Name:	Teacher:

Grade 7 Math

Week	Online Lesson	Book Pages	Date Due
April 13 – April 17	3.1	Pgs. 72-76	
April 13 April 17	3.2	Pgs. 77-82	- April 24 th at 3pm
April 20 – April 24	3.3	Pgs. 83-88	April 24 at 3pill
April 20 April 21	Module 3 Quiz	Pg. 89	
April 27 – May 1	4.1	Pgs. 95-100	
April 27 – May 1	4.2	Pgs. 101-106	May Oth at 2mm
May 4 May 9	4.3	Pgs. 107-112	May 8 th at 3pm
May 4 – May 8	4.4	Pgs. 113-120	
May 11 – May 15	Module 4 Quiz	Pgs. 121	
May II May IS	5.1	Pgs. 127-132	May 22 nd at 3pm
May 18 – May 22	5.2	Pgs. 133-138	- May 22 at Spill
May 16 - May 22	5.3	Pgs. 139-146	
May 2E May 20	Module 5 Quiz	Pgs. 147	
May 25 – May 29	6.1	Pgs. 153-160	June 5 th at 3pm
June 1 – June 5	6.2	Pgs. 161-166	- Julie 5 th at 5pm
Julie 1 – Julie 5	6.3	Pgs. 167-172	
luna O luna 12	6.4	Pgs. 173-178	
June 8 – June 12	e 8 – June 12 Module 6 Quiz		June 19 th at 3pm
June 15 – June 19	TBA	TBA	

Note: We do not know when we will be returning to school, the schedule was created with a worst-case scenario of us not returning in mind; when we return to school plans will be adjusted again.

Do your best to complete all of the pages associated with each lesson. If you need any help, please reach out to your math teacher using Remind (information in below).

If you would like to join the appropriate class and ask your teachers a question, you may communicate via Remind. Communication to your teachers is available Monday thru Friday from 7:30am – 2:30pm.

- Mr. Zona to join his class is @zonamath7
- Ms. Molnar to join Grade 7 Math is @molnar2019
 - Mr. Aloian to join is @aloian207
 - Mrs. Nearhood to join Team 7A is @cluster7a
 - Mr. Wisniewski to join Team 7A is @LPS7b







ESSENTIAL QUESTION

How can you use nonproportional relationships to solve real-world

problems?



Representing Linear Nonproportional Relationships



8.F.3

LESSON 4.2

Determining Slope and y-intercept



8.EE.6, 8.F.4

LESSON 4.3

Graphing Linear Nonproportional Relationships using Slope and *y*-intercept



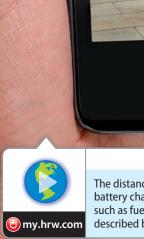
8.F.3, 8.F.4

LESSON 4.4

Proportional and Nonproportional Situations

COMMON CORE

8.F.2, 8.F.3, 8.F.4



Real-World Video

The distance a car can travel on a tank of gas or a full battery charge in an electric car depends on factors such as fuel capacity and the car's efficiency. This is described by a nonproportional relationship.





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Are Read

Complete these exercises to review skills you will need for this module.



Integer Operations

EXAMPLE
$$-7 - (-4) = -7 + 4$$

 $|-7| - |4|$
 $7 - 4$, or 3
 $= -3$

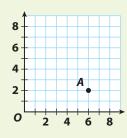
To subtract an integer, add its opposite. |-7|-|4| The signs are different, so find the difference of the absolute values.

Use the sign of the number with the greater absolute value.

Find each difference.

Graph Ordered Pairs (First Quadrant)

EXAMPLE



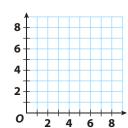
To graph a point at (6, 2), start at the origin.

Move 6 units right.

Then move 2 units up.

Graph point A(6, 2).

Graph each point on the coordinate grid.



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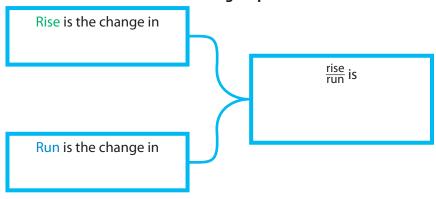
Reading Start-Up

Visualize Vocabulary

Use the

✓ words to complete the diagram. You can put more than one word in each box.

