

Name: \_\_\_\_\_

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## Slope and Parallel Lines Algebra 1

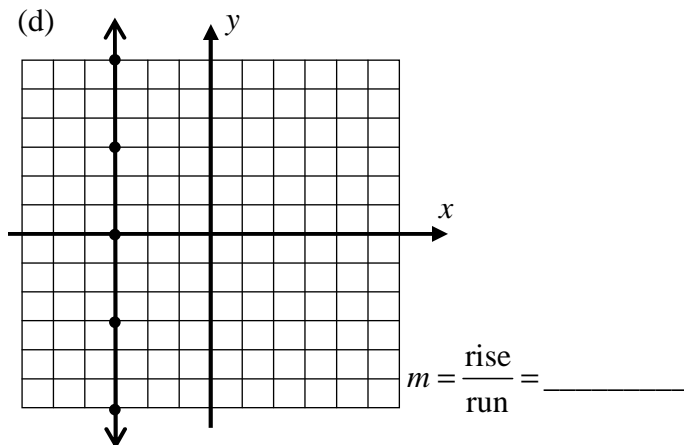
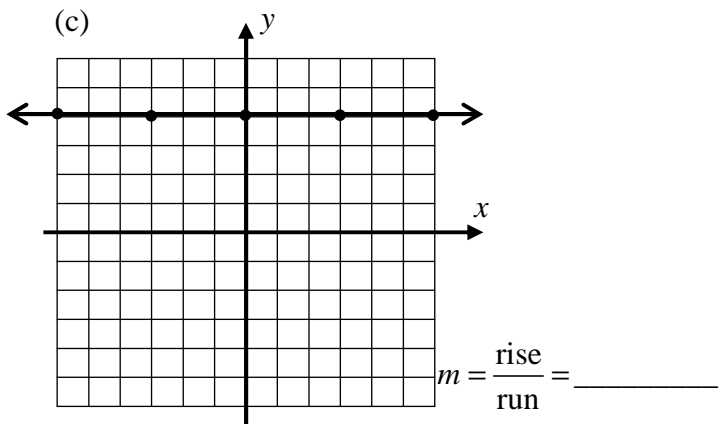
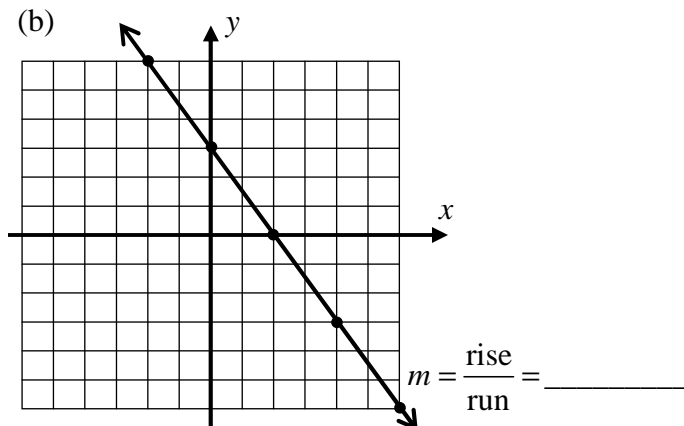
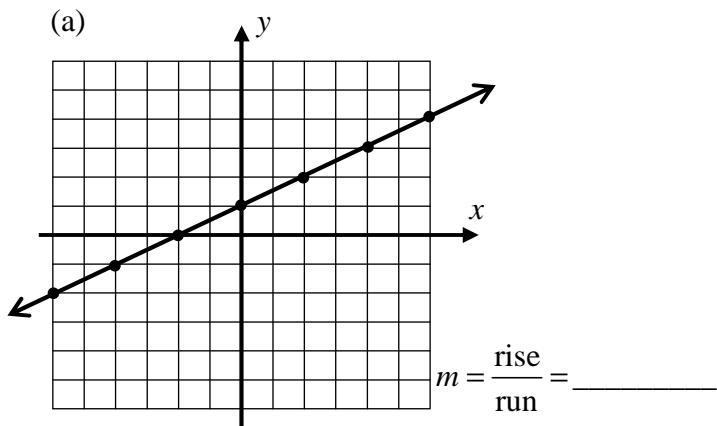
The slope of a line measures the **steepness** of the line. We're familiar with the word slope as it relates to mountains. Skiers and snowboarders refer to "hitting the slopes." Slope measures the ratio of the change in the  $y$ -value of a line to a given change in its  $x$ -value.

### DEFINITION OF SLOPE

$$\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{\Delta y}{\Delta x}$$

Slope is oftentimes symbolized using the variable  $m$ . Think of the slope of the line as the line's ***m***ovement and this will help you remember what it signifies.

