

**LESSON 19: Parallel and Perpendicular Lines**

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**[OBJECTIVE]**

The student will learn how to identify parallel and perpendicular lines and write an equation of the line that passes through a given point, parallel to a given line or perpendicular to a given line.

**[MATERIALS]**

Student pages **S156–S164**

Transparencies **T410, T412, T414, T416, T419**

Wall-size four-quadrant grid

**[ESSENTIAL QUESTIONS]**

1. What are the differences between parallel lines and perpendicular lines?
2. How do the  $y$ -intercepts of lines affect whether they are parallel or perpendicular?

**[GROUPING]**

Cooperative Pairs, Whole Group, Individual

**[LEVELS OF TEACHER SUPPORT]**

Modeling (M), Guided Practice (GP), Independent Practice (IP)

**[MULTIPLE REPRESENTATIONS]**

SOLVE, Graph, Algebraic Formula, Verbal Description

**[WARM-UP] (5 minutes – IP) S156 (Answers on T409.)**

- Have students turn to S156 in their books to begin the Warm-Up. Students will practice changing equations of lines to slope-intercept form. Monitor students to see if any of them need help during the Warm-Up. Give students 3 minutes to complete the problems and then spend 2 minutes reviewing the answers as a class. {Algebraic Formula}

**[HOMEWORK]: (5 minutes)**

Take time to go over the homework from the previous night.

**[LESSON]: (45–55 minutes – M, GP, IP)**

## LESSON 19: Parallel and Perpendicular Lines

**SOLVE Problem****(5 minutes – GP) T410, S157 (Answers on T411.)**

Have students turn to S157 in their books, and place T410 on the overhead. The first problem is a SOLVE problem. You are only going to complete the S step with students at this point. Tell students that during the lesson they will continue to write equations of lines and learn how to tell if lines are parallel or perpendicular. They will use this knowledge to complete this SOLVE problem at the end of the lesson. **{SOLVE}**

**Slope Using Two Points****(5 minutes – GP) T410, S157 (Answers on T411.)**

Complete S157 (T410) with students. Your students should know how to write the equation of a line given two points, but it is important to review all of the steps. **{Algebraic Formula, Verbal Description}**

**Graph and Compare Parallel Lines****(8 minutes – M, GP) T412, S158  
(Answers on T413.)**

Have students turn to S158 in their books, and place T412 on the overhead. Use the following activity to model for students how to identify parallel lines from their graphs and by comparing the equations used to describe them. **{Graph, Algebraic Formula, Verbal Description}**

**MODELING****Parallel Lines**

**Step 1:** For Problem 1, have students first label the  $x$ -coordinates and the  $y$ -coordinates of the points given, as shown below.

$$\begin{array}{ccc} (0, 4) & \text{and} & (-3, -5) \\ x_1, y_1 & & x_2, y_2 \end{array}$$

**Step 2:** Next, have students find the slope ( $m$ ) of the line passing through the two points, using the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$ .

$$m = \frac{-5 - 4}{-3 - 0} = \frac{-9}{-3} = 3$$

**Step 3:** Have students list the slope and the  $x$ -coordinate and  $y$ -coordinate of one of the points.

$$m = 3 \qquad x\text{-coordinate} = 0 \qquad y\text{-coordinate} = 4$$

## LESSON 19: Parallel and Perpendicular Lines

**Step 4:** Have students write  $y = mx + b$ , the general equation for a line in slope-intercept form, substitute the values they listed in Step 3 into the equation, and solve for  $b$ , or the  $y$ -intercept.

$$\begin{aligned}y &= mx + b \\4 &= 3(0) + b \\4 &= 3(0) + b \\4 &= 0 + b \\4 &= b\end{aligned}$$

**Step 5:** Finally, have students substitute the values for  $m$  and  $b$  into the equation  $y = mx + b$  in order to write the equation of the line passing through the two points in Problem 1.

$$y = 3x + 4$$

**Step 6:** Have students graph the point showing the  $y$ -intercept of the line. The  $y$ -intercept is 4, so the point should be graphed at  $(0, 4)$ . Then have students use the slope (3, or  $\frac{3}{1}$ ) to find other points on the line and draw a line to connect the points. Optional: Use the wall-size four-quadrant grid.

Repeat the steps above to list the slope,  $y$ -intercept, and equation for the line passing through the two points given in Problem 2 and then graph the line.