Reviewing Slope



Understand Vocabulary

Complete the sentences using the preview words.

- The y-coordinate of the point where a graph of a line crosses the y-axis is the _______.
- **2.** A ______ is an equation whose solutions form a straight line on a coordinate plane.
- **3.** A linear equation written in the form y = mx + b is the

Active Reading

Booklet Before beginning the module, create a booklet to help you learn the concepts. Write the main idea of each lesson on each page of the booklet. As you study each lesson, write important details that support the main idea, such as vocabulary and formulas. Refer to your finished booklet as you work on assignments and study for tests.

Vocabulary

Review Words

ordered pair (par ordenado) proportional relationship (relación proporcional)

- ✓ rate of change (tasa de cambio)
- ✓ slope (pendiente)
- ✓ *x*-coordinate (*coordenada x*)
- ✓ y-coordinate (coordenada y)

Preview Words

linear equation (ecuación lineal)

slope-intercept form of an equation (forma de pendiente-intersección) y-intercept (intersección con el eje y)

Unpacking the Standards

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.



Interpret the equation y = mx + b as defining a linear function whose graph is a straight line.

Key Vocabulary

slope (pendiente)

A measure of the steepness of a line on a graph; the rise divided by the run.

y-intercept (intersección con el eje y)

The *y*-coordinate of the point where the graph of a line crosses the y-axis.

What It Means to You

You will identify the slope and the y-intercept of a line by looking at its equation and use them to graph the line.

UNPACKING EXAMPLE 8.F.3

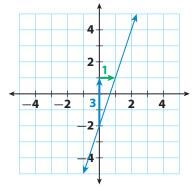
Graph y = 3x - 2 using the slope and the y-intercept.

$$y = mx + b$$

slope y-intercept

The slope *m* is 3, and the *y*-intercept

Plot the point (0, -2). Use the slope $3 = \frac{3}{1}$ to find another point by moving up 3 and to the right 1. Draw the line through the points.



COMMON 8.F.3

Give examples of functions that are not linear.

Key Vocabulary

function (función)

An input-output relationship that has exactly one output for each input.

linear function (función lineal)

A function whose graph is a straight line.



Visit my.hrw.com to see all the Common Core Standards unpacked.

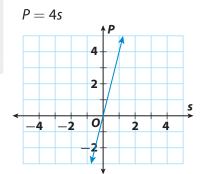
ny.hrw.com

What It Means to You

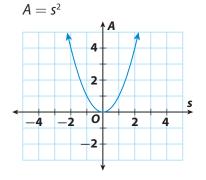
You will distinguish linear relationships from nonlinear relationships by looking at graphs.

UNPACKING EXAMPLE 8.F.3

Which relationship is linear and which is nonlinear?



P = 4s is linear because its graph is a line.



 $A = s^2$ is not linear because its graph is not a line.

Representing Linear 4.1 Nonproportional Relationships

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Interpret the equation *y* = mx + b as defining a linear function, whose graph is a straight line; ...

ESSENTIAL QUESTION

How can you use tables, graphs, and equations to represent linear nonproportional situations?

EXPLORE ACTIVITY





Prep for 8.F.3

Representing Linear Relationships Using Tables

You can use an equation to describe the relationship between two quantities in a real-world situation. You can use a table to show some values that make the equation true.



EXAMPLE 1 The equation y = 3x + 2 gives the total charge, y, for one person to rent a pair of shoes and bowl x games at Baxter Bowling Lanes based on the prices shown. Make a table of values for this situation.



Choose several values for x that make sense in context. Count by ones.

x (number of games)	1	2	
y (total cost in dollars)			



STEP 2

Use the equation y = 3x + 2 to find y for each value of x.

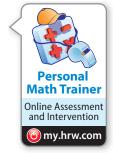
x (number of games)	1	2	
y (total cost in dollars)	5		



Substitute 1 for x: y = 3(1) + 2 = 5

1. Francisco makes \$12 per hour doing part-time work on Saturdays. He spends \$4 on transportation to and from work. The equation y = 12x - 4gives his earnings y, after transportation costs, for working x hours. Make a table of values for this situation.

x (number of hours)		
y (earnings in dollars)		



Examining Linear Relationships

Recall that a proportional relationship is a relationship between two quantities in which the ratio of one quantity to the other quantity is constant. The graph of a proportional relationship is a line through the origin. Relationships can have a constant rate of change but not be proportional.

