Pearson, Rob   Lesson Plan (Station Activity) – "Writing Linear Equations"

COMMON CORE STANDARD(S)	ENDURING UNDERSTANDINGS
MCC8.EE.5 **Graph proportional relationships, interpreting the unit rate as a slope of the graph.** **Compare two different proportional relationships represented in different ways.**	**MCC8.EE.5** ✓ **Understand the connections between proportional relationships, lines, and linear equations.** ✓ **To provide opportunities for students to develop skills related to writing linear equations in slope-intercept form (y=mx+b) and in standard form (Ax+By=C) given two points or a point and a slope.** ✓ **Given an equations of proportional relationship, students will be able to draw a graph of the relationship.** ✓ **Students will recognize that the unit rate is the coefficient of x and that this value is also the slope of the line.**

Possible Misconceptions:

- Incorrectly plotting the coordinates in reverse order
- Not keeping track of signs when writing equations in slope-intercept and point-slope forms
- Not making sure that the *y*-value is 0 for the *x*-intercept
- Not making sure that the *x*-value is 0 for the *y*-intercept
- Incorrectly finding the slope as run/rise instead of rise/run

LESSON OVERVIEW

In this lesson, students will engage in four different stations located in different areas of the classroom. Each station will be completed on a 10-minute timed rotation (Hourglass will be displayed on Promethean board). Students will be placed in different groupings of six members. Members will travel through each station in clockwise fashion. Group ONE will begin at Station 1, then proceed to Station 2, Station 3, and Station 4 accordingly when each 10-minute rotation culminates.

Materials List/Setup

Station 1   spaghetti noodles; graph paper

Station 2   spaghetti noodles; graph paper

Station 3   number cube

Station 4   10 index cards with the following equations written on them:

$$y = 2x + 12 \quad y = -5x - 8 \quad y = \frac{1}{2}x + 16 \quad y = \frac{-2}{3}x - 20 \quad y = 10x - 24$$

$$-x + 2y = 32 \quad 2x + 3y = -60 \quad 4x - 2y = -24 \quad -15x + \frac{3}{2}y = -36 \quad \frac{-5}{2}x - \frac{1}{2}y = 4$$

Station 1

Students will be given spaghetti noodles, graph paper, and the general point-slope form of an equation. Students will use the spaghetti noodles to model different equations. Then they will write the slope-intercept form of an equation given the slope and y-intercept. They will also write the slope-intercept form of an equation given the y-intercept and a parallel or perpendicular equation.

Answers

1. $y = 5x + 10$
2. $y = -4x - 8$
3. $y = \dfrac{-1}{3}x + 18$
4. $y = -4x$

Station 2

Students will be given spaghetti noodles, graph paper, and the general slope-intercept and point-slope forms of a linear equation. They will determine which form of the equation to use first in order to write a linear equation when given the slope and a point on the line. They will use spaghetti noodles to model the equations. Then they will write the slope-intercept form of a line given the slope and a point on the line.

Answers

1. Use point-slope form first because you can plug in the given point for x_1 and y_1.
2. $y = 2x + 14$
3. $y = \dfrac{1}{8}x + \dfrac{95}{8}$
4. $y = -3x - 22$
5. $y = \dfrac{-2}{5}x + 14$

Station 3

Students will be given a number cube. They will use it to populate two ordered pairs. From the ordered pairs, they will find the slope and write the equation in slope-intercept form. Then they will explain how they found the slope and the equation in slope-intercept form.

Answers

1. Answers will vary.
2. Answers will vary.
3. Answers will vary.
4. Slope $= \dfrac{\text{rise}}{\text{run}} = \dfrac{y_2 - y_1}{x_2 - x_1}$
5. Find the slope from the two points. Plug one of the points and the slope into $y = mx + b$ to find b. Then write the equation in slope-intercept form.

