Just in Time Quick Check

Standard of Learning A.F.1

Strand: Functions

Standard of Learning A.F.1

The student will investigate, analyze, and compare linear functions algebraically and graphically, and model linear relationships.

Students will demonstrate the following Knowledge and Skills:

a) Determine and identify the domain, range, zeros, slope, and intercepts of a linear function, presented algebraically or graphically, including the interpretation of these characteristics in contextual situations.

b) Investigate and explain how transformations to the parent function $y = x$ affects the rate of change (slope) and the y-intercept of a linear function.

c) Write equivalent algebraic forms of linear functions, including slope-intercept form, standard form, and point-slope form, and analyze and interpret the information revealed by each form.

d) Write the equation of a linear function to model a linear relationship between two quantities, including those that can represent contextual situations. Writing the equation of a linear function will include the following situations:

   i) given the graph of a line;

   ii) given two points on the line whose coordinates are integers;

   iii) given the slope and a point on the line whose coordinates are integers;

   iv) vertical lines as $x = a$; and

   v) horizontal lines as $y = c$.

e) Write the equation of a line parallel or perpendicular to a given line through a given point.

f) Graph a linear function in two variables, with and without the use of technology, including those that can represent contextual situations.

g) For any value, x, in the domain of f, determine $f(x)$, and determine x given any value $f(x)$ in the range of f, given an algebraic or graphical representation of a linear function.

h) Compare and contrast the characteristics of linear functions represented algebraically, graphically, in tables, and in contextual situations.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting and Prerequisite SOL: 8.PFA.2, A.F.2

Just in Time Quick Check A.F.1

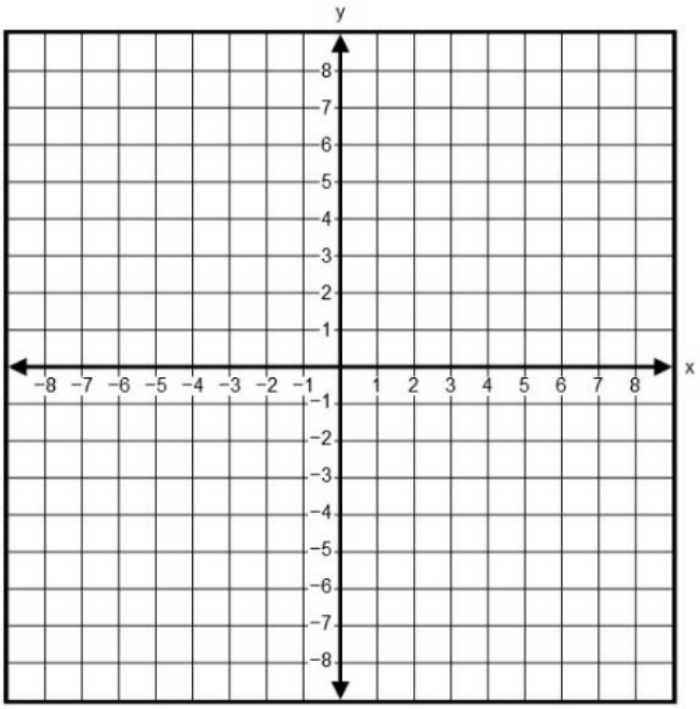
1. Determine whether the relation is a function. If the relation is a function, identify the domain and range.

x	y
-3	-3
-1	-3
0	-3
5	-3

2. Evaluate the function rule $f(a) = -2a + 7$ to find the range of the function for the domain {-2, 0, 8}.

3. Sketch the graph of each function on the coordinate plane below.

i. $f(x) = -5x + 1$ ii. $g(x) = -5x + 5$ iii. $h(x) = -2x + 1$



a) How does changing the value of *b* affect the graph of an equation in slope-intercept form?

b) How does changing the value of the slope affect the steepness of the line?