The entrance fee for Mountain World theme park is \$20. Visitors purchase additional \$2 tickets for rides, games, and food. The equation y = 2x + 20gives the total cost, y, to visit the park, including purchasing x tickets.

STEP 1

Complete the table.

x (number of tickets)	0	2	4	6	8
y (total cost in dollars)	20				

STEP 2

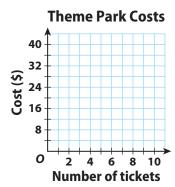
Plot the ordered pairs from the table. Describe the shape of the graph.

STEP 3

Find the rate of change between each point and the next. Is the rate constant?

STEP 4

Calculate $\frac{y}{y}$ for the values in the table. Explain why the relationship between number of tickets and total cost is not proportional.



2. Analyze Relationships Would it make sense to add more points to the graph from x = 0 to x = 10? Would it make sense to connect the points with a line? Explain.

Representing Linear Relationships **Using Graphs**

A linear equation is an equation whose solutions are ordered pairs that form a line when graphed on a coordinate plane. Linear equations can be written in the form y = mx + b. When $b \neq 0$, the relationship between x and y is nonproportional.



My Notes

EXAMPLE 2





8.F.3

The diameter of a Douglas fir tree is currently 10 inches when measured at chest height. Over the next 50 years, the diameter is expected to increase by an average growth rate of $\frac{2}{5}$ inch per year. The equation $y = \frac{2}{5}x + 10$ gives y, the diameter of the tree in inches, after x years. Draw a graph of the equation. Describe the relationship.

STEP 1

Make a table. Choose several values for x that make sense in context. To make calculations easier, choose multiples of 5.

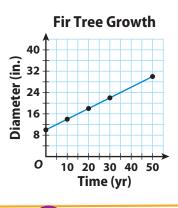
x (years)	0	10	20	30	50
y (diameter in inches)	10	14	18	22	30

STEP 2

Plot the ordered pairs from the table. Then draw a line connecting the points to represent all the possible solutions.

STEP 3

The relationship is linear but nonproportional. The graph is a line but it does not go through the origin.

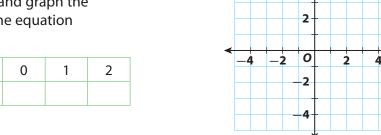


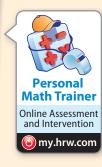


YOUR TURN

3. Make a table and graph the solutions of the equation y = -2x + 1.

Х	-1	0	1	2
у				





Guided Practice

Make a table of values for each equation. (Explore Activity Example 1)

1.
$$y = 2x + 5$$

X	-2	-1	0	1	2
у					

2.
$$y = \frac{3}{8}x - 5$$

X	-8	0	8	
у				

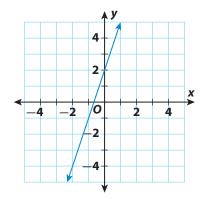
Explain why each relationship is not proportional. (Explore Activity 2)

3.

X	0	2	4	6	8
у	3	7	11	15	19

First calculate $\frac{y}{x}$ for the values in the table.

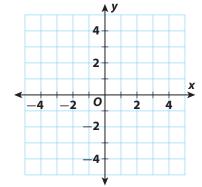
4.



Complete the table for the equation. Then use the table to graph the equation. (Example 2)

5. y = x - 1

X	-2	-1	0	1	2
у					



2

ESSENTIAL QUESTION CHECK-IN

6. How can you choose values for *x* when making a table of values representing a real world situation?

4.1 Independent Practice

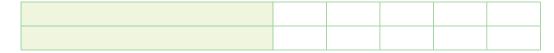




State whether the graph of each linear relationship is a solid line or a set of unconnected points. Explain your reasoning.

