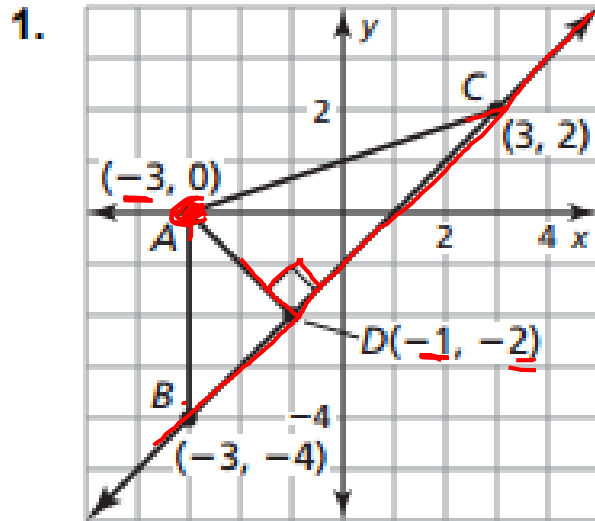# Equations of Parallel and Perpendicular Lines

Lesson 3.5

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

In Exercises 1–4, find the distance from point A to $\overline{BC}$.
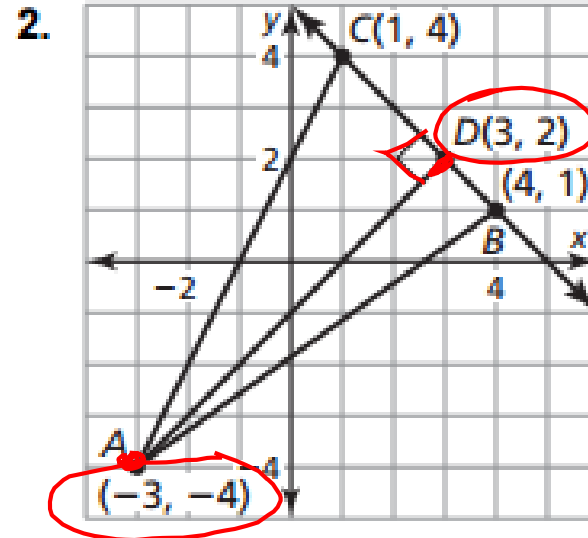
Which lines, if any, must be parallel? Justify your reasoning.

1.

C (3, 2)
(−3, 0)
A
D(−1, −2)
B
(−3, −4)

2.

C(1, 4)
D(3, 2)
(4, 1)
B
A
(−3, −4)

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$\sqrt{(-1+3)^2 + (-2-0)^2}$$
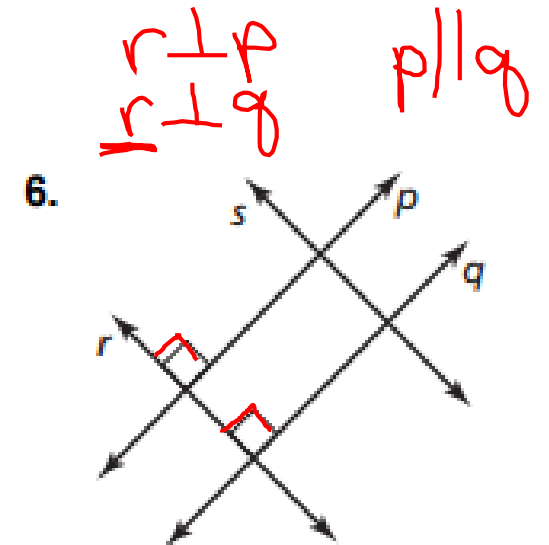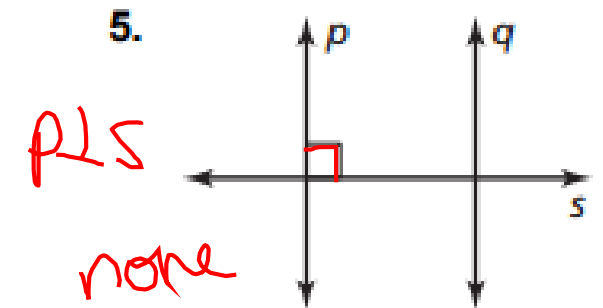$$\sqrt{(2)^2 + (-2)^2}$$
$$\sqrt{8} \quad \sqrt{4+4}$$
$$\boxed{2\sqrt{2}}$$
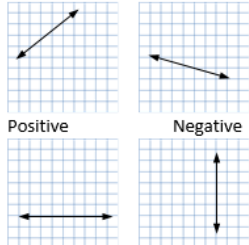
5.