Station 4

Students will be given 10 index cards with the following equations written on them:

$$y = 2x + 12 \qquad y = -5x - 8 \qquad y = \frac{1}{2}x + 16 \qquad y = \frac{-2}{3}x - 20 \qquad y = 10x - 24$$

$$-x + 2y = 32 \qquad 2x + 3y = -60 \qquad 4x - 2y = -24 \qquad -15x + \frac{3}{2}y = -36 \qquad \frac{-5}{2}x - \frac{1}{2}y = 4$$

They will work as a group to match the equations written in standard form with the equations written in slope-intercept form. Then they convert an equation written in standard form to slope-intercept form and vice versa.

Answers

1. $y = \frac{1}{2}x + 16$ and $-x + 2y = 32$

2. $y = \frac{-2}{3}x - 20$ and $2x + 3y = -60$

3. $y = 10x - 24$ and $-15x + \frac{3}{2}y = -36$

4. $4x - 2y = -24$ and $y = 2x + 12$

5. $\frac{-5}{2}x - \frac{1}{2}y = 4$ and $y = -5x - 8$

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

7. $x - 5y = 50$

WARM-UP (5 min.)   Projected on Promethean Board.

Students will analyze an example of direct variation to describe relationship between two variable quantities (x and y). STUDENTS write down on graph paper, then discuss with a partner.

Compare the scenarios to determine which represents a greater speed. Explain your choice including a written description of each scenario. Be sure to include the unit rates in your explanation.

Scenario 1:

Traveling Time

400 — Distance (miles)
300 (4,240)
200
100 (1,60)
0 1 2 3 4 5 6 7 8
Time (hours)
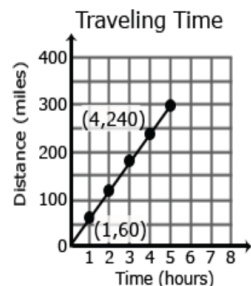
Scenario 2:

$y = 55x$
x is time in hours
y is distance in miles

Solution: Scenario 1 has the greater speed since the unit rate is 60 miles per hour. The graph shows this rate since 60 is the distance traveled in one hour. Scenario 2 has a unit rate of 55 miles per hour shown as the coefficient in the equation.

Given an equation of a proportional relationship, students draw a graph of the relationship. Students recognize that the unit rate is the coefficient of x and that this value is also the slope of the line.

GUIDED PRACTICE (10 mins) – Students: THINK PAIR SHARE

Prompts/Questions

1. How can you find the y-value coordinate given an equation and its x-coordinate?

2. What are the definitions of the terms "x-intercept" and "y-intercept"?

3. How do you write the slope-intercept form of a linear equation?

4. How do you write the standard form of a linear equation?

5. How can you write an equation in slope-intercept form if it is given to you in standard form?

6. How can you find the equation for a line given two points on the line?

Suggested Appropriate Responses

1. Plug the x-value into the equation and solve for the y-coordinate.

2. The x-intercept is the coordinate pair at which the graph crosses the x-axis. The y-intercept is the coordinate pair at which the graph crosses the y-axis.

3. $y = mx + b$

4. $ax + by = c$

5. Solve for y and write the equation as $y = mx + b$.

6. Find the slope of the line from the two points. Then plug in the slope and one of the points into $y - y_1 = m(x - x_1)$. Then solve for y.

INTRODUCTION OF STATION ACTIVITIES # 1-4 (5 min.)

Teacher will read the directions for each of the stations # 1-4 to address any procedural concerns that may arise. Participant expectations will be given at this time as well.

INDEPENDENT PRACTICE – STATIONS   (42 min. including transitions)

Teacher will act as a facilitator and time keeper for the activity. Every ten minutes, students will rotate clockwise to the next station activity area. There are 30 second transition times (does not affect work time at station).

Students will be observed during their discussions as a formative assessment. Students may ask teacher questions, but this process should be after no successful conclusion has been reached at the group level.

Each student is responsible for completion of his/her own Station Recording Sheet.

DEBRIEF (6 min.)