4. The table shows data that can be used to model a linear function. Use the data to answer the following questions.

x	*y*
-4	9
2	-3
5	-9
9	-17

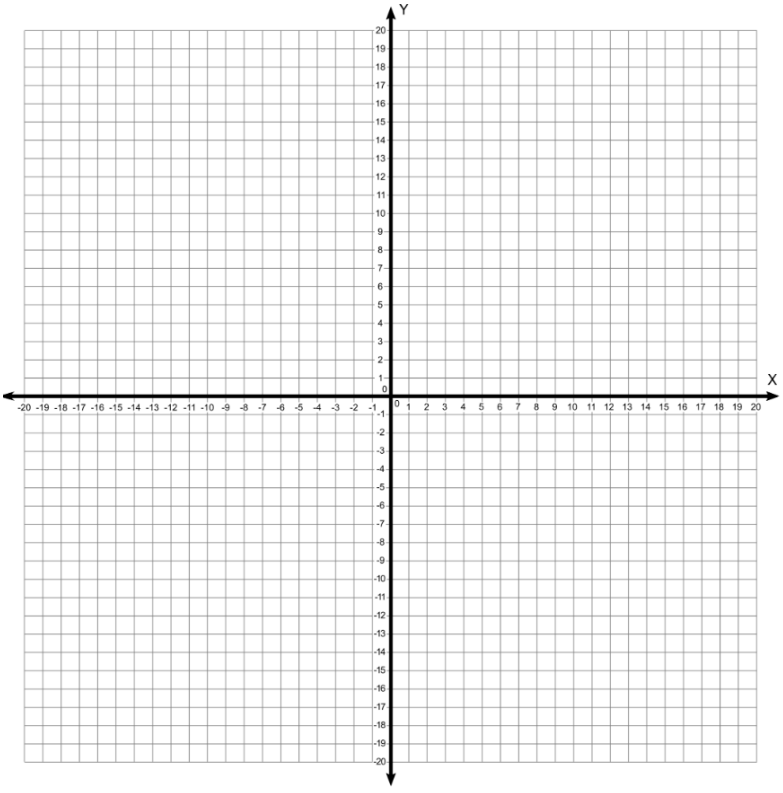
a) Use the data to write the equation in slope-intercept form. What is the slope?

b) Convert the equation to standard form. Explain how the constant in the equation written in standard form is related to the terms in the equation written in slope-intercept form.

c) Convert the equation to point-slope form.

d) Graph the equations on the coordinate plane below.

e) What do you notice about the graph of each equation?

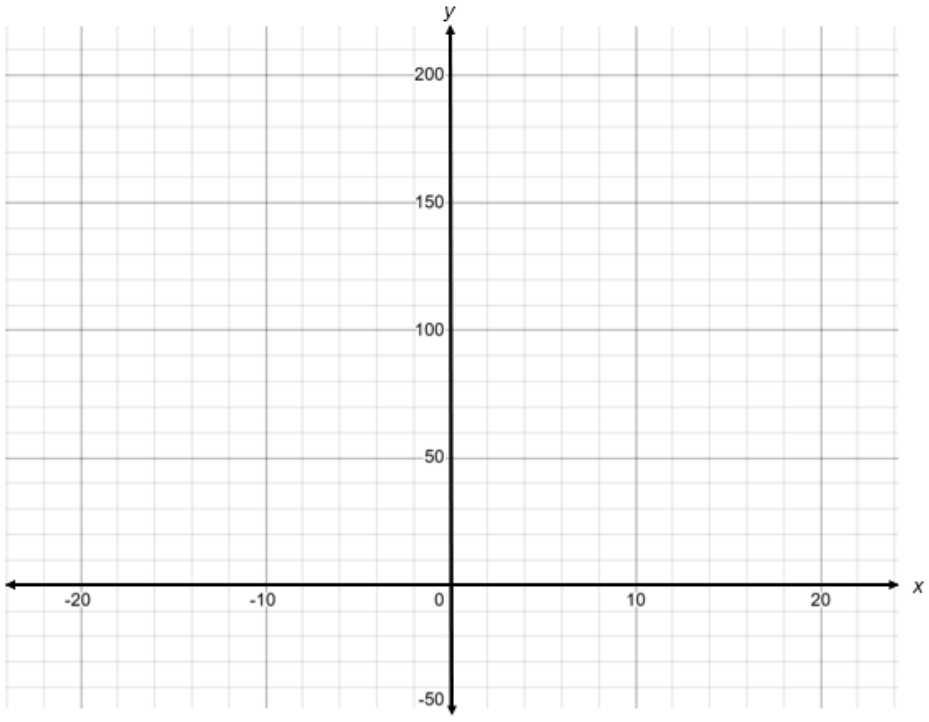


5. Write an equation of a line that in point slope form that is perpendicular to $-10x + 8y = 3$ and passes through the given point (15, 12).