Use the questions at the bottom of the page to discuss the lines that students graphed. For example, ask students, "What do you notice about the lines?" "Do you think they will ever intersect?" Explain to students that the lines they graphed are parallel lines and that parallel lines always have the same slope.

**Graph and Compare Perpendicular Lines**

(8 minutes – (M, GP) T414, S159  
(Answers on T415.)

Repeat the steps above to graph and compare the perpendicular lines passing through the points given in Problems 1 and 2 on T414 (S159). **{Graph, Algebraic Formula, Verbal Description}**

Use the questions at the bottom of T414 (S159) to discuss the lines that students graphed. To prove to your students that the lines are perpendicular, put the corner of a piece of paper or sticky note where the lines intersect so that students can see that the two sides of the paper match the lines. Explain to students that perpendicular lines have slopes which are negative reciprocals of each other.

## LESSON 19: Parallel and Perpendicular Lines

**Parallel and Perpendicular Equations****(10 minutes – M, GP) T416, S160  
(Answers on T417.)**

Work with students to complete Problems 1 and 2 on T416 (S160). Remind students that parallel lines have the same slope and perpendicular lines have slopes that are negative reciprocals of each other. You may want to have students practice writing the negative reciprocals of numbers (For example:  $2, \frac{1}{2}; 1, -1; -3, \frac{1}{3}; \frac{2}{3}, \frac{3}{2}$ .) Once students have identified the slopes to use for the parallel and perpendicular lines, they can complete each problem by following the steps listed on S157. **{Algebraic Formula}**

**If time permits...****(10 minutes – IP) S161 (Answers on T418.)**

Have students complete Problems 1–4 on S161. They can work in cooperative pairs or independently. Remind students that, if necessary, they can use the steps listed on S157 after they have found the slope of either the parallel or perpendicular line. Give students 8 minutes to complete the problems. Then use 2 minutes to review the answers as a class. **{Algebraic Formula}**

**SOLVE Problem****(9 minutes – GP) T419, S162 (Answers on T420.)**

Remind students that the SOLVE problem is the same one from the beginning of the lesson. Complete the SOLVE problem with your students. Students may have problems writing the coordinates to use for the second equation. **{SOLVE, Algebraic Formula}**

**[CLOSURE]: (5 minutes)**

- To wrap up the lesson, go back to the essential questions and discuss them with students.
  - What are the differences between parallel lines and perpendicular lines? (*Parallel lines never intersect and have the same slope. Perpendicular lines intersect forming four  $90^\circ$  angles. Their slopes are negative reciprocals of each other.*)
  - How do the  $y$ -intercepts of lines affect whether they are parallel or perpendicular? (*The  $y$ -intercepts do not affect the lines at all.*)

**[HOMEWORK]:** Assign S163 and S164 for homework. (Answers on T421, T422.)

**[QUIZ ANSWERS]: T423–T424**

1. D    2. B    3. B    4. D    5. A    6. B    7. A    8. C    9. A    10. A

The quiz can be used at any time as extra homework or to see how students did on understanding parallel and perpendicular lines.

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S156**.

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**Warm-Up**

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**Directions:** Write each equation in slope-intercept form ( $y = mx + b$ ).

1.  $x + y = 7$

$$\frac{-x}{-1} = \frac{-x}{-1} + \frac{7}{-1}$$
$$y = -x + 7$$

2.  $4x + y = 1$

$$\frac{-4x}{-1} = \frac{-4x}{-1} + \frac{1}{-1}$$
$$y = -4x + 1$$

3.  $x - y = -2$

$$\frac{-x}{-1} = \frac{-x}{-1} + \frac{-2}{-1}$$
$$y = x + 2$$

4.  $3x + 6y = 12$

$$\frac{-3x}{6} = \frac{-3x}{6} + \frac{12}{6}$$
$$y = -\frac{1}{2}x + 2$$

LESSON 19: Parallel and Perpendicular Lines

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**TRANSPARENCY MASTER**

**Directions:** Complete the following SOLVE problem with your teacher. You will only complete the S step.

Aiden works for his parents every weekend at the local fruit stand. They pay him \$10 per day and \$0.10 for every pound of fruit he sells. The equation  $T = 0.10p + 10$  represents the amount he will make in a day ( $T$ ) and the number of pounds of fruit he sells ( $p$ ). Aiden asked for a raise, so his parents told him they would still pay him \$0.10 for every pound of fruit he sold, but if he sold 20 pounds of fruit they would pay him \$22.00. What equation would represent the amount of money Aiden's parents are going to pay him after the raise, and how does the new equation compare to the equation which represents the amount of money he was originally paid?