Each group verbally shares a question they had difficulty with or a question that sparked a learning moment within the task.
_____

CLOSING (6 min.) EXIT TICKET ISSUED TO STUDENTS

Prompts/Questions

1. How do you write the standard form of a linear equation?

2. How do you write the slope-intercept form of a linear equation?

3. How do you write the slope-intercept form of a linear equation given a point and the slope?

4. How do you write the slope-intercept form of a linear equation given two points on the line?

5. How do you convert the standard form of a linear equation into slope-intercept form?

6. How do you convert the slope-intercept form of a linear equation into standard form?

HOMEWORK	
Multiple Choice Practice SLOPE-BASED CALCULATIONS Attached Worksheet at End of File.	

ASSESSING PROFICIENCY OF THE STUDENTS KNOWLEDGE (SEE BELOW)
Mathematically proficient students should communicate verbally, and in written form, precisely by engaging in dialogue using appropriate mathematical language (vocabulary). Students should be able to communicate with increased precision and frequency using the following vocabulary: **Unit Rate, Proportional Relationships, Slope, Vertical, Horizontal, Rise / Run, x and y intercepts, Slope-Intercept Form, Point-Slope Form, and Standard Form, Parallel, and Perpendicular.** Students should: ✦ Show proficiency in converting between the various forms of Slope (Slope-Intercept, Standard, and Point-Slope ✦ Know each of the slope formulas by heart and know what each of the forms can tell you when writing an equation. ✦ Be able to find missing parts of an equation when given two ordered pairs OR one ordered pair + the slope of the line. Students build on previous work with unit rates in 6th grade and proportional relationships in 7th grade to compare graphs, tables and equations of proportional relationships. Students identify the unit rate (or slope) in graphs, tables and equations to compare two proportional relationships represented in various ways. The Warm-Up problem in this lesson would be an example.

Expressions and Equations

Mr.PEARSON

Set 3: Writing Linear Equations

MCC8.EE.5

Station 1

You will find spaghetti noodles and graph paper at this station. Draw a coordinate plane on your graph paper by creating and labeling the x-axis and the y-axis. For each problem, use the given information and the spaghetti to find the slope-intercept form of the equation.

- Slope-intercept form is written as $y = mx + b$.

1. The equation has a y-intercept of (0, 10) and a slope of 5.

   Model this equation using the spaghetti. Then write the equation in slope-intercept form.

2. The equation has a y-intercept of (0, –8) and is parallel to the line $y = -4x - 16$.

   Model this equation using the spaghetti. Then write the equation in slope-intercept form.

3. The equation has a y-intercept of 18 and is perpendicular to the line $y = 3x + 9$.

   Model this equation using the spaghetti. Then write the equation in slope-intercept form.

4. The graph of the equation passes through the origin and is perpendicular to $y = \dfrac{1}{4}x$.

   Model this equation using the spaghetti. Then write the equation in slope-intercept form.

Expressions and Equations

Set 3: Writing Linear Equations

Station 2

You will find spaghetti noodles and graph paper at this station. Draw a coordinate plane on your graph paper by creating and labeling the *x*-axis and the *y*-axis. Use the spaghetti and what you know about the slope-intercept and point-slope forms of a linear equation to answer the questions.

- Slope-intercept form is written as $y = mx + b$.
- Point-slope form is written as $y - y_1 = m(x - x_1)$.

1. You want to find a linear equation. Which form should you use first if you are given the slope and a point on the line?

2. Use spaghetti to model a line that has a slope of 2 and passes through (–3, 8). Then write the equation for this line in slope-intercept form.

3. Use spaghetti to model a line that has a slope of $\frac{1}{8}$ and passes through (1, 12). Then write the equation for this line in slope-intercept form.

4. Use spaghetti to model a line that has a slope of –3 and passes through (–4, –10). Then write the equation for this line in slope-intercept form.

5. Use spaghetti to model a line that has a slope of $-\frac{2}{5}$ and passes through (–15, 20). Then write the equation for this line in slope-intercept form.