6. A middle school soccer team purchased 205 bottles of sports drink. They plan to drink 12 bottles of sports drink each day they have practice.
   a) Write an equation in slope-intercept form that shows the number of bottles of sports drink left *(l)* after (*d)* days.

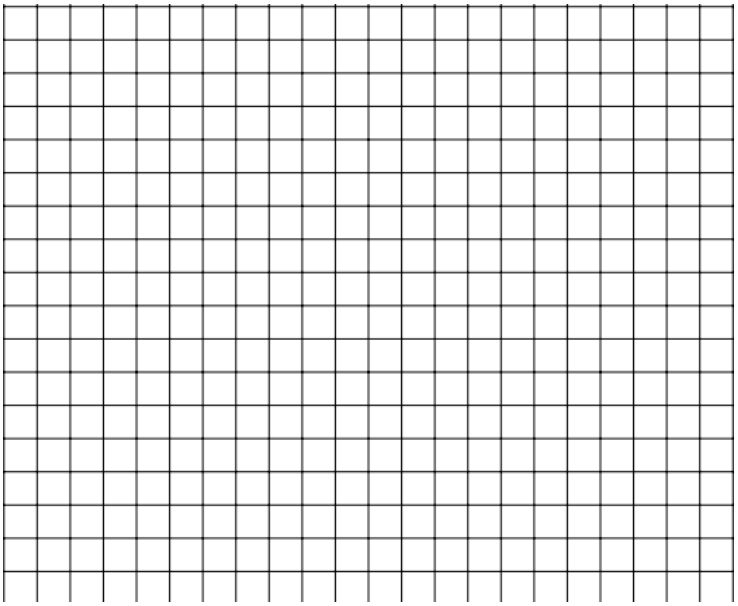
   b) Graph the equation of the related function on the coordinate plane below.

   c) Using the graph, estimate how many days the soccer team's bottles of sports drink will last.