p
q
s

r⊥s
none

r⊥p
r⊥q   p∥q

6.

s
p
q
r

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

$\dfrac{rise}{run} \rightarrow \dfrac{\Delta y}{\Delta x}$ $m = \dfrac{(y_2 - y_1)}{(x_2 - x_1)}$ $(1, 2)\ (3, 4)$ $m = \dfrac{(4-2)}{(3-1)} = \dfrac{2}{2} = 1$	(-4, 4) ... (3, 1) $m = \dfrac{(1-4)}{(3--4)} = \dfrac{-3}{7}$	Positive Negative 0 y = a # und. x = a #	**Mr. Slope** + — U o——o
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. $m_1 = m_2$
y = m(x − x₁) + y₁ Equation of a line with slope **m** and point (x₁, y₁).	Find an equation of a line through (-2, 7) with slope of -5. y = m(x − x₁) + y₁ 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; $y = -\frac{2}{3}x + 2\frac{2}{3}$	In a coordinate plane, two non-vertical lines are perpendicular if and only if the product of their slopes is -1. **Negative reciprocals** $m_1 \cdot m_2 = -1$

Slopes of ∥ and ⊥ Lines

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

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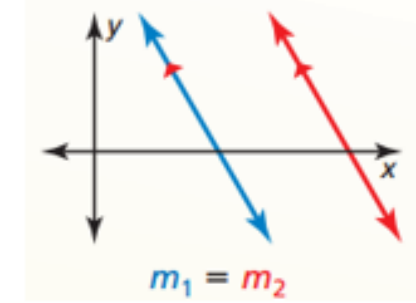
Equation of a line with
slope m and point (0, b).
Most commonly used.
If standard form
(ax + by = c) is given
solve for y.

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

$m_1 = m_2$

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

Negative
reciprocals

$m_1 \cdot m_2 = -1$
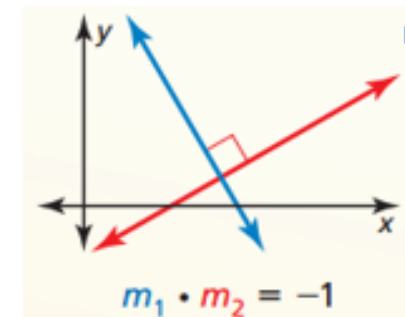
Desmos Introduction

