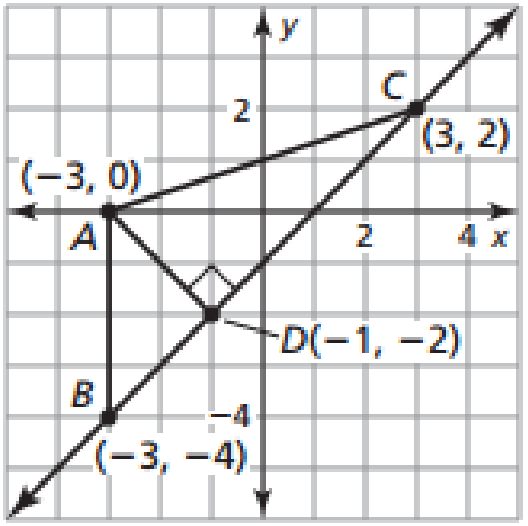
Equations of Parallel and Perpendicular Lines

Lesson 3.5

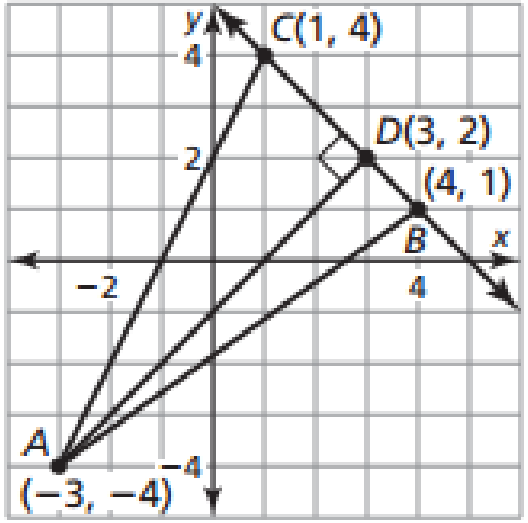
Bell Work: Student Journal p.84: 1, 2, 5, 6

In Exercises 1–4, find the distance from point *A* to $\overline{BC}$.

1.

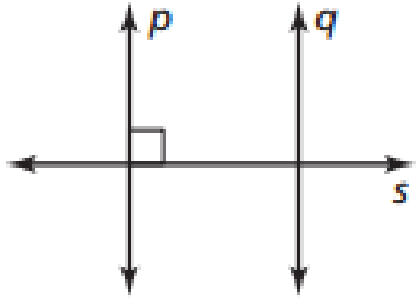


2.

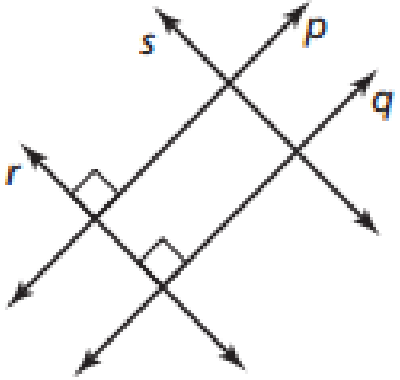


Which lines, if any, must be parallel? Justify your reasoning.

5.



6.



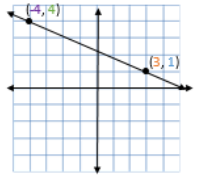
If your All About Slope Foldable is not filled out, sign up for a time to come in and do so.

$$\frac{rise}{run} \rightarrow \frac{\Delta y}{\Delta x}$$

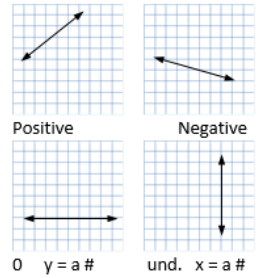
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

(1, 2) (3, 4)

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



$$m = \frac{(1-4)}{(3--4)} = \frac{-3}{7}$$



Mr. Slope

y = mx + b

Equation of a line with slope m and point (0, b). Most commonly used. If standard form (ax + by = c) is given solve for y.

Find an equation of a line with slope -3 passing through (-1, 5).

y = mx + b

5 = -3(-1) + b

5 = 3 + b

2 = b

y = -3x + 2

Find an equation of the line parallel to $y = -\frac{1}{2}x + 2$ passing through (8, -3).