**Exercise #1:** For each of the following lines, state the slope, if it exists.



The slope of a line is important because it tells us two things: (1) how steep the line is and (2) whether the line rises or falls as  $x$  gets larger.

**Exercise #2:** Below is a list of words. Fill in the blank of each statement below to make it true. Words may be used more than once.

undefined      falls      rises      zero      runs

- (a) When a line has a **positive slope**, it \_\_\_\_\_ from left to right.
- (b) When a line has a **negative slope**, it \_\_\_\_\_ from left to right.
- (c) When a line is **horizontal**, it only \_\_\_\_\_ from left to right and has slope of \_\_\_\_\_.
- (d) When a line is **vertical**, it only \_\_\_\_\_ and has an \_\_\_\_\_ slope.

It is important to be able to calculate the slope of a line if you are given two points on that line.

### THE SLOPE FORMULA

The slope of the line that passes through the points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by

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

The subscripts (little numbers) just indicate that these are two different points. As seen in Exercises #1 and #2, horizontal lines have slopes of zero and vertical lines have undefined slopes.

**Exercise #3:** Find the slope of the line that passes through the points  $(8, 7)$  and  $(4, 5)$ . Compute the slope using two different orders. What do you notice?

Order #1:  $(8, 7)$  and  $(4, 5)$

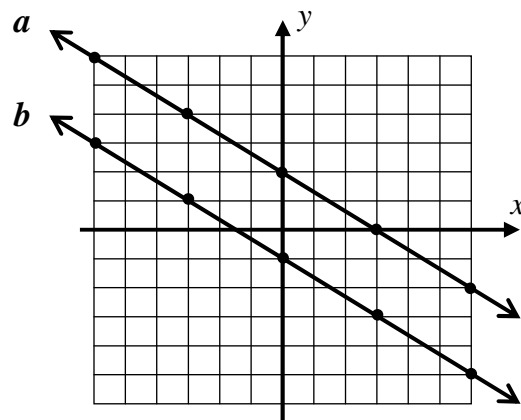
Order #2:  $(4, 5)$  and  $(8, 7)$

**Exercise #4:** The graphs of two lines are shown below. If extended these lines would not intersect at any points.

- (a) Calculate the slopes of both lines graphically.

Line *a*

Line *b*



- (b) What are coplanar lines called that never intersect?

## PARALLELISM AND SLOPE

In a plane, two nonvertical lines are **parallel** if and only if they have **equal** slopes. Of course, two vertical lines are parallel, but have nonexistent slopes.

**Exercise #5:** Is line  $\overline{AB}$  parallel to line  $\overline{CD}$  ( $\overline{AB} \parallel \overline{CD}$ ) given  $A(1,1)$ ,  $B(3,7)$ ,  $C(2,0)$  and  $D(5,9)$ . Justify.

**Exercise #6:** Is  $\overline{AB} \parallel \overline{CD}$  given  $A(-2,4)$ ,  $B(6,-8)$ ,  $C(3,5)$  and  $D(9,-7)$ . Justify.

**Exercise #7:** Two linear functions are given below.

$$y_1 = 2x - 1 \quad \text{and} \quad y_2 = 2x + 3$$

(a) Enter these two equations into your graphing calculator and fill out the table shown at the right.

(b) For both functions, by how much does each  $y$ -value increase as the  $x$ -variable increases by exactly one unit?

(c) Explain why there is a constant difference of 4 units in the  $y$ -values for the two functions.

(d) Graph the two equations using the window shown at the right. How would you characterize these two lines?

$x$	$Y_1$	$Y_2$
0		
1		
2		
3		
4		

$$x_{\min} = -2$$

$$x_{\max} = 5$$

$$x_{\text{scl}} = 1$$

$$y_{\min} = -2$$

$$y_{\max} = 10$$

$$y_{\text{scl}} = 1$$

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## Slope and Parallel Lines Algebra 1 Homework

### Skills

1. Find the slope of the line that passes through each of the following sets of points. If the slope does not exist, so state.

