2) or T(5, 2) S(-3, 6)

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

$$m = \frac{2 - 6}{5 - (-3)}$$

$$m = \frac{-4}{8} = -\frac{1}{2}$$

Nov 14-4:10 PM

a)  $x_1 y_1$   $x_2 y_2$   
 $H(4, 3)$   $K(4, 8)$

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

$$m = \frac{8 - 3}{4 - 4}$$

$$m = \frac{5}{0} = \text{undefined}$$

c)  $x_1 y_1$   $x_2 y_2$   
 $N(-1, -7)$   $M(-9, -7)$

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

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

$$m = \frac{0}{-8} = 0$$

Nov 14-4:12 PM

**your Turn**

- a) Use a graph to determine the slope of the line segment with endpoints  $P(-5, 6)$  and  $Q(1, 10)$ .  
 b) Use the slope formula to determine the slope of the line segment with endpoints  $W(2, -2)$  and  $X(-5, 5)$ .


Nov 14-4:13 PM

Chapter  
**6**

## Calculate Slope

Work in pairs.

1. On the number generator, click on the white box to generate a number. Then, click on the arrow to output that number.
2. Drag the number to the brackets under Point A to form its  $x$ -coordinate.
3. Repeat steps 1 and 2 for the  $y$ -coordinate of Point A.
4. Repeat steps 1 and 2 for the  $x$ -coordinate of Point B.
5. Repeat steps 1 and 2 for the  $y$ -coordinate of Point B.
6. Calculate the slope of AB.
7. Check your answer with your partner.



Point A  
 (   ,   )

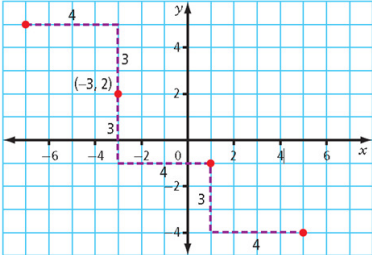
Point B  
 (   ,   )

Formula

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**Example 4 Use Slope to Graph a Line**  
 The point  $(-3, 2)$  is on a line that has a slope of  $-\frac{3}{4}$ .

List three other points on the line. Graph the line.



Move down 6 units and right 8 units from the point  $(-3, 2)$ .  
 What do you notice?  
 Explain.

Three other points on the line are  $(-7, 5)$ ,  $(1, -1)$ , and  $(5, -4)$ .  
 Now draw the line through the points.

Nov 14-4:13 PM

**Your Turn**

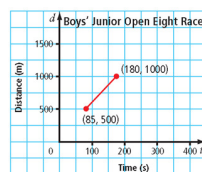
The point  $(-6, 1)$  is on a line that has a slope of  $\frac{1}{3}$

List three other points on the line and graph the line.

Nov 14-4:15 PM

**Example 5 Slope as a Rate of Change**

The Brentwood Regatta in Mill Bay, BC, is the largest junior rowing regatta hosted by a single school in North America. The races are all 1500 m in length. The graph shows the approximate times at the 500-m mark and the 1000-m mark for one of the boys' races. Determine the average rate of change for this portion of the race.

**Solution**

The slope of the line segment gives the ratio of the change in distance to the change in time. For this portion of the race,

$$\text{rate of change} = \frac{\Delta d}{\Delta t}$$

$$\text{rate of change} = \frac{(1000 - 500)}{(180 - 85)}$$

$$\text{rate of change} = \frac{500}{95}$$

Nov 14-4:17 PM



Homework Page 325 #1, 2, 3, 4 (odd letters), 5, 6, 8, 10, 13 ch 14, 16

Nov 14-4:18 PM