∥ lines = slopes

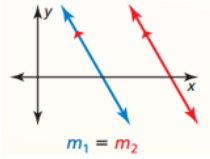
y = mx + b

$-3 = -\frac{1}{2}(8) + b$

-3 = -4 + b

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

In a coordinate plane, two non-vertical lines are parallel if and only if they have the same slope.



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

Equation of a line with slope m and point (x_1, y_1).

Find an equation of a line through (-2, 7) with slope of -5.

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

$y = -5(x - -2) + 7$

$y = -5(x + 2) + 7$

$y = -5x - 10 + 7$

$y = -5x - 3$

Find an equation of a line perpendicular to 3x – 2y = 6, passing through (1, 2).

Solve for y

-2y = -3x + 6

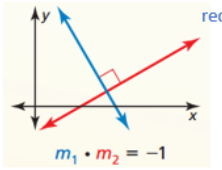
$y = \frac{3}{2}x - 3$; $-\frac{2}{3}$ is ⊥ slope

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

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

In a coordinate plane, two non-vertical lines are perpendicular if and only if the product of their slopes is -1.

Negative reciprocals



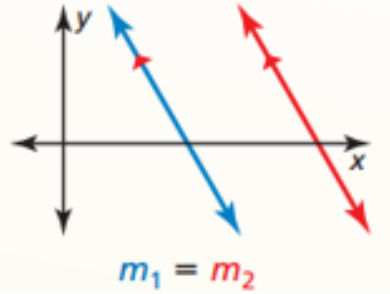
Slopes of ∥ and ⊥ Lines

$$y = \frac{2}{5}x + 6$$

y = mx + b

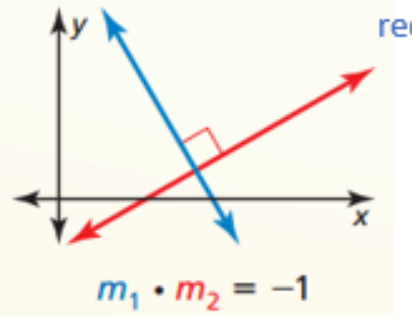
Equation of a line with slope m and point (0, b). Most commonly used. If standard form (ax + by = c) is given solve for y.

In a coordinate plane, two non-vertical lines are parallel if and only if they have the same slope.



In a coordinate plane, two non-vertical lines are perpendicular if and only if the product of their slopes is -1.

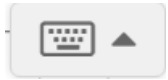
Negative reciprocals



Desmos Introduction

Open Safari and go to Desmos.com.