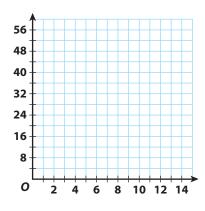
- **7.** The relationship between the number of \$4 lunches you buy with a \$100 school lunch card and the money remaining on the card
- 8. The relationship between time and the distance remaining on a 3-mile walk for someone walking at a steady rate of 2 miles per hour

- **9. Analyze Relationships** Simone paid \$12 for an initial year's subscription to a magazine. The renewal rate is \$8 per year. This situation can be represented by the equation y = 8x + 12, where x represents the number of years the subscription is renewed and y represents the total cost.
 - **a.** Make a table of values for this situation.



- **b.** Draw a graph to represent the situation. Include a title and axis labels.
- **c.** Explain why this relationship is not proportional.

d. Does it make sense to connect the points on the graph with a solid line? Explain.



10.	Analyze Relationships A proportional relationship is a linear relationship because the rate of change is constant (and equal to the constant of proportionality). What is required of a proportional relationship that is <i>not</i> required of a general linear relationship?				
11.	Communicate Mathematical Ideas Explain how you can identify a linear non-proportional relationship from a table, a graph, and an equation.				



FOCUS ON HIGHER ORDER THINKING

12. Critique Reasoning George observes that for every increase of 1 in the value of *x*, there is an increase of 60 in the corresponding value of *y*. He claims that the relationship represented by the table is proportional. Critique George's reasoning.

X	1	2	3	4	5
у	90	150	210	270	330

13.	Make a Conjecture Two parallel lines are graphed on a coordinate
	plane. How many of the lines could represent proportional relationships?
	Explain.

Explain.	,	•		

Work Area

4.2 Determining Slope and y-intercept

...; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b. Also 8.F.4

ESSENTIAL QUESTION

How can you determine the slope and the y-intercept of a line?

EXPLORE ACTIVITY 1

Investigating Slope and y-intercept

The graph of every nonvertical line crosses the y-axis. The y-intercept is the y-coordinate of the point where the graph intersects the y-axis. The x-coordinate of this point is always 0.

The graph represents the linear equation $y = -\frac{2}{3}x + 4$.

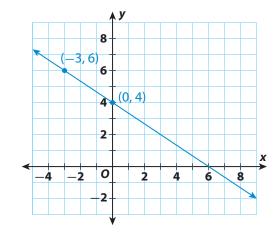
STEP 1

Find the slope of the line using the points (0, 4) and (-3, 6).

$$m = \frac{6 - \bigcirc}{\bigcirc - 0} = \bigcirc$$

STEP 2

The line also contains the point (6, 0). What is the slope using (0, 4) and (6, 0)? Using (-3, 6)and (6, 0). What do you notice?



STEP 3

Compare your answers in Steps 1 and 2 with the equation of the graphed line.

STEP 4

Find the value of y when x = 0 using the equation $y = -\frac{2}{3}x + 4$. Describe the point on the graph that corresponds to this solution.

STEP 5

Compare your answer in Step 4 with the equation of the line.



Determining Rate of Change and Initial Value

The linear equation shown is written in the v = mx + bslope-intercept form of an equation. Its graph is a line with **slope** *m* and *y*-intercept *b*. y-intercept

A linear relationship has a constant rate of change. You can find the rate of **change** *m* and the **initial value** *b* for a linear situation from a table of values.

EXAMPLE 1



8.F.4

A phone salesperson is paid a minimum weekly salary and a commission for each phone sold, as shown in the table. Confirm that the relationship is linear and give the constant rate of change and the initial value.

STEP 1

Confirm that the rate of change is constant.

$$\frac{\text{change in income}}{\text{change in phones sold}} = \frac{630 - 480}{20 - 10} = \frac{150}{10} = 15$$

$$\frac{\text{change in income}}{\text{change in phones sold}} = \frac{780 - 630}{30 - 20} = \frac{150}{10} = 15$$

change in income	930-780 _	$=\frac{150}{12}=15$
change in phones sold	40-30	$-\frac{10}{10}$



Math Talk **Mathematical Practices**

How do you use the rate of change to work backward to find the initial value?

The rate of change is a constant, 15.

The salesperson receives a \$15 commission for each phone sold.

Find the initial value when the number of phones sold is 0.

-10 -10								
	K	K						
Number of phones sold	0	10	20	Work backward from $x = 10$ to $x = 0$ to				
Weekly income (\$)	330	480	630	find the initial value.				
−150 −150								

The initial value is \$330. The salesperson receives a salary of \$330 each week before commissions.

