

## Warm-up

Same slope



7. Find the value of  $x$  that will make the points  $J(-4, 15)$ ,  $K(x, 10)$  and  $L(14, 3)$  collinear.

$$m = \frac{y - y}{x - x}$$

$$JL = \frac{15 - 3}{-4 - 14} = \frac{12}{-18} = -\frac{2}{3}$$

$$KL = \frac{10 - 3}{x - 14} = \frac{7}{x - 14} = -\frac{2}{3}$$

$$-21 = 2(x - 14)$$

$$-21 = 2x - 28$$

$$+28$$

$$+28$$

$$\frac{7}{2} = \frac{2x}{2}$$

$$\boxed{3.5 = x}$$



# What is Slope?



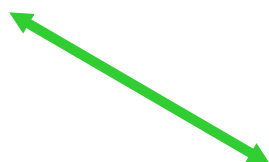
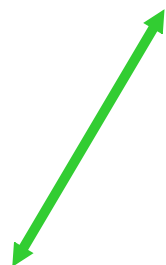
Slope can be:

Positive

Negative

Zero

Undefined





## The Slope Formula



Given any two points on a line  $(x_1, y_1)$  and  $(x_2, y_2)$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$





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

Date: \_\_\_\_\_

## Geometry HW: CG - 2

1. Find the slope and y-intercept for each of the following lines. Then graph each line on graph paper. (The lines may all be graphed on one set of axes but *label* each line.)

a.  $y = 5$

b.  $y = -2x$

c.  $y = 8 - x$

d.  $3x - 6y = 12$

2. On a *new* set of axes, graph and label the following:

a.  $y \geq x + 1$

b.  $2x + 3y < 12$

c.  $x \geq 6$

3. Write the equation of the line having the given slope and y-intercept:

a. slope =  $-2$ , y-intercept is 6

b. slope =  $\frac{1}{2}$ ; y-intercept at the origin

c. slope = 0, y-intercept is 4

$$y = mx + b$$

$$y = -2x + 6$$

4. Find the equation of the line having slope 3 and passing through the point  $(4, -3)$ .

5. Find the equation of the line that passes through the points  $(3, 2)$  and  $(6, -4)$ .

$$y - y_1 = m(x - x_1)$$

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

$$y - y_1 = m(x - x_1)$$

$$x = 3$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-4)}{3 - 6} = \frac{6}{-3} = -2$$

6. Find the equation of the line passing through the points  $(3, -2)$  and  $(3, 4)$ .

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-2)}{3 - 3} = \frac{6}{0} \text{ undefined}$$

7. a. Graph the line  $y = 3x - 7$ .

- b. For the line in part (a), how much does  $y$  change when  $x$  increases by 1 unit? Does  $y$  increase or decrease?

- c. Graph the line  $y = -\frac{1}{2}x + 3$ . (This may go on the same axes as part a.)

- d. For the line in part (c), how much does  $y$  change when  $x$  increases by 1 unit?

- e. For the line  $y = -\frac{3}{8}x + 6$ , how much does  $y$  change when  $x$  increases by one unit? Does  $y$  increase or decrease? (Note: you should be able to answer this without needing to graph the line.)

8. The speed of sound at sea-level depends on temperature according to the equation  $S = 0.60T + 331.45$  where  $S$  is the speed in meters per second and  $T$  is the temperature in degrees Celsius.
- What is the slope of the line?
  - What is the speed of sound at  $0^{\circ}\text{C}$ ?
  - Every time the temperature goes up by  $1^{\circ}\text{C}$ , by how much will the speed of sound change? Will it increase or decrease?

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

Same slope

Date: \_\_\_\_\_

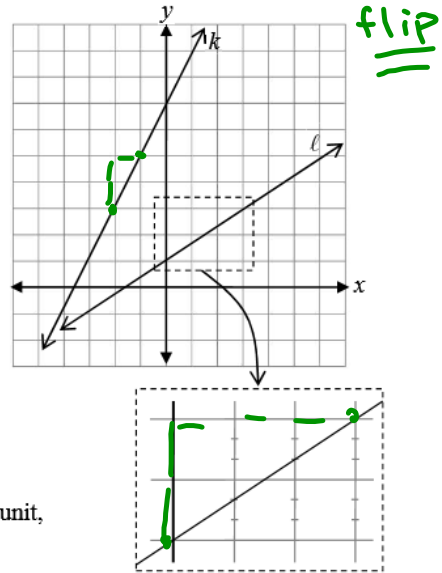
Geometry Notes CG - 3: Parallel and Perpendicular Lines

opposite reciprocals

Slope, Again

Ex: Two lines,  $k$  and  $\ell$ , are graphed at right.

- a. What is the slope of line  $k$ ?  $\frac{\text{rise}}{\text{run}} = \frac{2}{1}$
- b. As you travel left to right along line  $k$ , how does  $y$  change each time  $x$  increases by 1 unit?  
up 2
- c. What is the slope of line  $\ell$ ?  $\frac{2}{3}$
- d. As you travel left to right along line  $\ell$ , how does  $y$  change each time  $x$  increases by 1 unit?  
up  $\frac{2}{3}$



**Fact:** For a (non-vertical) line with slope  $m$ , each time  $x$  increases by 1 unit,

Ex: For the line  $7x + 4y = 12$ , what happens to  $y$  each time  $x$  increases by 1 unit?