Press **Launch Calculator**

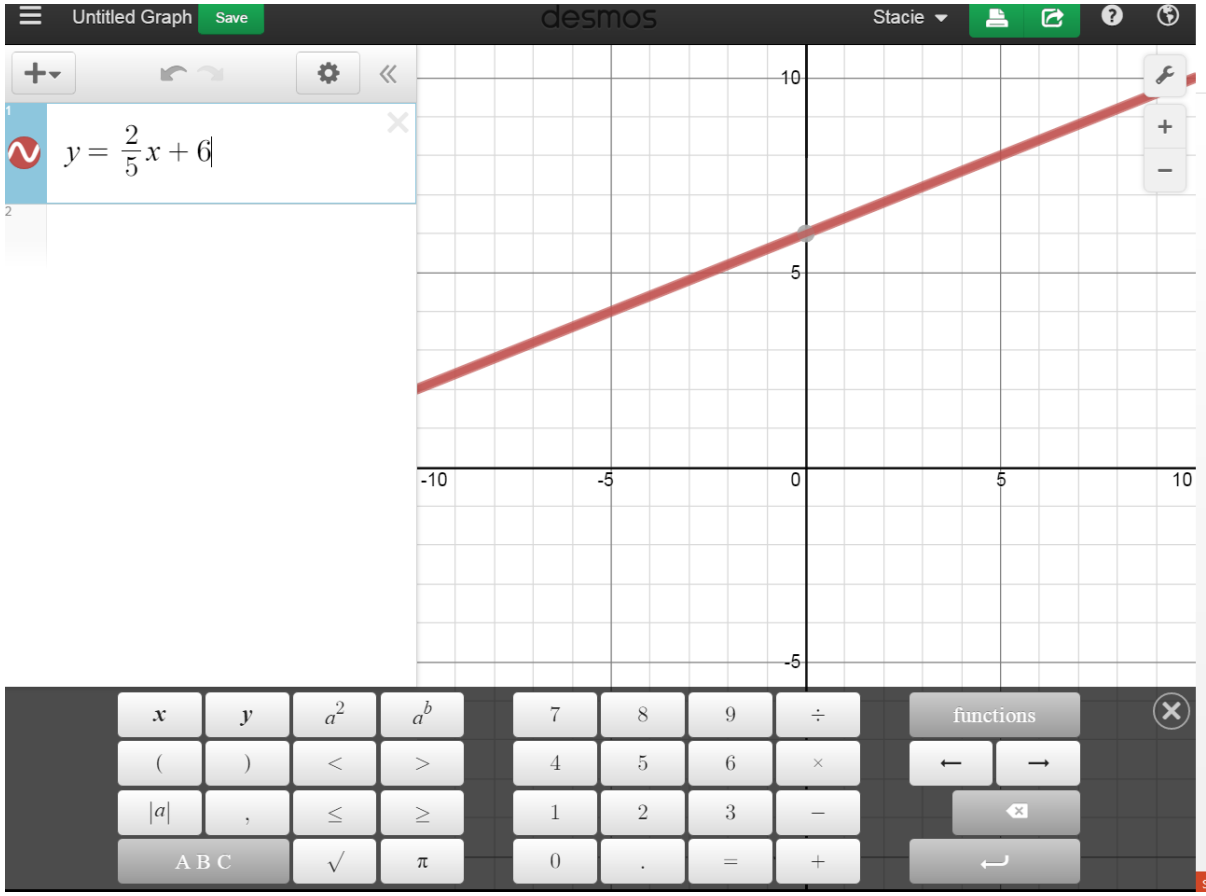
Press **Show Keypad** 

Type $y = \frac{2}{5}x + 6$ (use the ÷ symbol to write 2/5).

Press 

Now graph 2 other lines parallel to the first.

Next graph 2 lines perpendicular to the first.



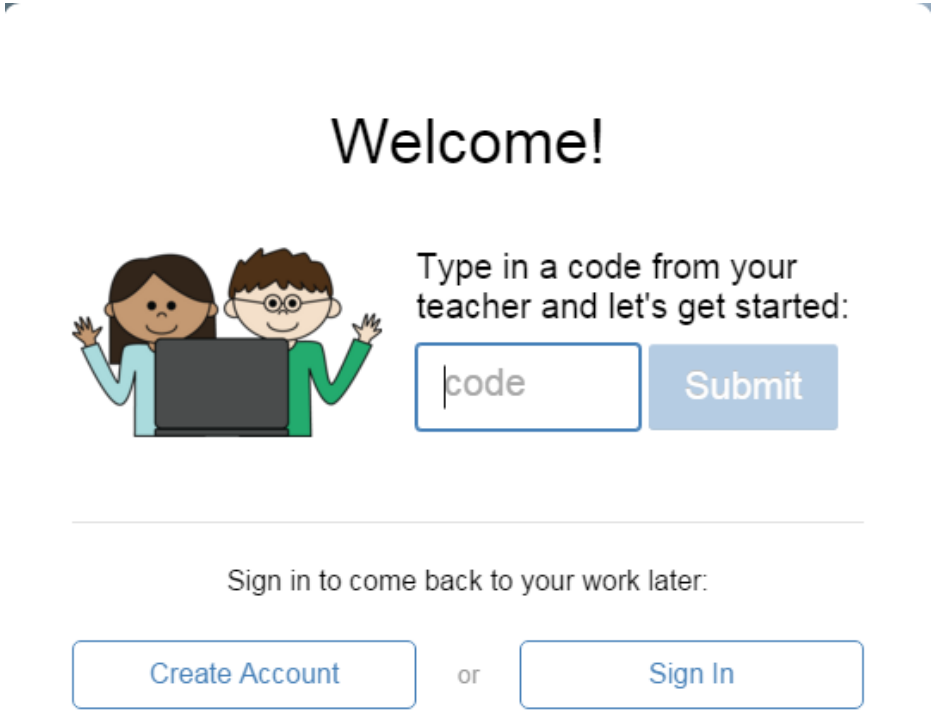
Desmos Activity

Go to **student.desmos.com**.