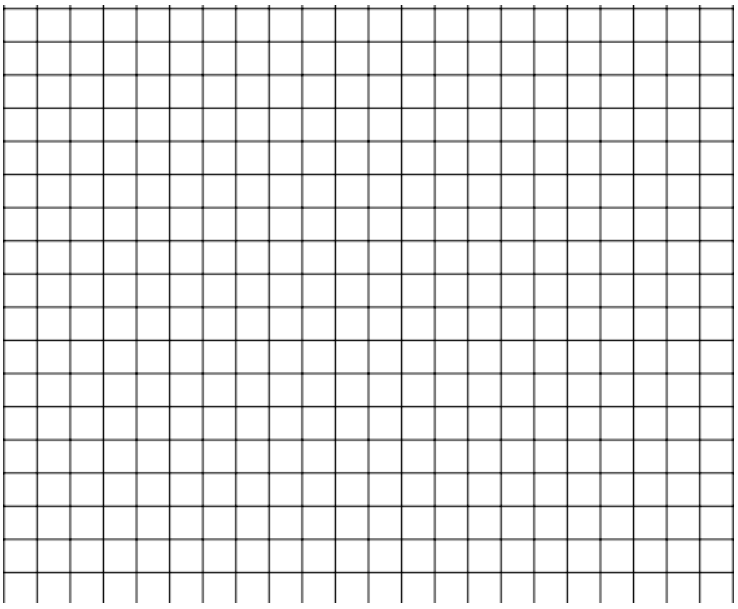


7. Use the slope and *y*-intercept to graph each equation.

a) $y + 3 = 6x - 7$



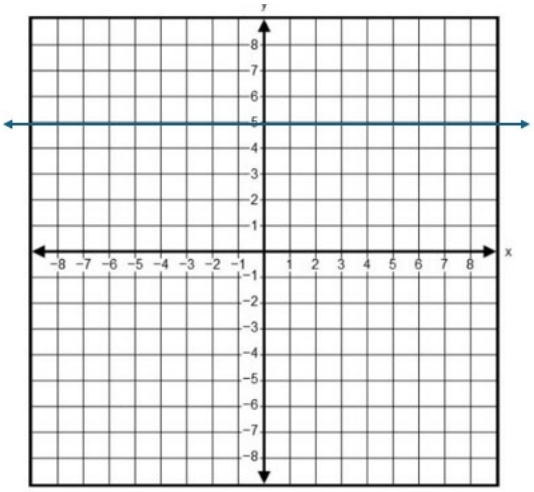
b) $-(5x + 7) + y = 0$



8. Compare the quantity in column A with the quantity in column B. Which is greater?

Column A	**Column B**
The product of the slopes of $2x + 5y = 4$ and $y = \frac{5}{2}x - 7$	The slope of the line through points (5, 3) and (4, 2)

9. Given the graph below, write an equation of the line and identify the slope.



A.F.1 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. Determine whether the relation is a function. If the relation is a function, identify the domain and range.

x	y
-3	-3
-1	-3
0	-3
5	-3

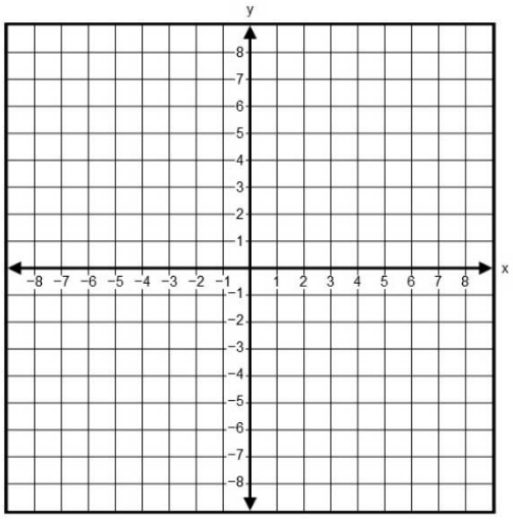
A common misconception students may demonstrate is believing that if the y-values (-3) repeat then the relation is not a function. Students may also switch the domain and ranges by identifying the domain as the set of all y-values {-3} while identifying the range as the set of all x-values {-3, -1, 0, 5}. Teachers can help by clarifying the definition of domain and range by showing that a relation is a function if each input has only one output, even if the outputs repeat. Teachers should also provide non-examples, where a relation is not a function (i.e., where at least one input maps to multiple outputs) to highlight the difference.

2. Evaluate the function rule $f(a) = -2a + 7$ to find the range of the function for the domain {-2, 0, 8}.

A common error may occur if students evaluate f(a) = -2a + 7 incorrectly. For example, students may have difficulty substituting values with negative numbers. Students may also confuse the domain and range by listing the domain values as the range and vice versa. Teachers can help by providing step-by-step instructions on how to substitute values into a function with an emphasis on using negative numbers. Teachers can also reinforce the difference between domain and range by using activities that help students identify the domain (input values) and then calculate the range (output values).

3. Sketch the graph of each function on the coordinate plane below.

i. $f(x) = -5x + 1$ ii. $g(x) = -5x + 5$ iii. $h(x) = -2x + 1$



a) How does changing the value of *b* affect the graph of an equation in slope-intercept form?

Common errors students may make when graphing equations in slope-intercept form is to confuse the y-intercept with the x-intercept or plot the y-intercept incorrectly. Students may also ignore the negative sign and sketch a line that increases (from left to right), incorrectly believing the line has a positive slope instead of sketching a line that decreases (from left to right) because it has a negative slope. Students may not understand that "b" represents the y-intercept, therefore changes in b shift the line up or down without changing the slope (steepness, stretches, shrinks) of the line.

b) How does changing the value of the slope affect the steepness of the line?

Students may not understand that changing the value of the slope affects the steepness of the line. Students should have opportunities to graph equations of lines in slope-intercept form with varying slopes and y-intercepts. Additionally, class discussions about how changes in the slope affect the steepness of a line may be beneficial for all students.