**S** Underline the question.

This problem is asking me to find \_\_\_\_\_.

**Directions:** Work with your teacher to write the equation of the line that passes through the points  $(2, -1)$  and  $(3, 2)$ .

1. Label the  $x$ -coordinate and  $y$ -coordinate of each of the points.
2. Find the slope of the line passing through the two points, using the formula
$$m = \frac{y_2 - y_1}{x_2 - x_1}.$$
3. List the slope and the  $x$ -coordinate and  $y$ -coordinate of one of the points.
4. Write  $y = mx + b$ , the general equation for a line in slope-intercept form, substitute the values you listed in Step 3 into the equation, and solve for  $b$ , or the  $y$ -intercept.
5. Substitute the values for  $m$  and  $b$  into the equation  $y = mx + b$  in order to write the equation of the line passing through the two points.

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S157**.

**Directions:** Complete the following SOLVE problem with your teacher. You will only complete the S step.

Aiden works for his parents every weekend at the local fruit stand. They pay him \$10 per day and \$0.10 for every pound of fruit he sells. The equation  $T = 0.10p + 10$  represents the amount he will make in a day ( $T$ ) and the number of pounds of fruit he sells ( $p$ ). Aiden asked for a raise, so his parents told him they would still pay him \$0.10 for every pound of fruit he sold, but if he sold 20 pounds of fruit they would pay him \$22.00. What equation would represent the amount of money Aiden's parents are going to pay him after the raise, and how does the new equation compare to the equation which represents the amount of money he was originally paid?

**S** Underline the question.

This problem is asking me to find **the equation which represents Aiden's new pay and how it compares to the equation for his original pay.**

**Directions:** Work with your teacher to write the equation of the line that passes through the points  $(2, -1)$  and  $(3, 2)$ .

1. Label the x-coordinate and y-coordinate of each of the points.  **$(2, -1)$   $(3, 2)$**   
 $x_1$   $y_1$   $x_2$   $y_2$

2. Find the slope of the line passing through the two points, using the formula

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

3. List the slope and the x-coordinate and y-coordinate of one of the points.

$$m = 3 \quad x\text{-coordinate} = 2 \quad y\text{-coordinate} = -1$$

4. Write  $y = mx + b$ , the general equation for a line in slope-intercept form, substitute the values you listed in Step 3 into the equation, and solve for  $b$ , or the y-intercept.

$$\begin{aligned} y &= mx + b \\ -1 &= (3)(2) + b \\ -1 &= 6 + b \\ \underline{-6 \quad -6} \\ -7 &= b \end{aligned}$$

5. Substitute the values for  $m$  and  $b$  into the equation  $y = mx + b$  in order to write the equation of the line passing through the two points.

$$y = 3x + -7 \quad \text{or} \quad y = 3x - 7$$

## LESSON 19: Parallel and Perpendicular Lines

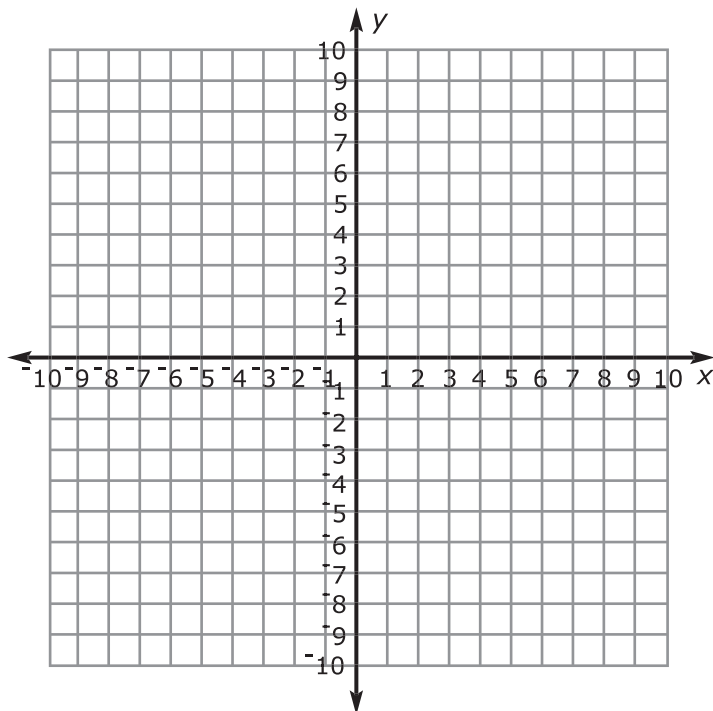
## TRANSPARENCY MASTER

**Directions:** Write the slope,  $y$ -intercept, and equation of the line passing through the points shown in each problem below. Graph the two lines and then answer the questions.