Enter the class code, press **Submit**.

Enter you and your partner's names.

You will get a participation grade on this.



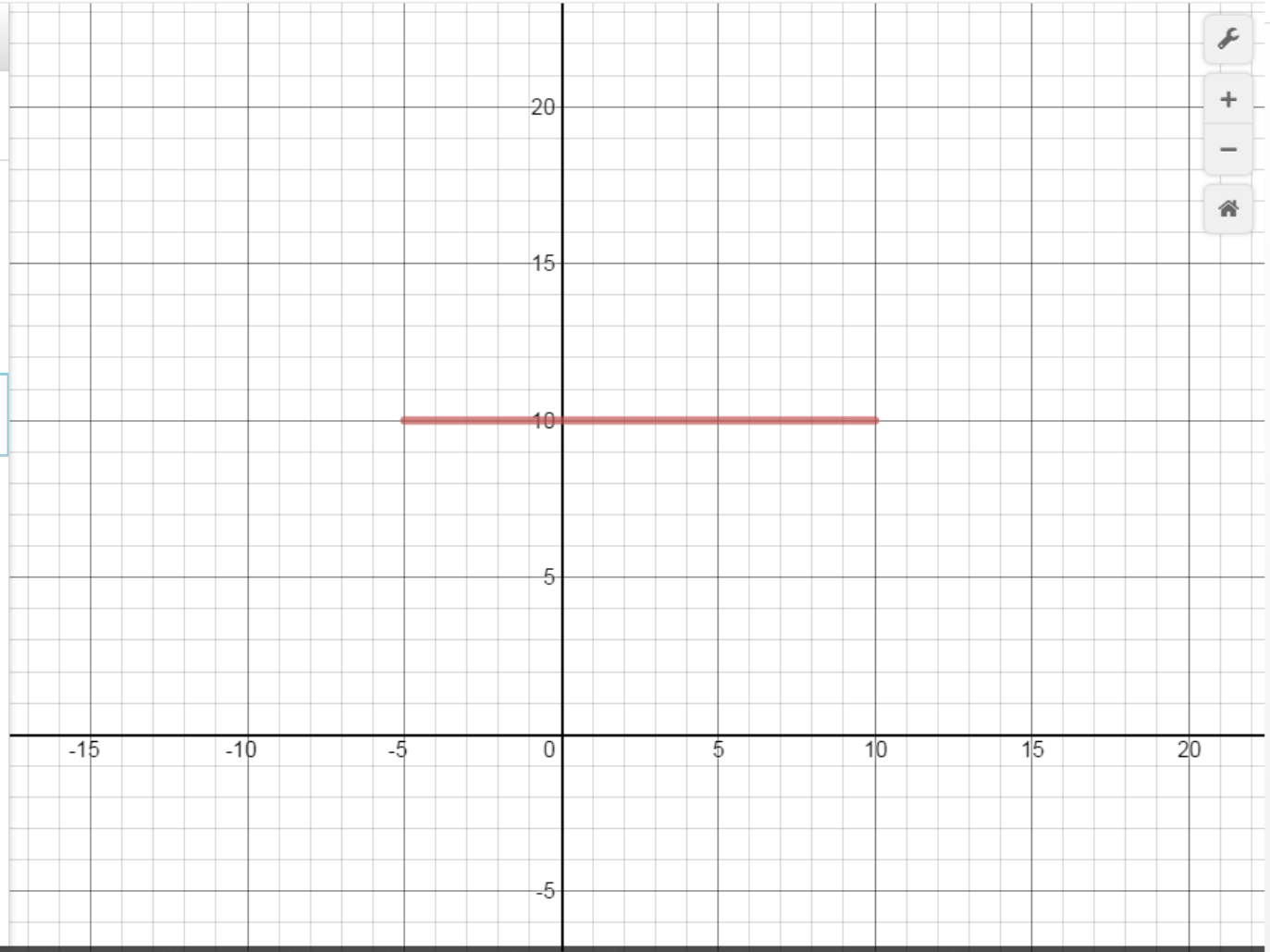
Construct a square.