4. The table shows data that can be used to model a linear function. Use the data to answer the following questions.

x	*y*
-4	9
2	-3
5	-9
9	-17

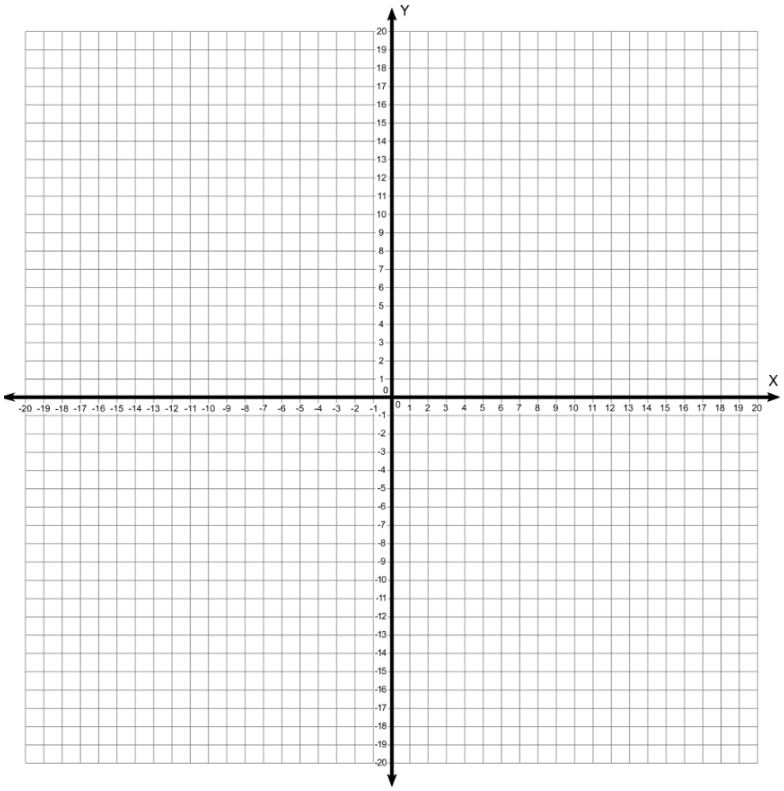
a) Use the data to write the equation in slope-intercept form. What is the slope?

b) Convert the equation to standard form. Explain how the constant in the equation written in standard form is related to the terms in the equation written in slope-intercept form.

c) Convert the equation to point-slope form.

d) Graph the equations on the coordinate plane below.

e) What do you notice about the graph of each equation?



A common error students may make is to incorrectly calculate the slope. Students may confuse slope-intercept, standard, and point-slope forms or fail to correctly convert between them. Students may not understand the relationship between the algebraic equations and the graphs of the related functions. They may think that each form represents different lines rather than the same line expressed differently. Students should have opportunities to explore each form and notice what information is easily determined from that form (e.g., slope-intercept form allows you to easily determine the slope and the y-intercept). Teachers may also use graphic organizers or graphing utilities to help reinforce all forms of an equation, which may help students connect each equation with the graph of its related function.

5. Write an equation of a line in point-slope form that is perpendicular to -10*x* + 8*y* = 3 and passes through the given point (15, 12).

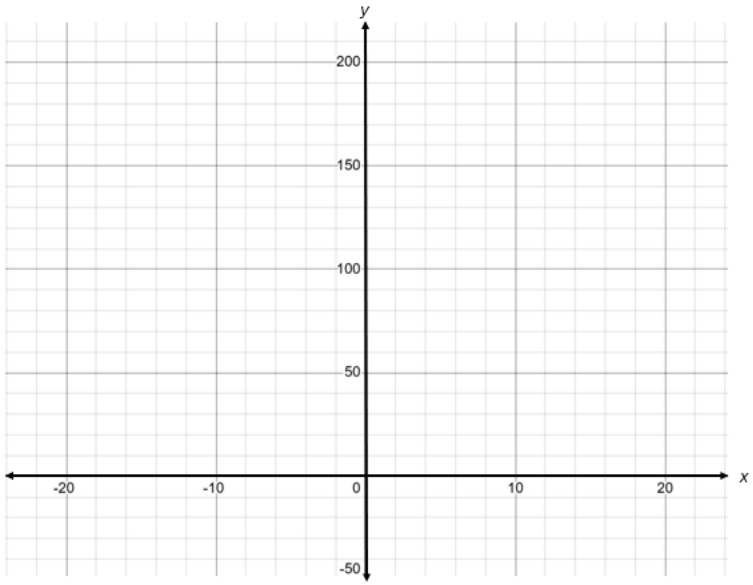
A common error students may make when writing an equation of a line perpendicular to a line that passes through a given point is to incorrectly determine the slope of the perpendicular line. For example, given the equation above, students may state that the slope of the perpendicular line is $-\frac{5}{4}$*, indicating that they determined the slope of the line and then multiplied it by -1. Students may also state that the slope of the perpendicular line is* $\frac{4}{5}$*, indicating that they found the reciprocal of the given line, but did not find the negative reciprocal.*