Slope

$$-7x \quad -7x$$

$$\frac{4y}{4} = -\frac{7x}{4} + \frac{12}{4}$$

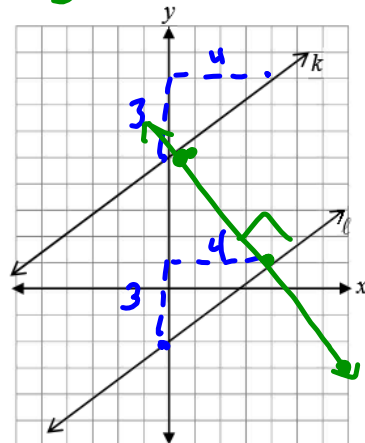
$$y = -\frac{7}{4}x + 3$$

\*  $y$  decreases by  $\frac{7}{4}$

Parallel and Perpendicular Lines

Ex: The diagram at right shows two lines,  $\ell$  and  $k$ .

- a. Find their slopes.  $\ell = \frac{3}{4}$      $k = \frac{3}{4}$
- b. Will the lines ever intersect?  
No - parallel same slope
- c. Draw line  $n$  perpendicular to line  $\ell$  at the point  $(4, 1)$ .  $\perp = -\frac{4}{3}$
- d. What is the slope of line  $n$ ?



- Important Facts:**
1.  $\parallel$  segments have **Same slope**
  2.  $\perp$  segments have **opposite reciprocals (flip)**

Ex: If  $\overline{AB} \perp \overline{BC}$  and the slope of  $\overline{AB}$  is  $-\frac{3}{4}$ , what is the slope of  $\overline{BC}$ ?

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

$$m = \frac{y - y_1}{x - x_1}$$

Ex: Quadrilateral  $ABCD$  has vertices  $A(-1, 2)$ ,  $B(2, 4)$ ,  $C(4, 1)$  and  $D(3, -4)$ .

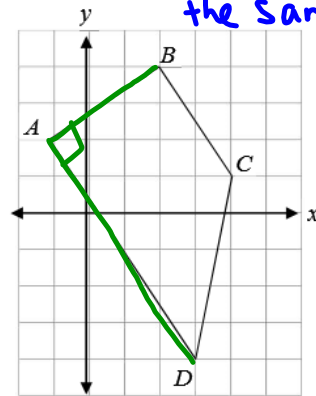
a. Is  $\overline{AD} \parallel \overline{BC}$ ?

$$AD = \frac{-4 - 2}{3 - (-1)} = \frac{-6}{4} = -\frac{3}{2}$$

$$BC = \frac{4 - 1}{2 - 4} = -\frac{3}{2}$$

same slope

\*  $\overline{AD} \parallel \overline{BC}$   
 b/c slopes are the same.



b. Is  $\angle A$  a right angle?

$$AD = \frac{-4 - 2}{3 - (-1)} = \frac{-6}{4} = -\frac{3}{2}$$

$$AB = \frac{4 - 2}{2 - (-1)} = \frac{2}{3}$$

\* Yes  $\angle A$  is a right  $\angle$  slopes are opposite reciprocals



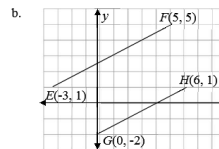
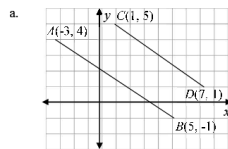
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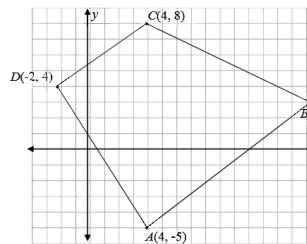
Geometry HW: CG - 3

1. a. Find the slope of the line  $3x - 4y = 8$ .
- b. Find the slope of a line parallel to the line in part a.
- c. Find the slope of a line perpendicular to the line in part a.

2. Determine using slopes whether or not the two segments shown are parallel and give a specific reason or why not.



3. In the quadrilateral at right, determine using slopes if  $\angle A$  and/or  $\angle D$  are right angles. For each angle, give a specific reason why or why not.



4. Find the equation of a line parallel to the line  $3x + 2y = 12$  and passing through the point  $(6, -2)$ .
  
  
  
  
  
  
  
  
  
  
5. Find the equation of a line perpendicular to the line  $y = \frac{5}{2}x + 3$  and passing through the point  $(5, -4)$ .
  
  
  
  
  
  
  
  
  
  
6. Two perpendicular lines have the same  $y$ -intercept. The equation of one of the lines is  $2x + 3y = 12$ . Find an equation for the other line.
  
  
  
  
  
  
  
  
  
  
7. Tom has a line of slope  $2/3$ . Sawyer has a line parallel to Tom's with a slope of  $p/q$ . Must  $p = 2$ ? Explain.
  
  
  
  
  
  
  
  
  
  
8. Triangle  $ABC$  has vertices  $A(-2, 3)$ ,  $B(6, 3)$  and  $C(6, 9)$ .
  - a. Graph  $\triangle ABC$ .
  - b. Find the area of the triangle.
  - c. Find the perimeter of the triangle.