Expressions and Equations
Set 3: Writing Linear Equations

Station 3

You will be given a number cube. For each problem, roll the number cube four times to create two ordered pairs. Then use these ordered pairs to find the slope and write the equation in slope-intercept form.

- Slope-intercept form is written as $y = mx + b$.

1. First ordered pair: (　　,　　)

   Second ordered pair: (　　,　　)

   Slope = _____

   Equation written in slope-intercept form: _____

2. First ordered pair: (　　,　　)

   Second ordered pair: (　　,　　)

   Slope = _____

   Equation written in slope-intercept form: _____

3. First ordered pair: (　　,　　)

   Second ordered pair: (　　,　　)

   Slope = _____

   Equation written in slope-intercept form: _____

4. How did you find the slope from the two ordered pairs?

5. How did you find b in the slope-intercept form of the equation?

Expressions and Equations
Set 3: Writing Linear Equations

Station 4

At this station, you will find 10 index cards with the following equations written on them:

$$y = 2x + 12 \qquad y = -5x - 8 \qquad y = \frac{1}{2}x + 16 \qquad y = \frac{-2}{3}x - 20 \qquad y = 10x - 24$$

$$-x + 2y = 32 \qquad 2x + 3y = -60 \qquad 4x - 2y = -24 \qquad -15x + \frac{3}{2}y = -36 \qquad \frac{-5}{2}x - \frac{1}{2}y = 4$$

As a group, shuffle the cards. Work as a group to match the linear equation written in standard form with the same equation written in slope-intercept form. Write your matches on the lines below.

1. _____

2. _____

3. _____

4. _____

5. _____

6. Rewrite the equation $-3x + 9y = 12$ so that it's in slope-intercept form. Show your work.

7. Rewrite the equation $y = \frac{1}{5}x - 10$ so that it's in standard form. Show your work.

Mr.Pearson   Name_____

Homework Assignment   Date_____ Period_____

Find the slope of each line.

1)
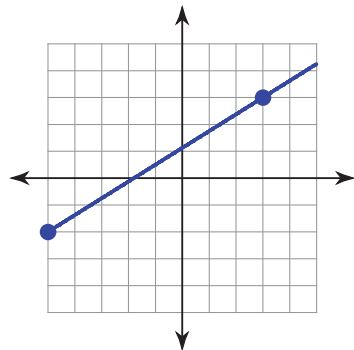
A) $-\dfrac{8}{5}$ B) $\dfrac{5}{8}$

C) $\dfrac{8}{5}$ D) $-\dfrac{5}{8}$

2)
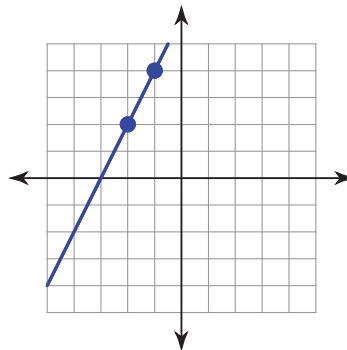
A) $-\dfrac{1}{2}$ B) 2

C) -2 D) $\dfrac{1}{2}$

Find the slope of the line through each pair of points.

3) $(-19, -6), (-17, -9)$

A) $\dfrac{3}{2}$ B) $\dfrac{2}{3}$

C) $-\dfrac{3}{2}$ D) $-\dfrac{2}{3}$

4) $(9, 14), (15, 15)$

A) $-\dfrac{1}{6}$ B) -6

C) $\dfrac{1}{6}$ D) 6

Find the slope of each line.

5) $y = \dfrac{7}{5}x + 5$

A) $-\dfrac{7}{5}$ B) $\dfrac{5}{7}$

C) $-\dfrac{5}{7}$ D) $\dfrac{7}{5}$

6) $y = -\dfrac{1}{2}x - 4$

A) $\dfrac{1}{2}$ B) $-\dfrac{1}{2}$

C) 2   D) -2

7) $5x + y = -4$

A) $-\dfrac{1}{5}$ B) -5

C) $\dfrac{1}{5}$ D) 5

8) $5x + y = -3$

A) $\dfrac{1}{5}$ B) 5

C) -5 D) $-\dfrac{1}{5}$

Sketch the graph of each line.