1.  $(0, 4)$  and  $(-3, -5)$   $m =$  \_\_\_\_\_  $b =$  \_\_\_\_\_  $y =$  \_\_\_\_\_

2.  $(-1, -6)$  and  $(2, 3)$   $m =$  \_\_\_\_\_  $b =$  \_\_\_\_\_  $y =$  \_\_\_\_\_

Graph the two equations from above on the coordinate grid below.



- How are the equations similar?  
\_\_\_\_\_
- What can you say about these two lines?  
\_\_\_\_\_
- If two lines have the same \_\_\_\_\_ then they are \_\_\_\_\_.

## LESSON 19: Parallel and Perpendicular Lines

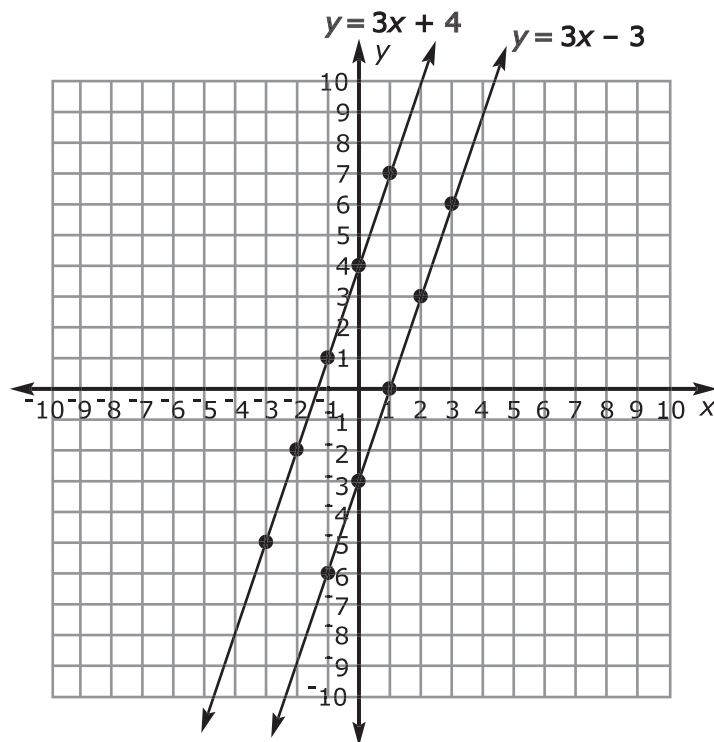
Here is the key to **S158**.

**Directions:** Write the slope,  $y$ -intercept, and equation of the line passing through the points shown in each problem below. Graph the two lines and then answer the questions.

1.  $(0, 4)$  and  $(-3, -5)$      $m = 3$                        $b = 4$                        $y = 3x + 4$

2.  $(-1, -6)$  and  $(2, 3)$      $m = 3$                        $b = -3$                        $y = 3x - 3$

Graph the two equations from above on the coordinate grid below.



- How are the equations similar?  
**Slopes are the same**
- What can you say about these two lines?  
**They appear to be parallel**
- If two lines have the same **slope** then they are **parallel**.