YOUR TURN

STEP 2



Find the slope and y-intercept of the line represented by each table.

1.	х	2	4	6	8
	у	22	32	42	52

2.	X	1	2	3	4
	у	8	15	22	29

Deriving the Slope-intercept Form of an Equation

In the following Explore Activity, you will derive the slope-intercept form of an equation.

STEP 1

Let L be a line with slope m and y-intercept b. Circle the point that must be on the line. Justify your choice.

- (b, 0)
- (0, b)
- (0, m)
- (m, 0)

STEP 2

Recall that slope is the ratio of change in y to change in x. Complete the equation for the slope *m* of the line using the *y*-intercept (0, *b*) and another point (x, y) on the line.

$$m = \frac{y - \left(\frac{y}{y} - \frac{y}{y} \right)}{y - y}$$

STEP 3

In an equation of a line, we often want y by itself on one side of the equation. Solve the equation from Step 2 for y.

$$m=\frac{y-b}{x}$$

Simplify the denominator.

$$m \cdot \bigcirc = \frac{y-b}{x} \cdot \bigcirc$$

Multiply both sides of the equation by __

$$m = y - b$$

$$mx + \boxed{} = y - b + \boxed{}$$

Add _____ to both sides of the equation.

$$mx + \bigcirc = y$$

$$y = mx + \bigcirc$$

Write the equation with yon the left side.

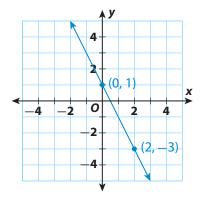
Reflect

3. Critical Thinking Write the equation of a line with slope *m* that passes through the origin. Explain your reasoning.

Guided Practice

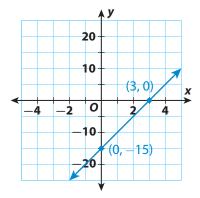
Find the slope and y-intercept of the line in each graph. (Explore Activity 1)

1.



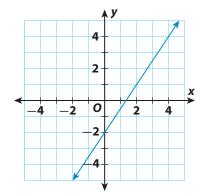
slope
$$m =$$
______ y -intercept $b =$ _____

2.



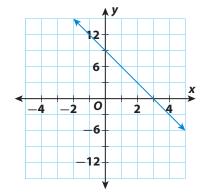
slope
$$m =$$
______ y -intercept $b =$ _____

3.



slope
$$m = v$$
-intercept $b = v$

4.



slope
$$m =$$
 _____ y-intercept $b =$ _____ slope $m =$ ____ y-intercept $b =$ _____

Find the slope and y-intercept of the line represented by each table. (Example 1)

5.

Х	0	2	4	6	8
у	1	7	13	19	25

slope
$$m =$$
_______ y -intercept $b =$ ______ slope $m =$ ______ y -intercept $b =$ ______

6.

Z	K	0	5	10	15	20
J	y	140	120	100	80	60

slope
$$m = \underline{\hspace{1cm}}$$
 y-intercept $b = \underline{\hspace{1cm}}$

ESSENTIAL QUESTION CHECK-IN

7. How can you determine the slope and the *y*-intercept of a line from a graph?

4.2 Independent Practice



EXAMPLE 2 8.EE.6, 8.F.4

8. Some carpet cleaning costs are shown in the table. The relationship is linear. Find and interpret the rate of change and the initial value for this situation.

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(a) my.hrw.com	Online Assessment and Intervention	

Rooms cleaned	1	2	3	4
Cost (\$)	125	175	225	275

- **9.** Make Predictions The total cost to pay for parking at a state park for the day and rent a paddleboat are shown.
 - **a.** Find the cost to park for a day and the hourly rate to rent a paddleboat.
 - **b.** What will Lin pay if she rents a paddleboat for 3.5 hours and splits the total cost with a friend? Explain.

	7	
Number of Hours	Cost (\$)	
1	\$17	
2	\$29	
3	\$41	
4	\$53	

10. Multi-Step Raymond's parents will pay for him to take sailboard lessons during the summer. He can take half-hour group lessons or half-hour private lessons. The relationship between cost and number of lessons is linear.