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.
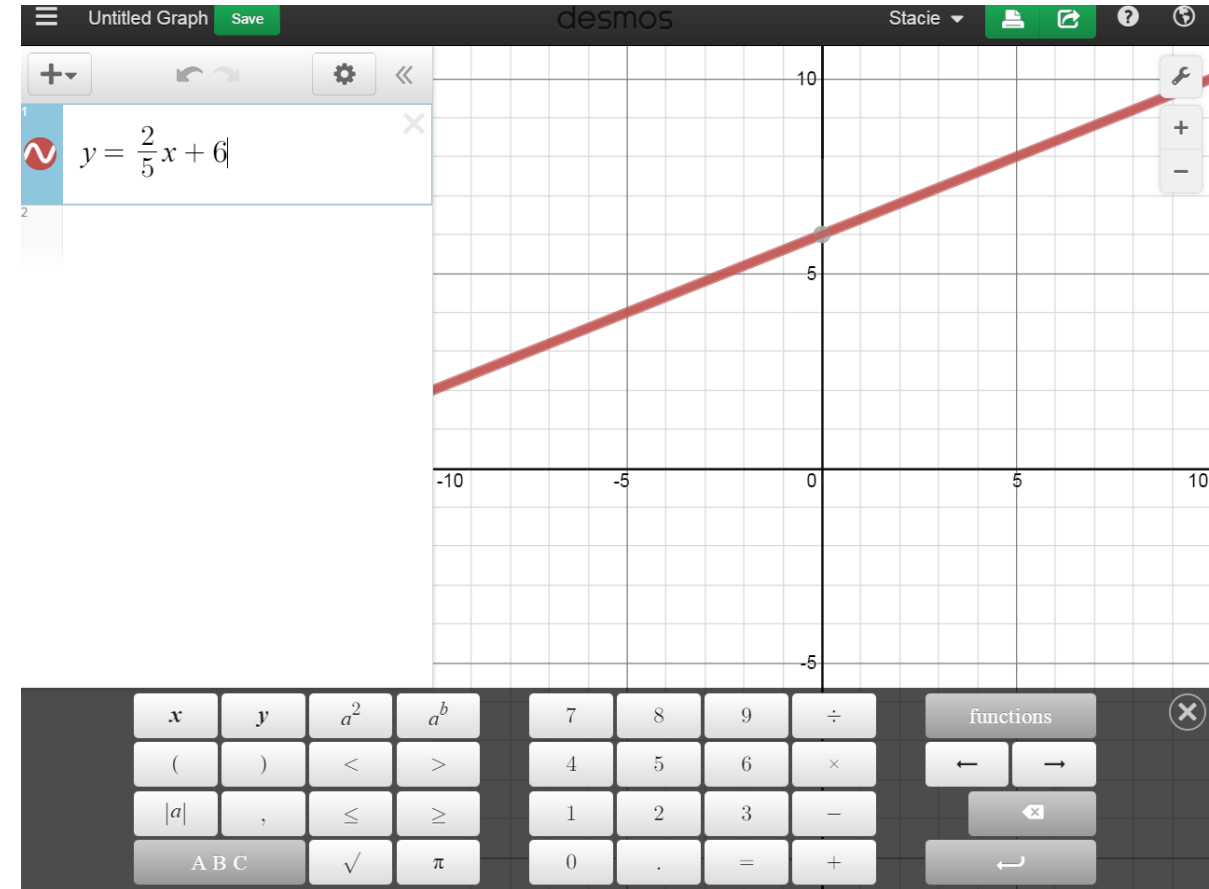
Desmos Activity

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.