## LESSON 19: Parallel and Perpendicular Lines

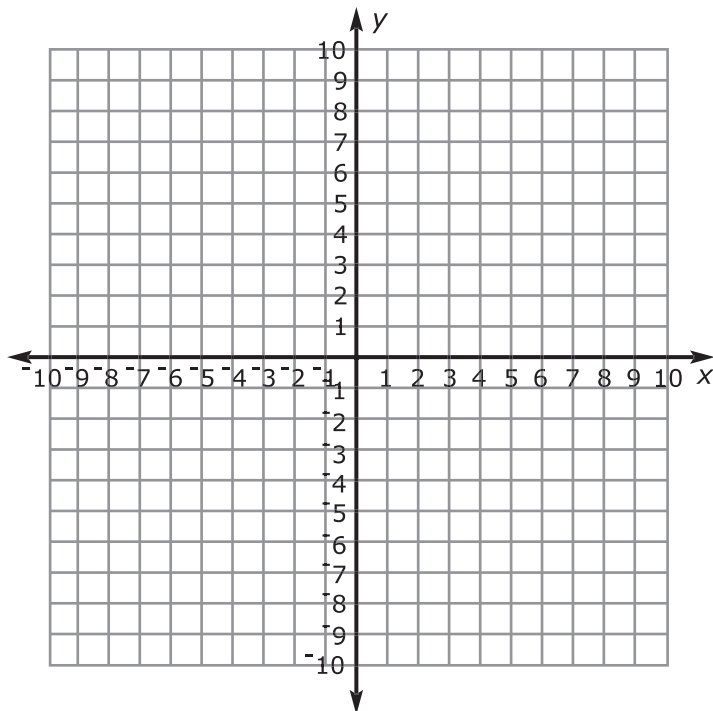
## TRANSPARENCY MASTER

**Directions:** Write the slope,  $y$ -intercept, and equation of the line passing through the points shown in each problem below. Graph the two lines and then answer the questions.

1.  $(0, 3)$  and  $(-2, -5)$   $m =$  \_\_\_\_\_  $b =$  \_\_\_\_\_  $y =$  \_\_\_\_\_

2.  $(4, -7)$  and  $(0, -6)$   $m =$  \_\_\_\_\_  $b =$  \_\_\_\_\_  $y =$  \_\_\_\_\_

Graph the two equations from above on the coordinate grid below.



- What do you notice about the slopes of the two equations?  
\_\_\_\_\_
- What can you say about these two lines?  
\_\_\_\_\_
- If two lines have \_\_\_\_\_ that are \_\_\_\_\_ reciprocals of each other, then they are \_\_\_\_\_.

## LESSON 19: Parallel and Perpendicular Lines

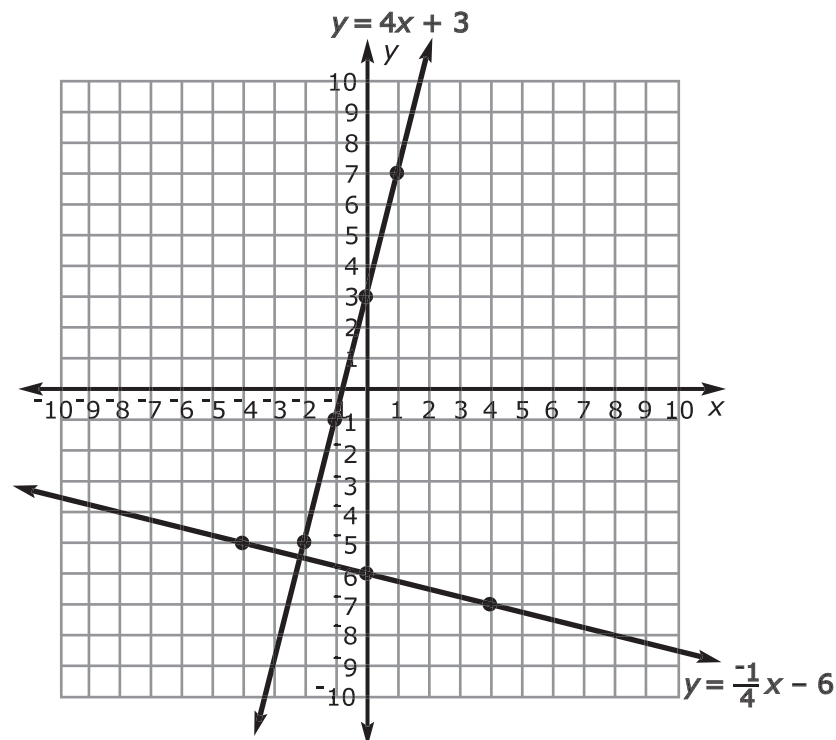
Here is the key to **S159**.

**Directions:** Write the slope,  $y$ -intercept, and equation of the line passing through the points shown in each problem below. Graph the two lines and then answer the questions.