Lessons	1	2	3	4
Group (\$)	55	85	115	145
Private (\$)	75	125	175	225

a. Find the rate of change and the initial value for the group lessons.

b. Find the rate of change and the initial value for the private lessons.

c. Compare and contrast the rates of change and the initial values.

Vocabulary Explain why each relationship is not linear.

11.

X	1	2	3	4
у	4.5	6.5	8.5	11.5

12.

X	3	5	7	9
y	140	126	110	92

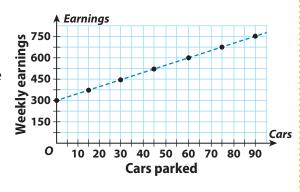
13. Communicate Mathematical Ideas Describe the procedure you performed to derive the slope-intercept form of a linear equation.

H.O.T.	

FOCUS ON HIGHER ORDER THINKING

Work Area

- **14. Critique Reasoning** Your teacher asked your class to describe a realworld situation in which a *y*-intercept is 100 and the slope is 5. Your partner gave the following description: *My younger brother originally had 100 small building blocks, but he has lost 5 of them every month since.*
 - **a.** What mistake did your partner make?
 - **b.** Describe a real-world situation that does match the situation.
- a job parking cars. He earns a fixed weekly salary of \$300 plus a fee of \$5 for each car he parks. His potential earnings for a week are shown in the graph. At what point does John begin to earn more from fees than his fixed salary? Justify your answer.



Graphing Linear 13 Nonproportional **Relationships Using** Slope and y-intercept



.. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph.... Also 8.F.3



ESSENTIAL QUESTION

How can you graph a line using the slope and y-intercept?

EXPLORE ACTIVITY



Using Slope-intercept Form to Graph a Line

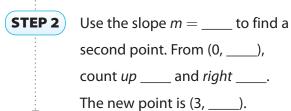
Recall that y = mx + b is the slope-intercept form of the equation of a line. In this form, it is easy to see the slope m and the y-intercept b. So you can use this form to quickly graph a line by plotting the point (0, b) and using the slope to find a second point.



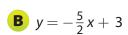
A
$$y = \frac{2}{3}x - 1$$



STEP 1 The *y*-intercept is b =____. Plot (0,).

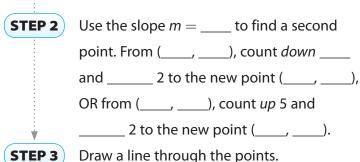


Draw a line through the points.



STEP 3

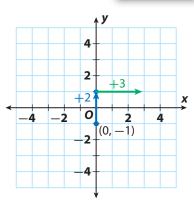
The *y*-intercept is $b = \underline{\hspace{1cm}}$. Plot $(0, \underline{\hspace{1cm}})$. STEP 1



(0, 3)







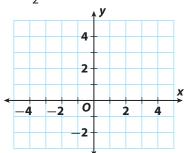
Reflect

1. **Draw Conclusions** How can you use the slope of a line to predict the way the line will be slanted? Explain.

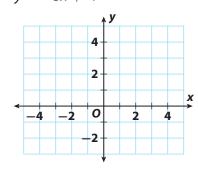


Graph each equation.

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



3.
$$y = -3x + 4$$







Analyzing a Graph

Many real-world situations can be represented by linear relationships. You can use graphs of linear relationships to visualize situations and solve problems.

EXAMPLE 2





Ken has a weekly goal of burning 2400 calories by taking brisk walks. The equation y = -300x + 2400 represents the number of calories y Ken has left to burn after x hours of walking which burns 300 calories per hour.



lack Graph the equation y = -300x + 2400.



Write the slope as a fraction.

$$m = \frac{-300}{1} = \frac{-600}{2} = \frac{-900}{3}$$

 $m = \frac{-300}{1} = \frac{-600}{2} = \frac{-900}{3}$ Using the slope as $\frac{-900}{3}$ helps in drawing a more accurate graph.

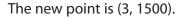


Plot the point for the *y*-intercept: (0, 2400).



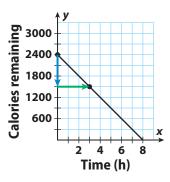
Use the slope to locate a second point.

From (0, 2400), count down 900 and right 3.





Draw a line through the two points.