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

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.)
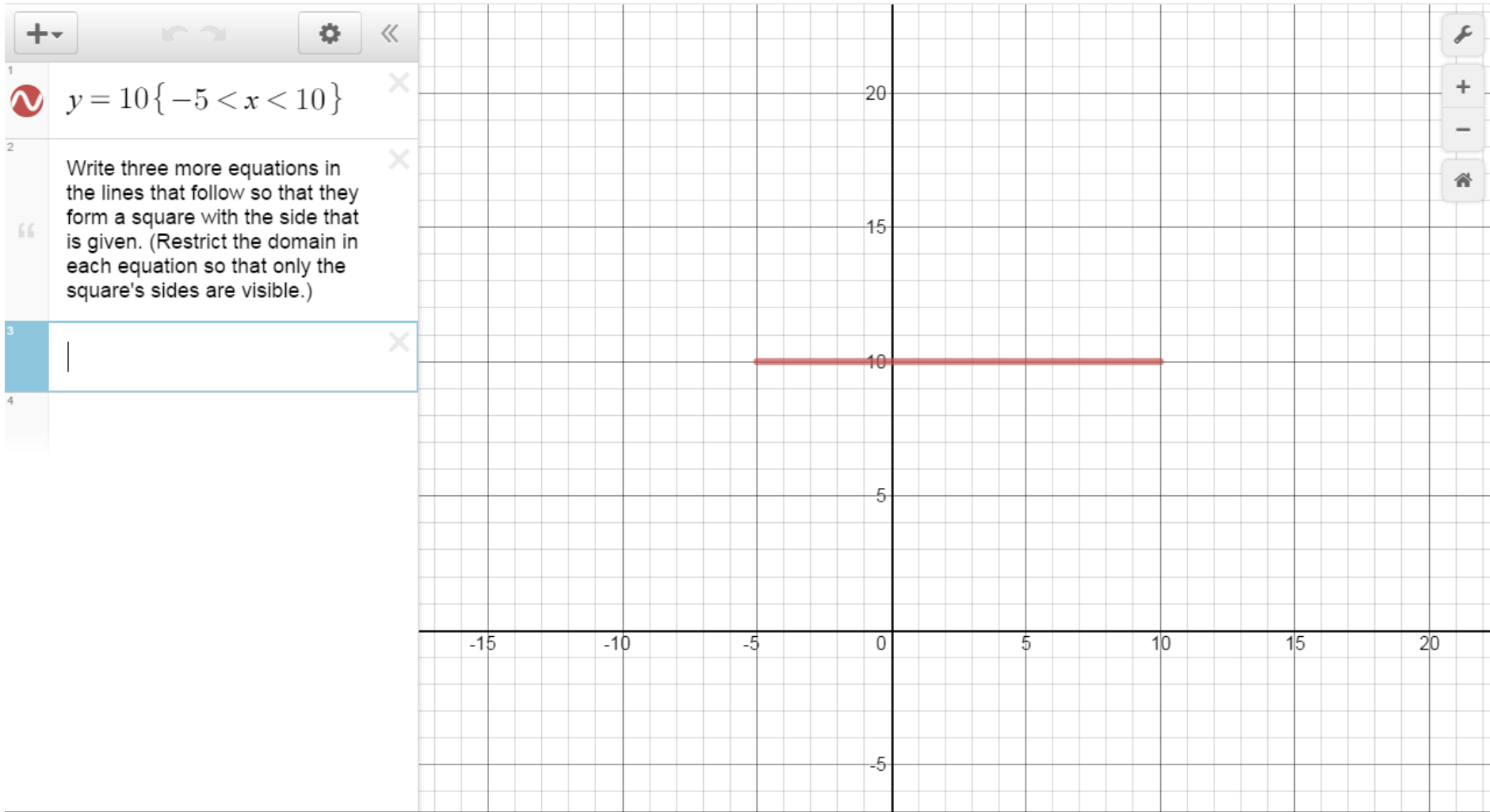
Construct a Square Summary

Insights?

Struggles?