9) $x - y = 2$

A)
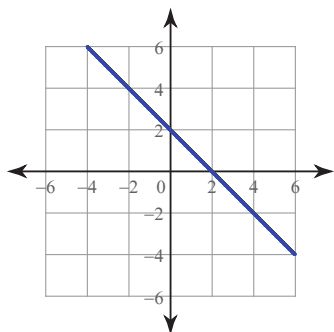
B)
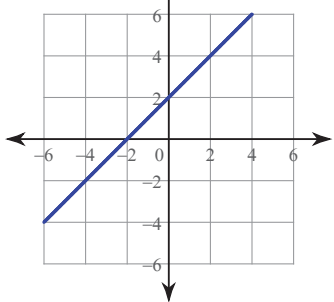
C)
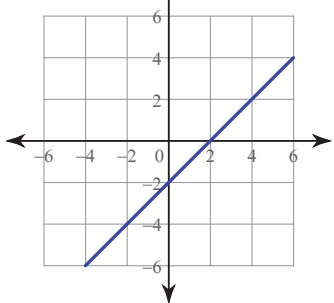
D)
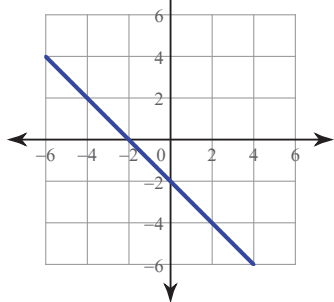
10) $x - 5y = 15$

A)
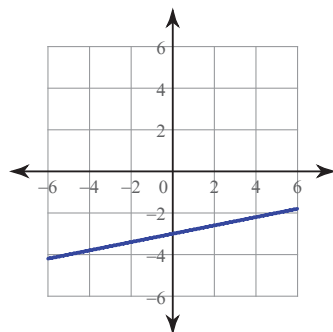
B)
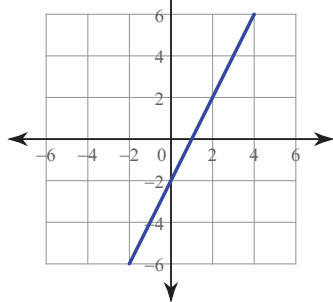
C)
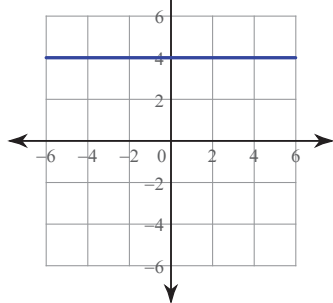
D)
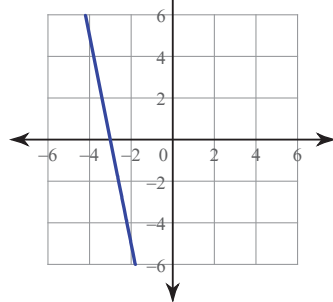
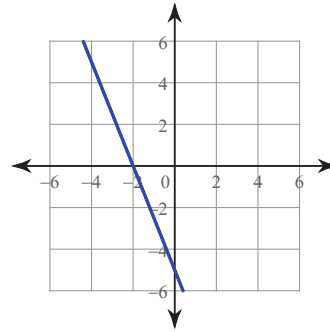11) x-intercept = 1, y-intercept = −4