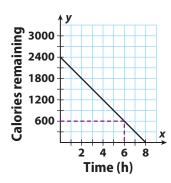
Locate 600 calories on the *y*-axis. Read across and down to the *x*-axis.

Ken will have 600 calories left to burn after 6 hours.



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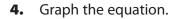
Ken will reach his weekly goal when the number of calories left to burn is 0. Because every point on the *x*-axis has a *y*-value of 0, find the point where the line crosses the *x*-axis.



Ken will reach his goal after 8 hours of brisk walking.

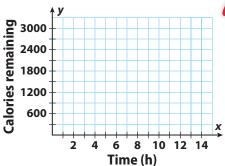
YOUR TURN

What If? Ken decides to modify his exercise plans from Example 2 by slowing the speed at which he walks. The equation for the modified plan is y = -200x + 2400.



5. How does the graph of the new equation compare with the graph in Example 2?

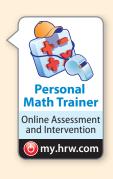
· _____



6. Will Ken have to exercise more or less to meet his goal? Explain.

7. Suppose that Ken decides that instead of walking, he will jog, and that jogging burns 600 calories per hour. How do you think that this would change the graph?





Mathematical Practices
What do the slope

and the *y*-intercept of the line represent in this

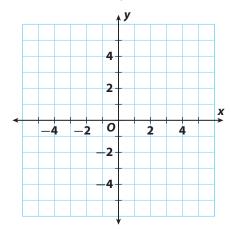
situation?

Guided Practice

Graph each equation using the slope and the y-intercept. (Explore Activity Example 1)

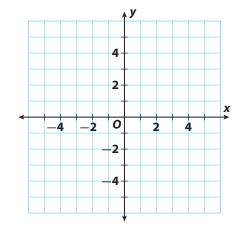
1. $y = \frac{1}{2}x - 3$

slope = ____ *y*-intercept = ____



2. y = -3x + 2

slope = _____ *y*-intercept = _____



3. A friend gives you two baseball cards for your birthday. Afterward, you begin collecting them. You buy the same number of cards once each week. The equation y = 4x + 2 describes the number of cards, y, you have after x weeks. (Example 2)

a. Find and interpret the slope and the *y*-intercept of the line that represents this situation. Graph y = 4x + 2. Include axis labels.

 ,

- 20 16 12 8
- **b.** Discuss which points on the line do not make sense in this situation. Then plot three more points on the line that do make sense.

? E!

ESSENTIAL QUESTION CHECK-IN

4. Why might someone choose to use the *y*-intercept and the slope to graph a line?

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Assessment and

Intervention

4.3 Independent Practice



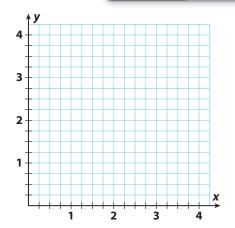
8.F.3, 8.F.4

5. Science A spring stretches in relation to the weight hanging from it according to the equation y = 0.75x + 0.25 where x is the weight in pounds and y is the length of the spring in inches.



- a. Graph the equation. Include axis labels.
- **b.** Interpret the slope and the y-intercept of the line.





c. How long will the spring be if a 2-pound weight is hung on it? Will the length double if you double the weight? Explain

Look for a Pattern Identify the coordinates of four points on the line with each given slope and y-intercept.

6. slope = 5, *y*-intercept =
$$-1$$

7. slope =
$$-1$$
, *y*-intercept = 8

8. slope = 0.2, *y*-intercept =
$$0.3$$

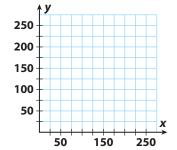
9. slope = 1.5, y-intercept =
$$-3$$

10. slope =
$$-\frac{1}{2}$$
, y-intercept = 4

11. slope =
$$\frac{2}{3}$$
, y-intercept = -5

12. A music school charges a registration fee in addition to a fee per lesson. Music lessons last 0.5 hour. The equation y = 40x + 30 represents the total cost y of x lessons. Find and interpret the slope and y-intercept of the line that represents this situation. Then find four points on the line.

- **13.** A public pool charges a membership fee and a fee for each visit. The equation y = 3x + 50 represents the cost y for x visits.
 - **a.** After locating the *y*-intercept on the coordinate plane shown, can you move up three gridlines and right one gridline to find a second point? Explain.