Students may also make errors substituting the point (15, 12) or the slope into point-slope form by confusing the x- and y-values in point-slope form equation $y - y_1 = m(x - x_1)$.

6. A middle school soccer team purchased 205 bottles of sports drink. They plan to drink 12 bottles of sports drink each day they have practiced.
   a) Write an equation in slope-intercept form that shows the number of bottles of sports drink left *(l)* after (*d)* days.

   b) Graph the equation of the related function on the coordinate plane below.

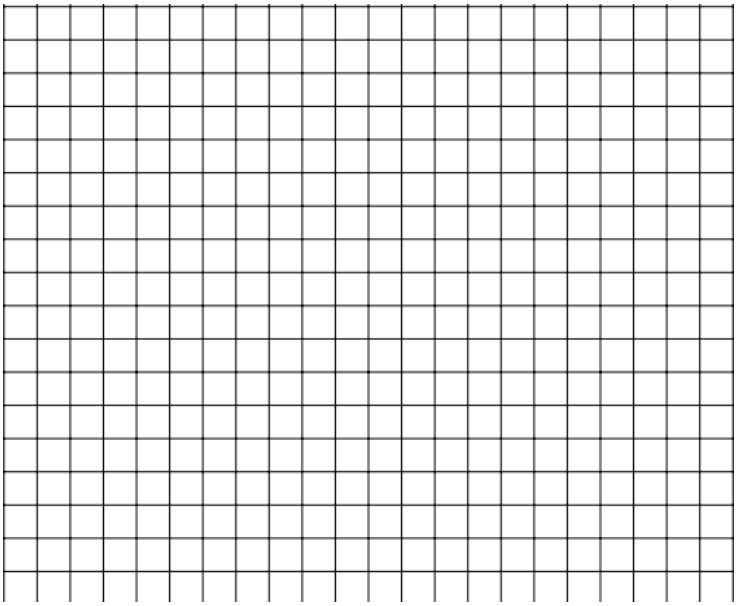
   c) Using the graph, estimate how many days the soccer team's bottles of sports drink will last.



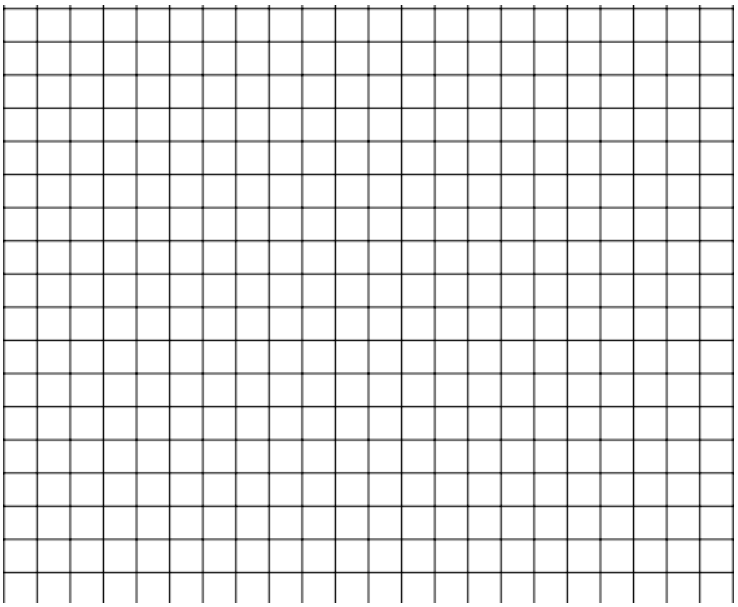
Common errors students may make when setting up this equation include confusing the expression for the number of bottles left after d days. Instead of writing $l = 205 - 12d$, they might write $l = 12d - 205$ or forget to subtract the sports drink consumed from the total. Some students may also mistakenly use positive 12 for the slope, thinking the number of bottles increases over time, when in fact it should be −12 because the sports drink decreases by 12 bottles each day. Additionally, students may struggle to interpret the value of their estimation and may not recognize that 17.08 is close to 17 days, or they may not realize that the number of bottles can't be negative. Teachers can support students by providing multiple examples that translate real-world situations into equations. Using tables of values or physical objects to represent quantities changing over time can help students better connect abstract equations to real-life contexts. Teachers should also encourage students to estimate their answers before solving problems and to check their work for reasonableness.