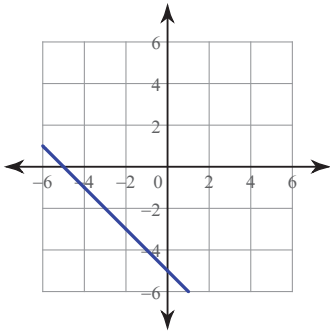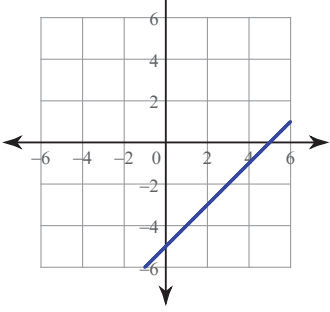A)
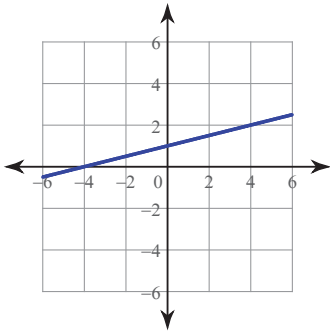
B)
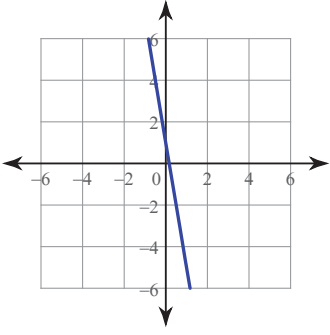
C)
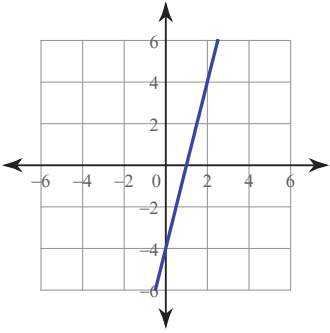
D)
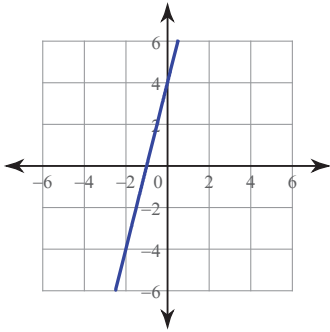
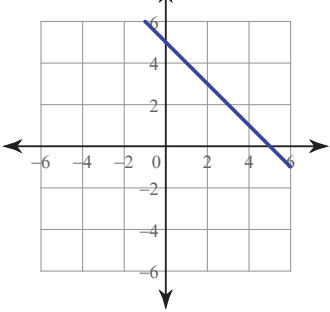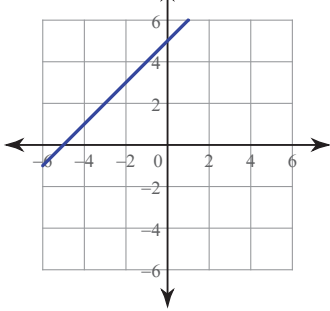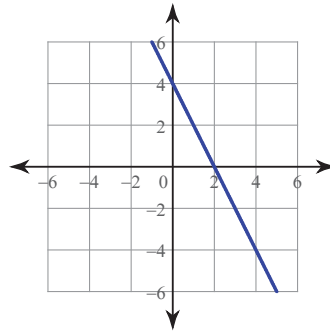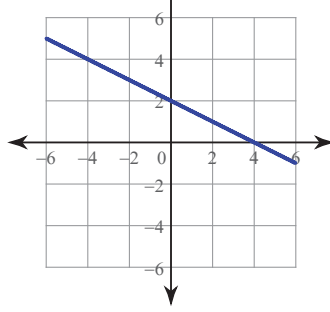12) x-intercept = 5, y-intercept = 2

A)
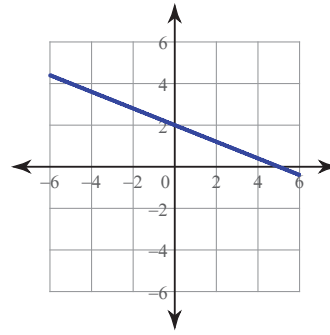
B)
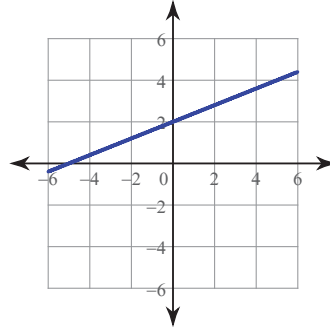
C)
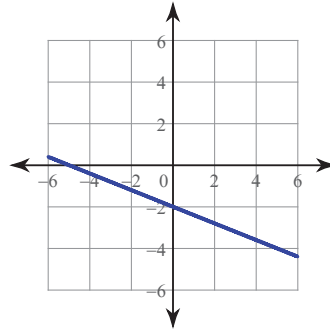
D)