1 $y = 10\{-5 < x < 10\}$

2 Write three more equations in the lines that follow so that they form a square with the side that is given. (Restrict the domain in each equation so that only the square's sides are visible.)

3

4



Construct a Square Summary

Insights?

Struggles?

Lesson 3.5 Day 2

Bell Work

1. Find the slope of the line that's parallel to $y = 2x - 7$.

$y = mx + b$

$m = 2$

2. Find the slope of the line that's parallel to $9x + 3y = 6$.

$m = -3$

$y = -3x + 2$

$-9x \quad -9x$

$\frac{3y}{3} = \frac{-9x}{3} + \frac{6}{3}$

3. Find the slope of the line that's perpendicular to $4x - 5y = 12$

Slope y-int

$\frac{-5y}{-5} = \frac{-4x}{-5} + \frac{12}{-5}$

$y = \frac{4}{5}x + \frac{-12}{5}$

$-\frac{5}{4}$

Determine which of the lines are parallel and which of the lines are perpendicular.

a ∥ b

a ⊥ c , b ⊥ c

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

$\frac{1-4}{-3+4}$

$\frac{-3}{1}$

c $m = \frac{1-4}{-3-6}$

$= \frac{-3}{-9}$

$= \frac{1}{3}$

(−4, 4) (−3, 1)

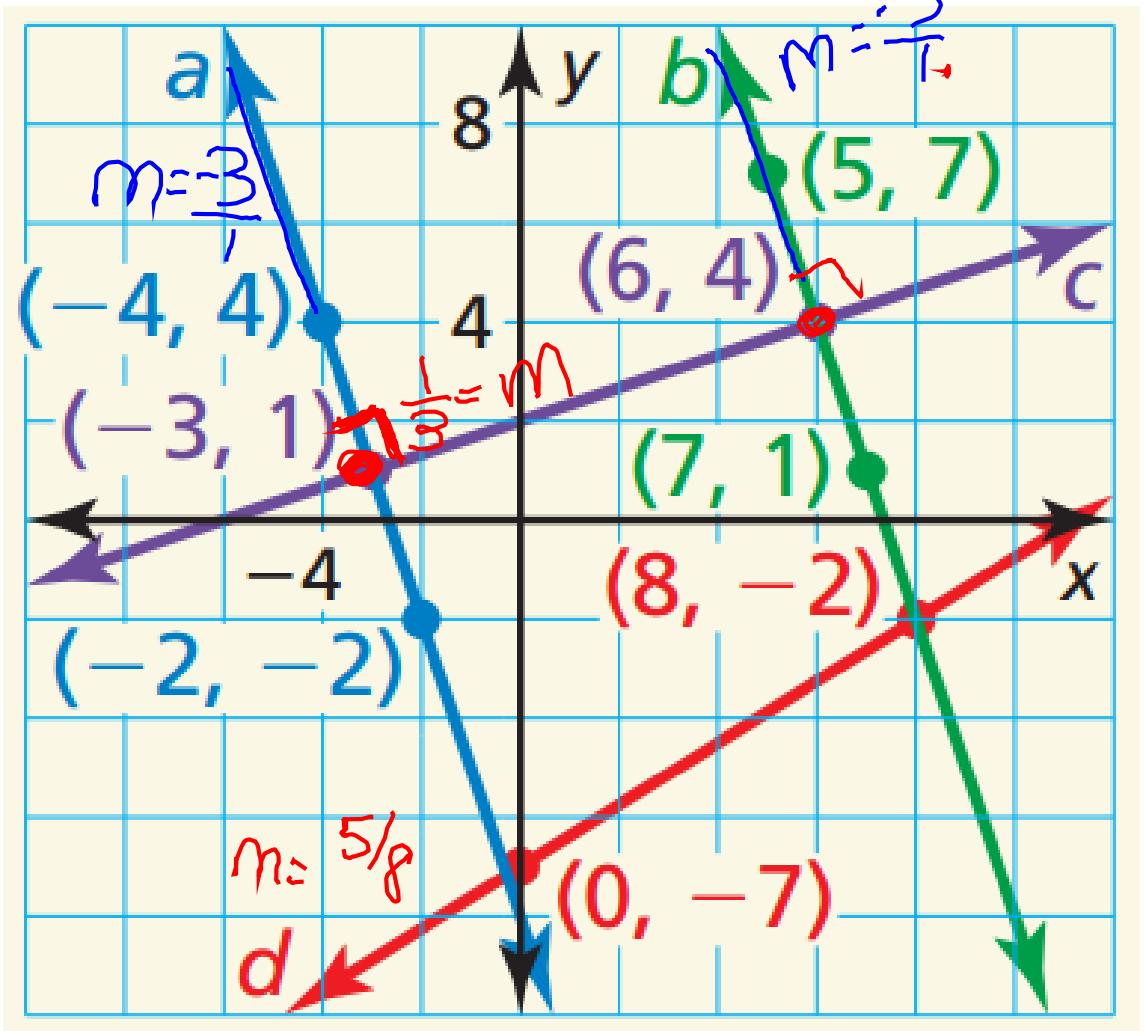
(5, 7) (6, 4)