1.  $(0, 3)$  and  $(-2, -5)$      $m = 4$                        $b = 3$                        $y = 4x + 3$

2.  $(4, -7)$  and  $(0, -6)$      $m = \frac{-1}{4}$                        $b = -6$                        $y = \frac{-1}{4}x - 6$

Graph the two equations from above on the coordinate grid below.



- What do you notice about the slopes of the two equations?  
**Slopes are negative reciprocals**
- What can you say about these two lines?  
**They are perpendicular**
- If two lines have **slopes** that are **negative** reciprocals of each other, then they are **perpendicular**.

LESSON 19: Parallel and Perpendicular Lines

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**TRANSPARENCY MASTER**

**Directions:** Write the equation of the line that passes through the point and is parallel or perpendicular to the equation given.

1.  $(1, 1)$      $y = \frac{1}{3}x + 2$

Parallel:

Perpendicular:

2.  $(0, 2)$      $y = \frac{3}{5}x - 4$

Parallel:

Perpendicular:

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S160**.**Directions:** Write the equation of the line that passes through the point and is parallel or perpendicular to the equation given.

1.  $(1, 1)$   $y = \frac{1}{3}x + 2$

Parallel:  $y = \frac{1}{3}x + \frac{2}{3}$

slope = same;  $\frac{1}{3}$ 

$y = \frac{1}{3}x + b$

substitute in  $(1, 1)$ 

$1 = \frac{1}{3}(1) + b$

$1 = \frac{1}{3} + b$

$$\frac{-\frac{1}{3} \quad -\frac{1}{3}}{\frac{2}{3} = b}$$

$\frac{2}{3} = b$

$y = \frac{1}{3}x + \frac{2}{3}$

Perpendicular:  $y = -3x + 4$

slope = negative reciprocal;  $-3$ 

$y = -3x + b$

substitute in  $(1, 1)$ 

$1 = -3(1) + b$

$1 = -3 + b$

$$\frac{+3 \quad +3}{4 = b}$$

$4 = b$

$y = -3x + 4$

2.  $(0, 2)$   $y = \frac{3}{5}x - 4$

Parallel:  $y = \frac{3}{5}x + 2$

slope = same;  $\frac{3}{5}$ 

$y = \frac{3}{5}x + b$

substitute in  $(0, 2)$ 

$2 = \frac{3}{5}(0) + b$

$2 = b$

$y = \frac{3}{5}x + 2$

Perpendicular:  $y = -\frac{5}{3}x + 2$

slope = negative reciprocal;  $-\frac{5}{3}$ 

$y = -\frac{5}{3}x + b$

substitute in  $(0, 2)$ 

$2 = -\frac{5}{3}(0) + b$

$2 = b$

$y = -\frac{5}{3}x + 2$

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S161**.

**Directions:** Write an equation in slope-intercept form of the line that passes through the point and is parallel to the graph of each equation.

$$\begin{array}{lll}
 1. \ y = \frac{4}{3}x + 5; (12, 3) & m = \frac{4}{3} & y = \frac{4}{3}x + b \\
 y = \frac{4}{3}x - 13 & & 3 = \frac{4}{3}(12) + b \\
 & & 3 = 16 + b \\
 & & \underline{-16 \quad -16} \\
 & & -13 = b
 \end{array}$$

$$\begin{array}{llll}
 2. \ 2x + y = 5; (3, 1) & 2x + y = 5 & m = -2 & y = -2x + b \\
 y = -2x + 7 & \underline{-2x \quad -2x} & & 1 = -2(3) + b \\
 & y = -2x + 5 & & 1 = -6 + b \\
 & & & \underline{+6 \quad +6} \\
 & & & 7 = b
 \end{array}$$

**Directions:** Write an equation in slope-intercept form of the line that passes through the point and is perpendicular to the graph of each equation.

$$\begin{array}{lll}
 3. \ y = \frac{1}{4}x - 4; (-2, 3) & m = -4 & y = -4x + b \\
 y = -4x - 5 & & 3 = -4(-2) + b \\
 & & 3 = 8 + b \\
 & & \underline{-8 \quad -8} \\
 & & -5 = b
 \end{array}$$

$$\begin{array}{lll}
 4. \ x - 6y = 2; (2, 4) & x - 6y = 2 & y = -6x + b \\
 y = -6x + 16 & \underline{-x \quad -x} & 4 = -6(2) + b \\
 & \frac{-6y}{-6} = \frac{-x+2}{-6} & 4 = -12 + b \\
 & y = \frac{1}{6}x - \frac{1}{3} & \underline{+12 \quad +12} \\
 & m = -6 & 16 = b
 \end{array}$$