Lesson 3.5 Day 2

Bell Work

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

$y = \overset{\downarrow}{m}x + b$

$m = 2$ $②$

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

$m = -3$

$y = -3x + 2$

$\boxed{-3}$

$-9x \qquad -9x$

$3y = -9x + 6$

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

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

Slope y-int

$-5y = -4x + 12$

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

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

$\boxed{\dfrac{-5}{4}}$

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

$a \parallel b$

$a \perp c, \quad b \perp c$

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

$(-4, 4)$

$(-3, 1)$

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

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

$(5, 7) \quad (6, 4)$

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

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

$$= \frac{-3}{-9} = \frac{1}{3}$$

$(6, 4)(-3, 1)$

$d \ (0, -7)(8, -2)$

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

a

$m = -3$

$(-4, 4)$

$(-3, 1) \quad \frac{1}{3} = m$

$(-2, -2)$

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

8

y

$(5, 7)$

$(6, 4)$

$(7, 1)$

$(8, -2)$

-4

x

c

$m = \frac{5}{8}$

d

$(0, -7)$
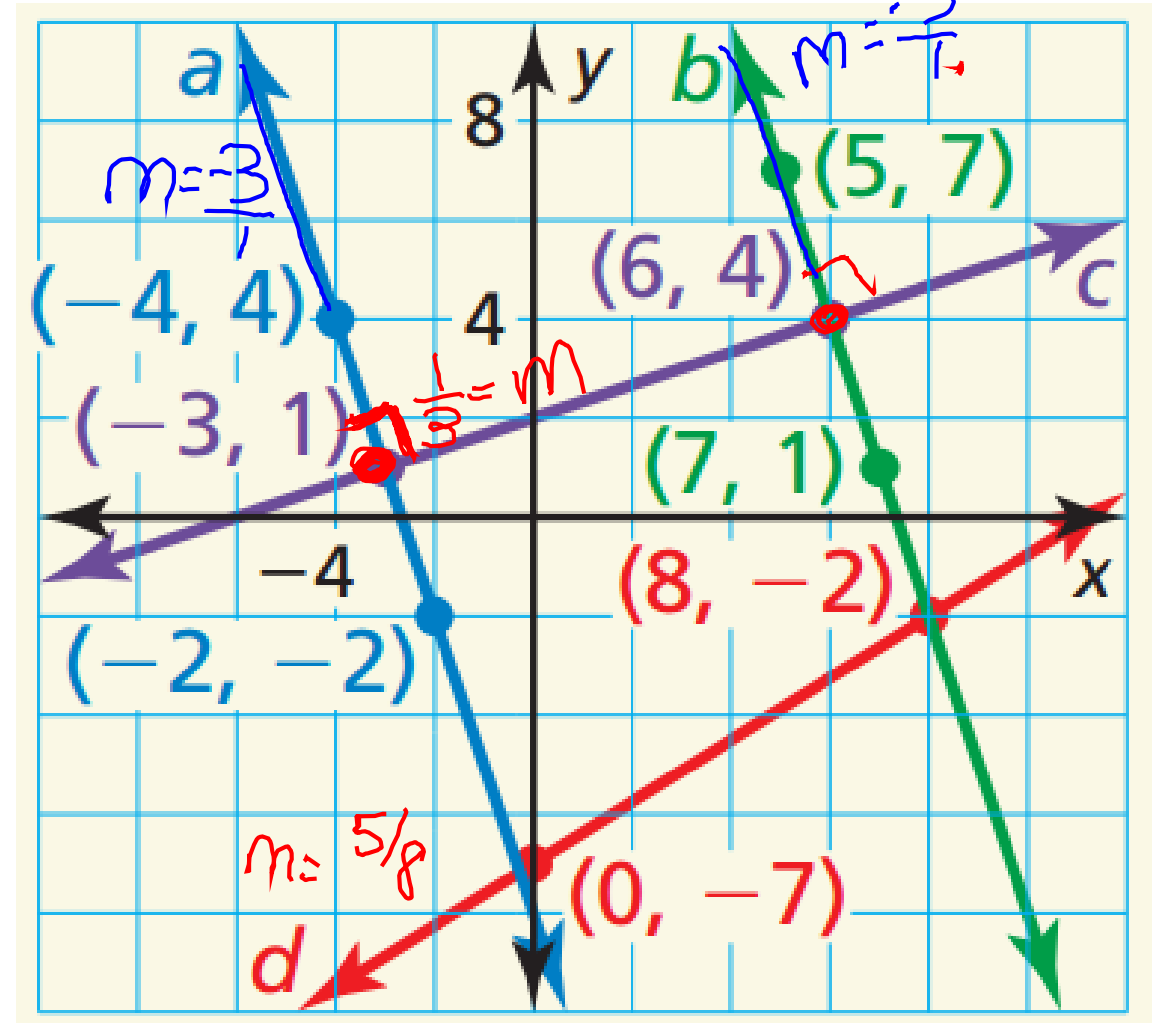
Find the slope of the line passing through (-11, 4) and (-7, -6)

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

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

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

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

Find the slope of 2x + 3y = 18

$-2x \qquad -2x$

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

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

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

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

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

$m = -2$

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.