$\frac{4-7}{6-5} = \frac{-3}{1}$

(6, 4) (−3, 1)

d (0, −7) (8, −2)

$\frac{-2+7}{8-0} = \frac{5}{8}$



Find the slope of the line passing through (-11, 4) and (-7, -6)

$$\frac{rise}{run} \rightarrow \frac{\Delta y}{\Delta x}$$

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

(1, 2) (3, 4)

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

Find the slope of $2x + 3y = 18$

$y = mx + b$

Equation of a line with slope m and point (0, b).

Most commonly used.

If standard form ($ax + by = c$) is given solve for y.

$-2x \quad -2x$

$\frac{+3y}{3} = \frac{-2x+18}{3}$

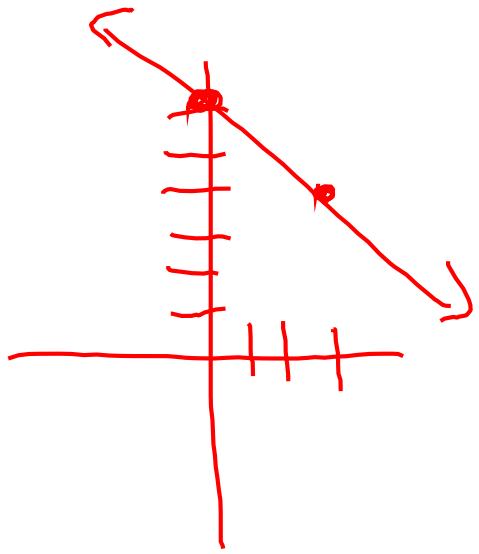
$y = -\frac{2}{3}x + 6$

$m = -\frac{2}{3} \qquad b = 6$

$y - 2 = -\frac{2}{3}(x - 7)$

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

$m = 2$



Write an equation of a line passing through (4, -3) with slope = -2.

Find an equation of a line with slope -3 passing through (-1, 5).

$y = mx + b$

$5 = -3(-1) + b$

$5 = 3 + b$

$2 = b$

$y = -3x + 2$

Find an equation of a line through (-2, 7) with slope of -5.

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

$y = -5(x - -2) + 7$

$y = -5(x + 2) + 7$

$y = -5x - 10 + 7$

$y = -5x - 3$

$y = mx + b$

$y = -2x + b$

$-3 = -2(4) + b$

$-3 = -8 + b$ $\quad b = 5$

$+8 \quad +8$

$y = -2x + 5$

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

$y = -2(x - 4) + -3$ ✓

$y = -2x + 8 - 3$

$y = -2x + 5$

Write an equation of a line passing through (-3, 5) and (-2, 4)

