

# 3-3 Study Guide and Intervention

## Slopes of Lines

Key Idea

**Slope of a Line** The slope  $m$  of a line containing two points with coordinates  $(x_1, y_1)$

and  $(x_2, y_2)$  is given by the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$ , where  $x_1 \neq x_2$ .

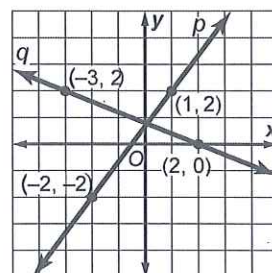
**Example** Find the slope of each line.

For line  $p$ , substitute  $(1, 2)$  for  $(x_1, y_1)$  and  $(-2, -2)$  for  $(x_2, y_2)$ .

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-2)}{1 - (-2)} = \frac{2 + 2}{1 + 2} = \frac{4}{3}$$

For line  $q$ , substitute  $(2, 0)$  for  $(x_1, y_1)$  and  $(-3, 2)$  for  $(x_2, y_2)$ .

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 0}{-3 - 2} = \frac{2}{-5}$$



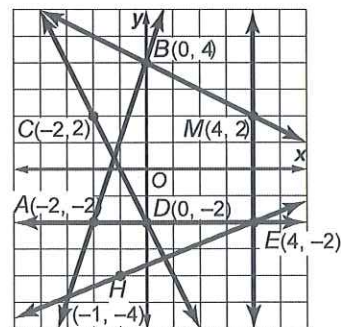
### Exercises

Determine the slope of the line that contains the given points.

- |                         |                           |
|-------------------------|---------------------------|
| 1. $J(0, 0), K(-2, 8)$  | 2. $R(-2, -3), S(3, -5)$  |
| 3. $L(1, -2), N(-6, 3)$ | 4. $P(-1, 2), Q(-9, 6)$   |
| 5. $T(1, -2), U(6, -2)$ | 6. $V(-2, 10), W(-4, -3)$ |

Find the slope of each line.

- |                     |                     |
|---------------------|---------------------|
| 7. $\overline{AB}$  | 8. $\overline{CD}$  |
| 9. $\overline{EM}$  | 10. $\overline{AE}$ |
| 11. $\overline{EH}$ | 12. $\overline{BM}$ |



3-3

Study Guide and Intervention (continued)

Key Ideas

Slopes of Lines

**Parallel and Perpendicular Lines** If you examine the slopes of pairs of parallel lines and the slopes of pairs of perpendicular lines, where neither line in each pair is vertical, you will discover the following properties.

Two lines have the same slope if and only if they are parallel.

Two lines are perpendicular if and only if the product of their slopes is  $-1$ .

ex  $\frac{2}{3} \times -\frac{3}{2} = -1$

Example

Determine whether  $\overline{AB}$  and  $\overline{CD}$  are parallel, perpendicular, or neither for  $A(-1, -1)$ ,  $B(1, 5)$ ,  $C(1, 2)$ ,  $D(5, 4)$ . Graph each line to verify your answer.

1 Find the slope of each line.

slope of  $\overline{AB} = \frac{5 - (-1)}{1 - (-1)} = \frac{6}{2}$  or

slope of  $\overline{CD} = \frac{4 - 2}{5 - 1} = \frac{2}{4} = \frac{1}{2}$

The two lines do not have the same slope, so they are not parallel.

To determine if the lines are perpendicular, find the product of their slopes

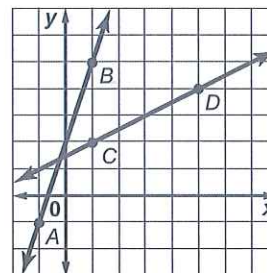
$3 \left(\frac{1}{2}\right) = \frac{3}{2}$  or

Product of slope for  $\overline{AB}$  and  $\overline{CD}$ .

Since the product of their slopes is not  $-1$ , the two lines are not perpendicular.

$\overline{AB}$  and  $\overline{MNCD}$

When graphed, the two lines intersect but not at a right angle.



• Parallel: same slope  
• Perpendicular slopes are opposite reciprocals  
ex  $\frac{2}{3}, -\frac{3}{2}$   
• write neither if not same or opp. recip.

Exercises

Determine whether  $\overline{MN}$  and  $\overline{RS}$  are parallel, perpendicular, or neither. Graph each line to verify your answer. Graph Paper Available on counter.

1.  $M(0, 3), N(2, 4), R(2, 1), S(8, 4)$

2.  $M(-1, 3), N(0, 5), R(2, 1), S(6, -1)$

3.  $M(-1, 3), N(4, 4), R(3, 1), S(-2, 2)$

4.  $M(0, -3), N(-2, -7), R(2, 1), S(0, -3)$

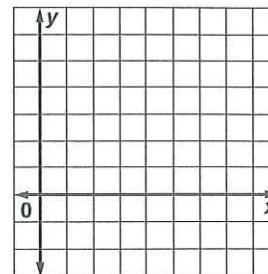
Graph the line that satisfies each condition.