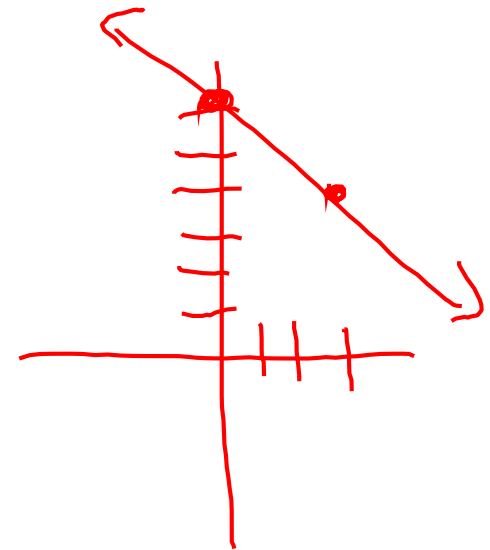# Write an equation of a line passing through (4, -3) with slope = -2.

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.

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

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

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

$$y = -5x - 10 + 7$$

$$y = -5x - 3$$

$$y = mx + b$$

$$y = -2x + b$$

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

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

$$+8 \qquad +8$$

$$\boxed{y = -2x + 5}$$

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

$$y = -2(x - 4) + -3 \checkmark$$

$$y = -2x + 8 - 3$$

$$\boxed{y = -2x + 5}$$

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

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

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

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

$$y = -x + 2$$

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

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

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

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. $6x + 4y = -12$

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.
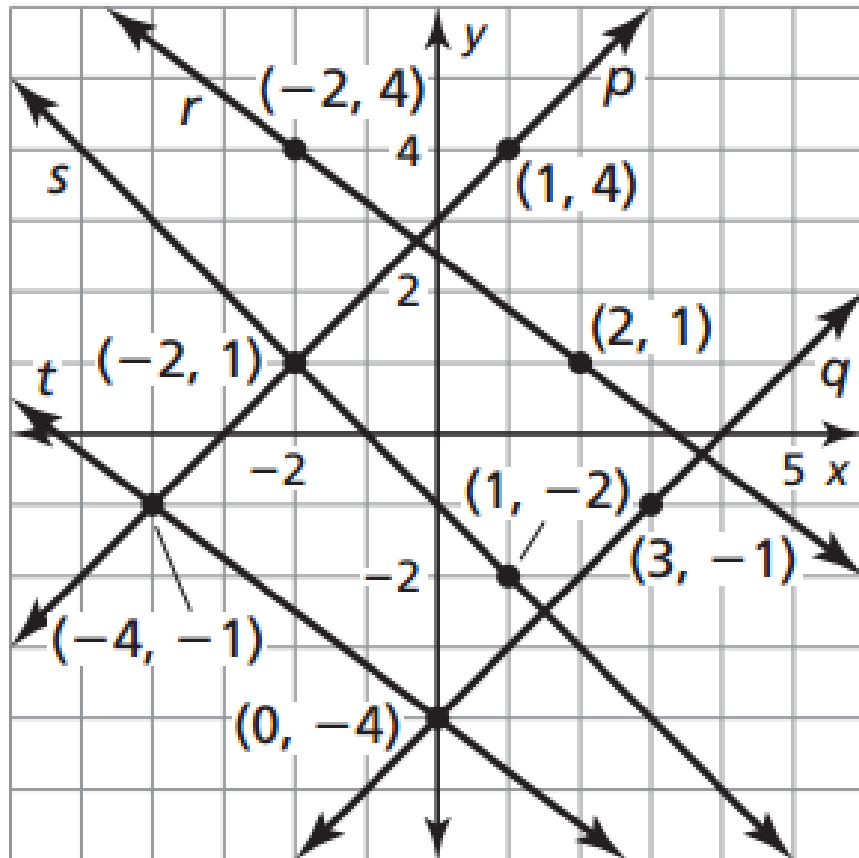
16. $(-3, 5)$ and $(-2, 4)$

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.

$y = mx + b$ $m = 3$

$6 = 3(-4) + b$

$6 = -12 + b$

$18 = b$

$y = 3x + 18$

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

$y = 3(x + 4) + 6$

$y = 3x + 12 + 6$

$y = 3x + 18$

Write an equation of a line passing through
x_1 y_1
(-12, 6) that is ~~perpendicular~~ to $y = \frac{2}{3}x - 10$.