y_1 y_2

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

$m = \frac{4-5}{-2+3}$

$= \frac{-1}{1}$

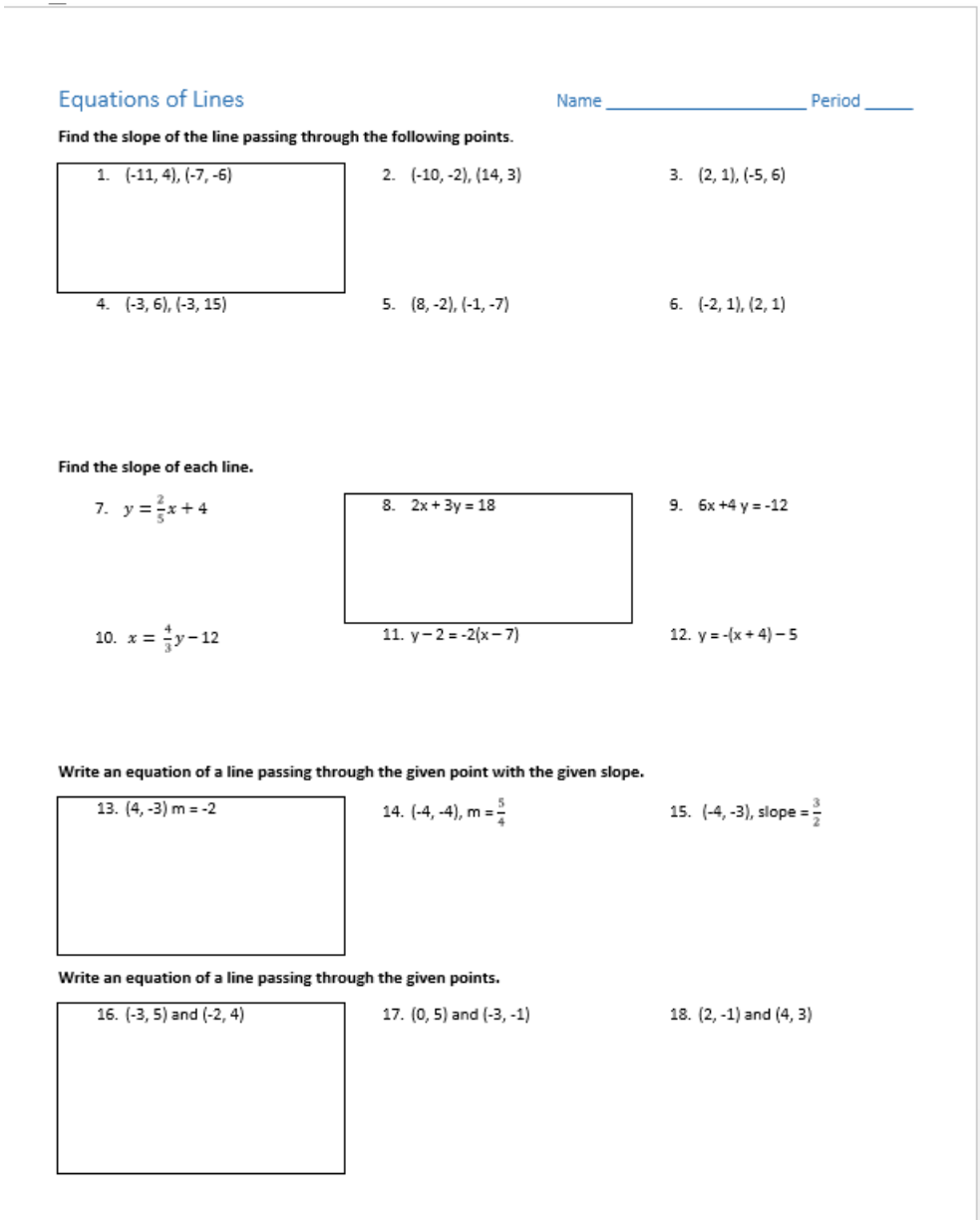
$y = m(x - x_1) + y_1$

$y = -1(x + 3) + 5$

$y = -x - 3 + 5$

$y = -x + 2$

Assignment – Finish the worksheet, review your notes.



Equations of Lines Name _____ Period ____

Find the slope of the line passing through the following points.