Label each Line #5, #6, #7.

5. slope = 4, passes through (6, 2)

6. passes through  $H(8, 5)$ , perpendicular to  $\overline{AG}$  with  $A(-5, 6)$  and  $G(-1, -2)$

7. passes through  $C(-2, 5)$ , parallel to  $\overline{LB}$  with  $L(2, 1)$  and  $B(7, 4)$



MUST DO  
ODDS  
Evens Extra  
Credit.

# 3-4 Study Guide and Intervention

## Key Ideas Equations of Lines

**Write Equations of Lines** You can write an equation of a line if you are given any of the following:

- the slope and the  $y$ -intercept,
- the slope and the coordinates of a point on the line, or
- the coordinates of two points on the line.

If  $m$  is the slope of a line,  $b$  is its  $y$ -intercept, and  $(x_1, y_1)$  is a point on the line, then:

- the **slope-intercept form** of the equation is  $y = mx + b$ ,
- the **point-slope form** of the equation is  $y - y_1 = m(x - x_1)$ .

**Example 1** Write an equation in slope-intercept form of the line with slope  $-2$  and  $y$ -intercept  $4$ .

$$y = mx + b \quad \text{Slope-intercept form}$$

$$y = -2x + 4 \quad m = -2, b = 4$$

The slope-intercept form of the equation of the line is  $y = -2x + 4$ .

**Example 2** Write an equation in point-slope form of the line with slope  $-\frac{3}{4}$  that contains  $(8, 1)$ .

$$y - y_1 = m(x - x_1) \quad \text{Point-slope form}$$

$$y - 1 = -\frac{3}{4}(x - 8)$$

The point-slope form of the equation of the

$$\text{line is } y - 1 = -\frac{3}{4}(x - 8).$$

## Exercises

Write an equation in slope-intercept form of the line having the given slope and  $y$ -intercept or given points. Then graph the line. *Graph Paper on Counter.*

1.  $m: 2, b: -3$

2.  $m: -\frac{1}{2}, b: 4$

3.  $m: -\frac{1}{4}, b: 5$

4.  $m: 0, b: -2$

5.  $m: -\frac{5}{3}, (0, -1)$

6.  $m: -3, (1, -11)$

Write an equation in point-slope form of the line having the given slope that contains the given point. Then graph the line. *Graph Paper on Counter.*

7.  $m = 2, (3, -1)$

8.  $m = -2, (4, -2)$

9.  $m = -1, (-1, 3)$

10.  $m = 4, (-3, -2)$

11.  $m = -2, (0, -3)$

12.  $m = 0, (-2, 5)$

**3-4**

**Study Guide and Intervention** *(continued)*

**Equations of Lines**

**Write Equations to Solve Problems** Many real-world situations can be modeled using linear equations.

**Example** Donna offers computer services to small companies in her city. She charges **\$55 per month** for maintaining a web site and **\$45 per hour** for each service call. *Fixed monthly cost* *Cost per hour is slope*

- a. Write an equation to represent the total monthly cost,  $C$ , for maintaining a web site and for  $h$  hours of service calls.

For each hour, the cost increases \$45. So the rate of change, or slope, is 45. The  $y$ -intercept is located where there are 0 hours, or \$55.

$$C = mh + b$$

$$= 45h + 55$$

- b. Donna may change her costs to represent them by the equation  $C = 25h + 125$ , where \$125 is the fixed monthly fee for a web site and the cost per hour is \$25. Compare her new plan to the old one if a

company has  $5\frac{1}{2}$  hours of service calls. Under which plan would Donna earn more?

*First plan* from part a

$$C = 45h + 55 = 45\left(5\frac{1}{2}\right) + 55$$

$$= 247.5 + 55 \text{ or } \$302.50$$

*Second Plan* new from part b

For  $5\frac{1}{2}$  hours of service Donna would earn

$$C = 25h + 125 = 25(5.5) + 125$$

$$= 137.5 + 125 \text{ or } \$262.50$$

Donna would earn more with the first plan.

**Exercises**

For Exercises 1–4, use the following information.

Jerri's current satellite television service charges a flat rate of \$34.95 per month for the basic channels and an additional \$10 per month for each premium channel. A competing satellite television service charges a flat rate of \$39.99 per month for the basic channels and an additional \$8 per month for each premium channel.

- Write an equation in slope-intercept form that models the total monthly cost for each satellite service, where  $p$  is the number of premium channels.
- If Jerri wants to include three premium channels in her package, which service would be less, her current service or the competing service?

*Jerri's Service:*  
*Competitor:*

- A third satellite company charges a flat rate of \$69 for all channels, including the premium channels. If Jerri wants to add a fourth premium channel, which service would be least expensive?
- Write a description of how the fee for the number of premium channels is reflected in the equation.