(a)  $(4, 2)$  and  $(10, 8)$

(b)  $(0, -7)$  and  $(4, -7)$

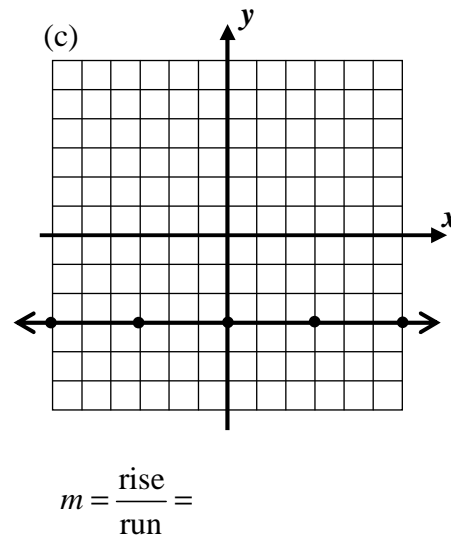
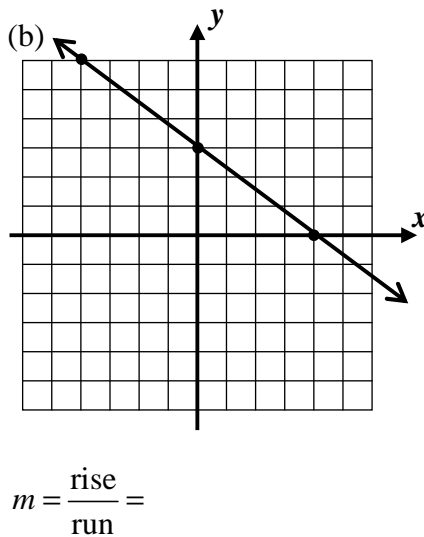
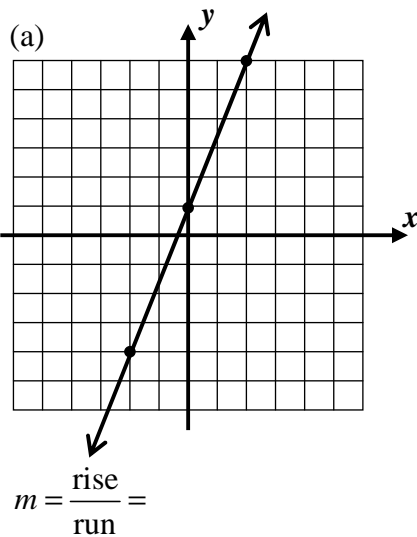
(c)  $(-4, -1)$  and  $(2, 9)$

(c)  $(-2, 6)$  and  $(-2, 13)$

(d)  $(1, 3)$  and  $(5, -3)$

(e)  $(-2, 8)$  and  $(6, 4)$

2. Find the slope of each of the following lines graphically:



3. The slope of line  $\overline{AB}$  is 2. Line  $\overline{CD}$  is parallel to line  $\overline{AB}$ . Which of the following must be the slope of  $\overline{CD}$ ?

(1)  $-2$

(2)  $2$

(3)  $\frac{1}{2}$

(4)  $-\frac{1}{2}$

\_\_\_\_\_

4. Line  $\overline{AB}$  passes through the points  $A(-4, 2)$  and  $B(6, -4)$ . Line  $\overline{AB}$  is parallel to line  $\overline{CD}$ . What is the slope of  $\overline{CD}$ ? Justify.

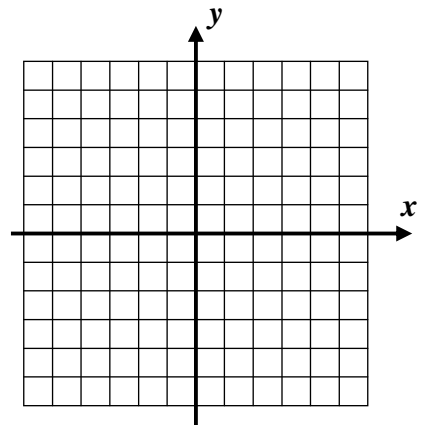
5. If  $\overline{PQ} \parallel \overline{RS}$  and the slope of  $\overline{PQ} = \frac{x-1}{4}$  and the slope of  $\overline{RS}$  is  $\frac{3}{8}$ , then find the value of  $x$ . Justify algebraically or numerically.

### Reasoning

6. Is line  $\overline{AB} \parallel \overline{CD}$  given the points  $A(4, -3)$ ,  $B(0, 5)$ ,  $C(-2, 11)$ , and  $D(-10, 7)$ ? Justify.

7. Is line  $\overline{AB} \parallel \overline{CD}$  given the points  $A(2, -4)$ ,  $B(3, -2)$ ,  $C(5, 6)$ , and  $D(7, 10)$ ? Justify.

8. The slope of  $\overline{AB}$  is  $\frac{3}{2}$ .  $\overline{AB}$  passes through the points  $A(-1, -2)$  and  $B(3, y)$ . Determine the value of  $y$ . (The use of the grid is optional.)



9. The slope of a line is  $-\frac{1}{2}$  and contains the point  $(-4, 3)$ . Which of the following points also falls on the line? (The use of the grid is optional.)

- (1)  $(-2, 1)$                       (3)  $(2, -2)$   
 (2)  $(4, -1)$                       (4)  $(1, -1)$