1. (-11, 4), (-7, -6)
2. (-10, -2), (14, 3)
3. (2, 1), (-5, 6)
4. (-3, 6), (-3, 15)
5. (8, -2), (-1, -7)
6. (-2, 1), (2, 1)

Find the slope of each line.

7. $y = \frac{2}{5}x + 4$
8. 2x + 3y = 18
9. 6x +4 y = -12
10. $x = \frac{4}{3}y - 12$
11. y – 2 = -2(x – 7)
12. y = -(x + 4) – 5

Write an equation of a line passing through the given point with the given slope.

13. (4, -3) m = -2
14. (-4, -4), m = $\frac{5}{4}$
15. (-4, -3), slope = $\frac{3}{2}$

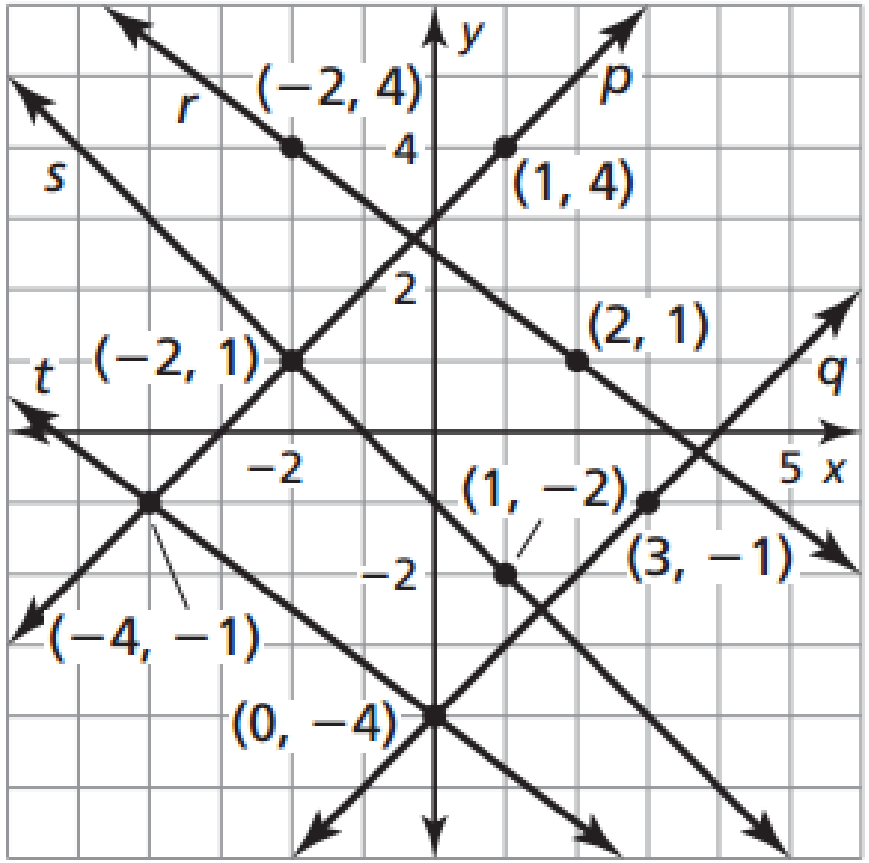
Write an equation of a line passing through the given points.

16. (-3, 5) and (-2, 4)
17. (0, 5) and (-3, -1)
18. (2, -1) and (4, 3)

Lesson 3.5 Day 3

Bell Work: Student Journal p. 89: 3, 4

3. Which lines are parallel and which are perpendicular?



4. Tell whether the lines through the points are parallel, perpendicular or neither.

Line 1: (2, 0), (-2, 2)

Line 2: (1, -2), (4, 4)

Write an equation of a line passing through (-4, 6) that is parallel to $y = 3x - 4$.

Write an equation of a line passing through (-12, 6) that is perpendicular to $y = \frac{2}{3}x - 10$.

Find the distance from the point (6, -2) to the line $y = 2x - 4$.

Find the distance from the point (0, 5) to the line $y = -3x - 5$.

Lesson 3.5 p. 160: 8-34 even, 43, 52-57