LESSON 19: Parallel and Perpendicular Lines

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**TRANSPARENCY MASTER**

**Directions:** Complete the following SOLVE problem with your teacher.

Aiden works for his parents every weekend at the local fruit stand. They pay him \$10 per day and \$0.10 for every pound of fruit he sells. The equation  $T = 0.10p + 10$  represents the amount he will make in a day ( $T$ ) and the number of pounds of fruit he sells ( $p$ ). Aiden asked for a raise, so his parents told him they would still pay him \$0.10 for every pound of fruit he sold, but if he sold 20 pounds of fruit they would pay him \$22.00. What equation would represent the amount of money Aiden's parents are going to pay him after the raise, and how does the new equation compare to the equation which represents the amount of money he was originally paid?

- S** Underline the question.  
This problem is asking me to find \_\_\_\_\_.
- O** Identify the facts.  
Eliminate the unnecessary facts.  
List the necessary facts.
- L** Choose an operation or operations.  
Write in words what your plan of action will be.
- V** Estimate your answer.  
Carry out your plan.
- E** Does your answer make sense? (Compare your answer to the question.)  
Is your answer reasonable? (Compare your answer to the estimate.)  
Is your answer accurate? (Check your work.)  
Write your answer in a complete sentence.

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S162**.

**Directions:** Complete the following SOLVE problem with your teacher.

~~Aiden works for his parents every weekend at the local fruit stand. | They pay him \$10 per day and \$0.10 for every pound of fruit he sells. | The equation  $T = 0.10p + 10$  represents the amount he will make in a day ( $T$ ) and the number of pounds of fruit he sells ( $p$ )|. Aiden asked for a raise, so his parents told him they would still pay him \$0.10 for every pound of fruit he sold,| but if he sold 20 pounds of fruit they would pay him \$22.00. | What equation would represent the amount of money Aiden's parents are going to pay him after the raise, and how does the new equation compare to the equation which represents the amount of money he was originally paid?~~

**S** Underline the question.

This problem is asking me to find **the equation which represents Aiden's new pay and how it compares to the equation for his original pay.**

**O** Identify the facts.

Eliminate the unnecessary facts.

List the necessary facts.

**Old pay = \$10 a day and \$0.10 a pound  $T = 0.10p + 10$**

**New pay = \$0.10 a pound and 20 pounds = \$22.00 or (20, 22)**

**L** Choose an operation or operations. **Multiplication, subtraction**

Write in words what your plan of action will be. **Find the  $y$ -intercept or the new amount his parents will pay each day and then write an equation. Then compare that equation to the old pay.**

**V** Estimate your answer. **The  $y$ -intercept will be larger than before.**

Carry out your plan.

$$T = 0.10p + b$$

$$22 = 0.10(20) + b$$

$$22 = 2 + b$$

$$\underline{-2} \quad \underline{-2}$$

$$20 = b$$

$$T = 0.10p + 20$$

**The lines are parallel because they have the same slope.**

**E** Does your answer make sense? (Compare your answer to the question.)

**Yes.**

Is your answer reasonable? (Compare your answer to the estimate.) **Yes.**

Is your answer accurate? (Check your work.) **Yes.**

Write your answer in a complete sentence.  **$T = 0.10p + 20$ ; The lines are parallel because they have the same slope.**

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S163**.**Homework**

**Directions:** Write an equation in slope-intercept form of the line that passes through the point and is parallel to the graph of each equation.

1.  $y = \frac{-3}{4}x + \frac{1}{4}; (4, -2)$

$$y = \frac{-3}{4}x + 1$$

2.  $9x + 3y = 8; (-1, -4)$

$$y = -3x - 7$$

3.  $3x - y = 5; (-1, -2)$

$$y = 3x + 1$$

**Directions:** Write an equation in slope-intercept form of the line that passes through the point and is perpendicular to the graph of each equation.

4.  $4x + 7y = 6; (-4, 1)$

$$y = \frac{7}{4}x + 8$$

5.  $2x + 10y = 3; (2, 3)$

$$y = 5x - 7$$

6.  $4x + 3y = -6; (2, 1)$

$$y = \frac{3}{4}x - \frac{1}{2}$$

## LESSON 19: Parallel and Perpendicular Lines

Here is the key to **S164**.**Homework**  
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**Directions:** Determine if the following lines are parallel, perpendicular, or neither.