13) $y = x + 5$

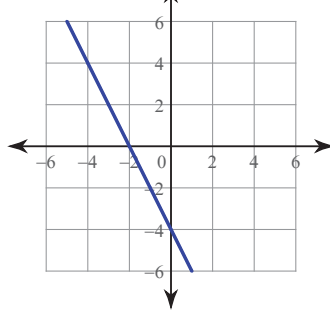A)

B)

C)

D)

14) $y = -2x + 4$
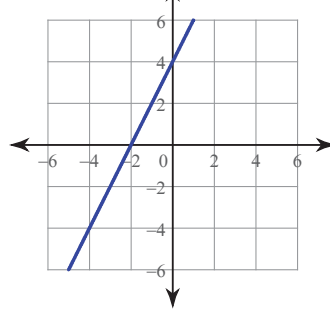
A)

B)

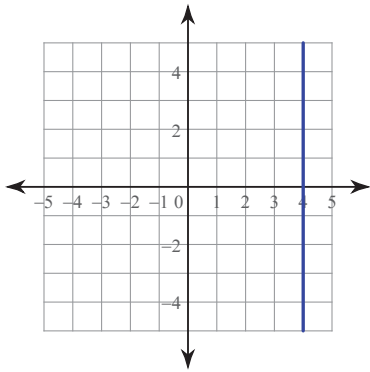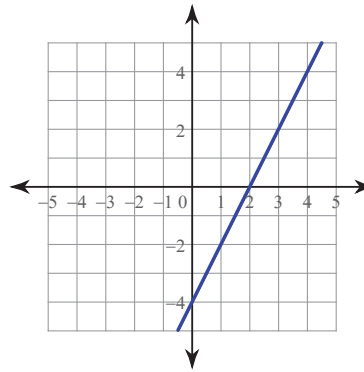C)

D)

Write the slope-intercept form of the equation of each line.

15)

A) $y = -4x$ B) $x = 4$

C) $y = -3x$ D) $y = -x$

16)

A) $y = 2x - 4$ B) $y = -2x - 4$

C) $y = -4x - 2$ D) $y = 4x - 2$

Write the slope-intercept form of the equation of each line given the slope and y-intercept.

17) Slope $= -\dfrac{5}{4}$,   y-intercept $= 0$

   A) $y = -1$ B) $y = -\dfrac{5}{4}x$

   C) $y = -x$ D) $y = \dfrac{5}{4}x$

18) Slope $= 8$,   y-intercept $= 5$

   A) $y = 8x - 4$ B) $y = 5x + 8$

   C) $y = 8x + 5$ D) $y = -4x + 8$

Write the slope-intercept form of the equation of each line.

19) $9x + 7y = -28$

   A) $y = -\dfrac{9}{7}x - 4$

   B) $y = -4x + \dfrac{3}{7}$

   C) $y = \dfrac{3}{7}x - 4$

   D) $y = \dfrac{4}{7}x + \dfrac{3}{7}$

20) $3x - 5y = -5$

   A) $y = x + \dfrac{3}{5}$ B) $y = -\dfrac{3}{5}x + 1$

   C) $y = \dfrac{3}{5}x + 1$ D) $y = -x + \dfrac{3}{5}$

Write the slope-intercept form of the equation of the line through the given points.

21) through: $(5, 0)$ and $(0, -5)$

   A) $y = -5x + 1$

   B) $y = -5x - 5$

   C) $y = 5x - 5$

   D) $y = x - 5$

22) through: $(1, -4)$ and $(1, 4)$

   A) $y = -1$ B) $x = 1$

   C) $y = -x - 1$ D) $y = x - 1$