$y = mx + b$

$6 = -\frac{3}{2}(-12) + b$

$6 = +18 + b$

$-18 \quad\quad -18$

$-12 = b$

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

$m = -\frac{3}{2}$

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

$y = -\frac{3}{2}x - 18 + 6$

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

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

$\perp$ lines Slope $-\frac{1}{2}$

$y = -\frac{1}{2}(x-6)+^-2$

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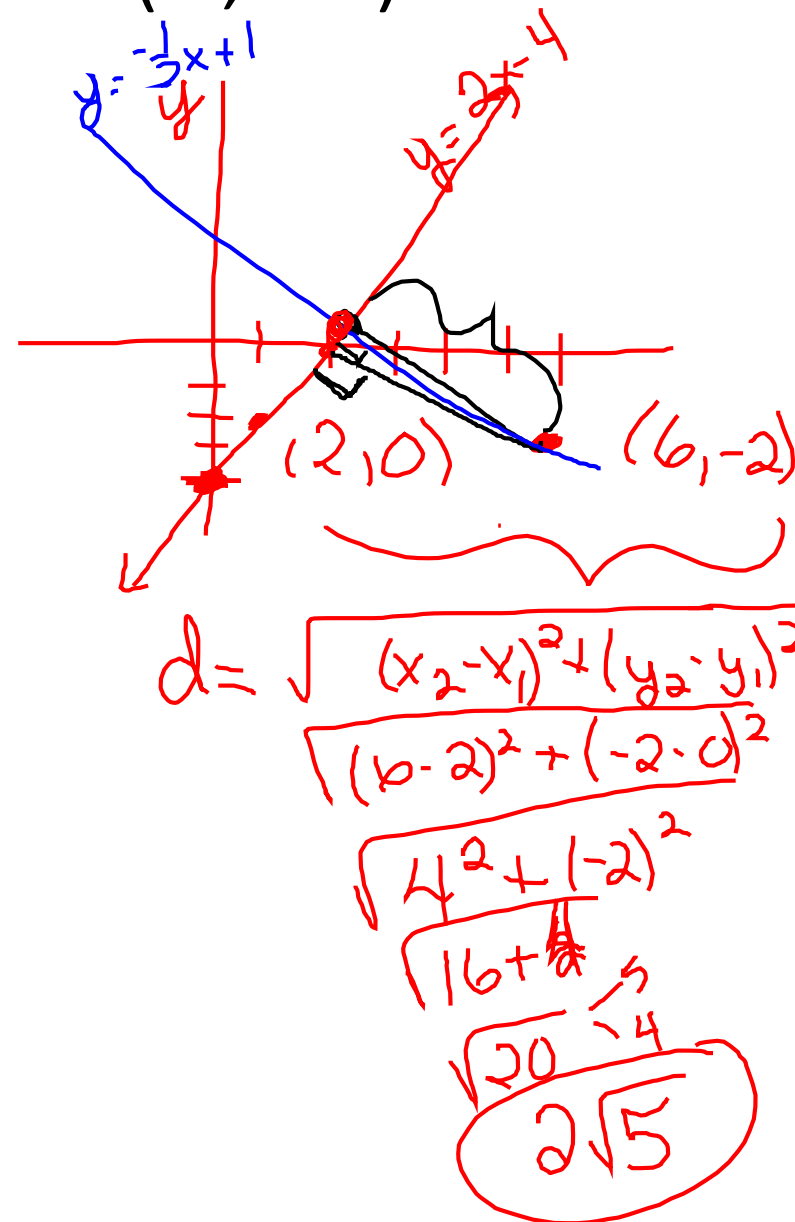
$y = -\frac{1}{2}x + 1$

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

$y = 0$

$2x - 4 = -\frac{1}{2}x + 1$

$2\frac{1}{2}x = 5$

$x = 5$

$x = \frac{2}{2.5}$

$x = 2$

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

$y = 2x - 4$

(2,0)   (6,-2)

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$\sqrt{(6-2)^2 + (-2-0)^2}$

$\sqrt{4^2 + (-2)^2}$

$\sqrt{16 + 4}$

$\sqrt{20}$

$2\sqrt{5}$

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