7. Use the slope and *y*-intercept to graph each equation.

a) $y + 3 = 6x - 7$



b) $-(5x + 7) + y = 0$



Students may have difficulty creating the coordinate grid when given a blank grid. Other common errors students may make when using the slope and y-intercept to graph equations is to incorrectly solve for y or confuse values of the slope and the y-intercept by misidentifying the slope and the y-intercepts. Students may also incorrectly plot the y-intercept and the slope on the graph or when plotting the slope they may misinterpret the rise/run moving horizontally or vertically in the wrong direction. Teachers may help by providing multiple opportunities for

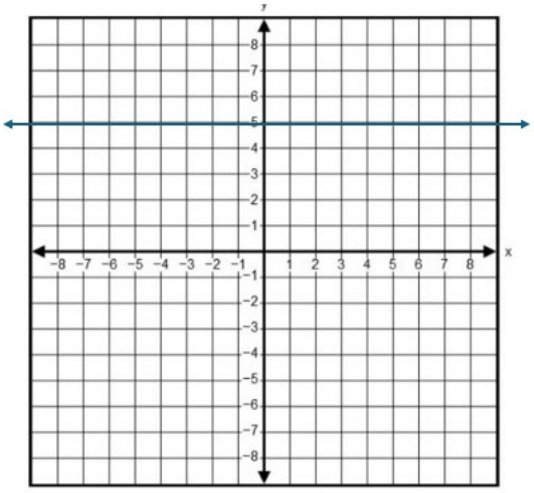
students to practice identifying the slope and y-intercepts of equations not written in slope-intercept form and graphing equations of lines without the use of a graphing utility.

8. Compare the quantity in column A with the quantity in column B. Which is greater?

Column A	**Column B**
The product of the slopes of $2x + 5y = 4$ and $y = \frac{5}{2}x - 7$	The slope of the line through points (5, 3) and (4, 2)

Common errors students may make when finding the slope of a line, whether in standard form or slope-intercept form, or when given two points include miscalculating or misidentifying the slope. Accurately determining the slope is essential for solving this example correctly and reaching the right conclusion. When finding the slope in Column A, students may incorrectly isolate y when placing 2x + 5y = 4 in standard form or slope-intercept form or forget to determine the products of the two slopes. When calculating the slope given the points (5, 3) and (4, 2) in Column B, students may incorrectly calculate the slope when using $m = \frac{y_2 - y_1}{x - x_1}$ *by swapping the points or reversing the numerator and denominators. Teachers can support students by providing additional practice with identifying and calculating slopes, including interpreting slope as steepness, stretch, or shrink. Encouraging students to compare and discuss their solutions can also deepen their understanding.*

9. Given the graph below, write an equation of the line and identify the slope.



Common errors students make when writing equations of horizontal lines is to write x = 5 instead of y = 5. Students may also write the equation in the form of y = mx + b, mistakenly including x, writing y = 5x. Teachers can help by providing more opportunities for students to write, sketch, and compare equations of horizontal and vertical lines. Teachers can also have students create horizontal and vertical lines and then generate a table of values for each, allowing them to observe which variable remains constant and which variable changes.