7.  $2x - y = -3$   
 $2x - y = 5$

$y = 2x + 3$   
 $y = 2x - 5$

**Parallel because they have the same slope.**

8.  $x + y = 2$   
 $x - y = -2$

$y = -x + 2$   
 $y = x + 2$

**Perpendicular because the slopes are the negative reciprocal.**

9.  $y = x + 3$   
 $y = 2x - \frac{1}{3}$

**Neither because the slopes are not the same or negative reciprocals.**

10.  $y = 5$   
 $x = 5$

**Perpendicular**

## LESSON 19: Parallel and Perpendicular Lines

Name \_\_\_\_\_

Date \_\_\_\_\_

**Quiz**

1. Which equation is parallel to  $y = 3x - 4$  and contains the point  $(2, -4)$ ?

- A.  $y = 3x + 4$                       B.  $y = 3x + 2$   
 C.  $y = 3x - 6$                       D.  $y = 3x - 10$

2. Which line is perpendicular to  $5x + 2y = 10$  and contains the point  $(3, -5)$ ?

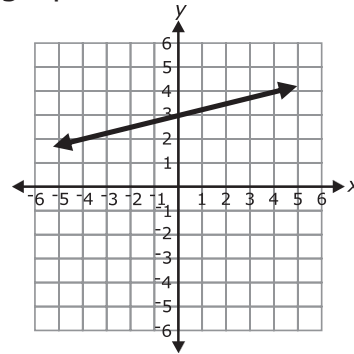
- A.  $y = \frac{2}{5}x - 2$                       B.  $y = \frac{2}{5}x - \frac{31}{5}$   
 C.  $y = -\frac{5}{2}x - 2$                       D.  $y = \frac{5}{2}x - \frac{31}{5}$

3. Which of the following equations is parallel to the line  $y = 2x + 4$ ?

- A.  $y = 4x + 2$                       B.  $y = 2x - 4$   
 C.  $y = -\frac{1}{2}x + 3$                       D.  $y = -2x + 1$

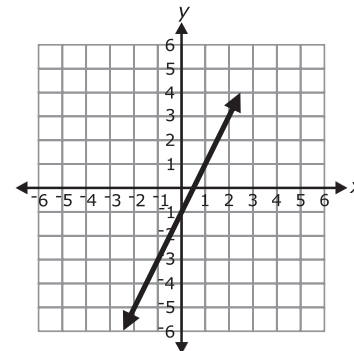
4. Which of the lines is perpendicular to the line graphed below?

- A.  $y = \frac{1}{4}x + 3$                       B.  $y = \frac{1}{4}x - 3$   
 C.  $y = 4x + 3$                       D.  $y = -4x + 3$



5. Which of the following lines is parallel to the line below and passes through the origin?

- A.  $y = 2x$   
 B.  $y = \frac{1}{2}x$   
 C.  $y = -\frac{1}{2}x$   
 D.  $y = x + 2$



LESSON 19: Parallel and Perpendicular Lines

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6. Which of the following lines is parallel to the line  $y = -x + 5$  and goes through the point  $(1, 3)$ ?

- A.  $-x + y = 4$
  - B.  $y = -x + 4$
  - C.  $y = -x + 2$
  - D.  $y = x + 2$
- 

7. Which of the following lines is perpendicular to the line  $y = \frac{1}{2}x - 3$  and goes through the point  $(-1, 2)$ ?

- A.  $2x + y = 0$
  - B.  $2x + y = 2$
  - C.  $2x + 2y = 2$
  - D.  $y = 2$
- 

8. Which of the following lines is parallel to the line  $y = 6$ ?

- A.  $x = 3$
  - B.  $x = -6$
  - C.  $y = 3$
  - D.  $x + y = 6$
- 

9. Which of the following lines is perpendicular to the line  $x + y = 3$ ?

- A.  $x - y = 3$
  - B.  $y = 3$
  - C.  $x = 3$
  - D.  $x + y = -3$
- 

10. Which of the following lines is perpendicular to the line graphed below?

- A.  $y = 4$
- B.  $x = 4$
- C.  $x + y = 4$
- D.  $x - y = 4$