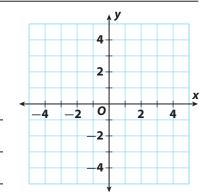


- **b.** Graph the equation y = 3x + 50. Include axis labels. Then interpret the slope and y-intercept.
- **c.** How many visits to the pool can a member get for \$200?



FOCUS ON HIGHER ORDER THINKING

- **14.** Explain the Error A student says that the slope of the line for the equation y = 20 15x is 20 and the *y*-intercept is 15. Find and correct the error.
- **15. Critical Thinking** Suppose you know the slope of a linear relationship and a point that its graph passes through. Can you graph the line even if the point provided does *not* represent the *y*-intercept? Explain.
- **16.** Make a Conjecture Graph the lines y = 3x, y = 3x 3, and y = 3x + 3. What do you notice about the lines? Make a conjecture based on your observation.



Work Area

4.4 Proportional and Nonproportional **Situations**

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Also 8.F.3, 8.F.4

ESSENTIAL QUESTION

How can you distinguish between proportional and nonproportional situations?

EXPLORE ACTIVITY Regi





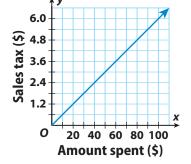
Distinguish Between Proportional and Nonproportional Situations **Using a Graph**



If a relationship is nonlinear, it is nonproportional. If it is linear, it may be either proportional or nonproportional. When the graph of the linear relationship contains the origin, the relationship is proportional.

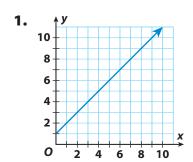
EXAMPLE 1 The graph shows the sales tax charged based on the amount spent at a video game store in a particular city. Does the graph show a linear relationship? Is the relationship proportional or nonproportional?

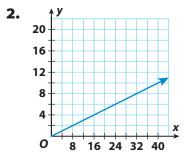
The graph shows a linear relationship because it is a _____ that contains the _____.



YOUR TURN

Determine if each of the following graphs represents a proportional or nonproportional relationship.











Distinguish Between Proportional and Nonproportional Situations Using an Equation

If an equation is not a linear equation, it represents a nonproportional relationship. A linear equation of the form y = mx + b may represent either a proportional (b = 0) or nonproportional ($b \neq 0$) relationship.

EXAMPLE 2





8.F.4

The number of years since Keith graduated from middle school can be represented by the equation y = a - 14, where y is the number of years and a is his age. Is the relationship between the number of years since Keith graduated and his age proportional or nonproportional?

$$y = a - 14$$

The equation is in the form y = mx + b, with a being used as the variable instead of x. The value of m is 1, and the value of b is -14. Since b is not 0, the relationship between the number of years since Keith graduated and his age is nonproportional.

Reflect

- **3.** Communicate Mathematical Ideas In a proportional relationship, the ratio $\frac{y}{x}$ is constant. Show that this ratio is not constant for the equation y = a 14.
- **4. What If?** Suppose another equation represents Keith's age in months *y* given his age in years *a*. Is this relationship proportional? Explain.

YOUR TURN

Determine if each of the following equations represents a proportional or nonproportional relationship.

5.
$$d = 65t$$

6.
$$p = 0.1s + 2000$$

7.
$$n = 450 - 3p$$



Distinguish Between Proportional and Nonproportional Situations **Using a Table**

If there is not a constant rate of change in the data displayed in a table, then the table represents a nonlinear nonproportional relationship.

A linear relationship represented by a table is a proportional relationship when the quotient of each pair of numbers is constant. Otherwise, the linear relationship is nonproportional.



EXAMPLE 3





8.F.4

The values in the table represent the numbers of U.S. dollars three tourists traded for Mexican pesos. The relationship is linear. Is the relationship proportional or nonproportional?

U.S. Dollars Traded	Mexican Pesos Received
130	1,690
255	3,315
505	6,565

$$\frac{1,690}{130} = \frac{169}{13} = 13$$

$$\frac{3,315}{255} = \frac{221}{17} = 13$$

$$\frac{6,565}{505} = \frac{1313}{101} = 13$$
 to the dollars traded.

Simplify the ratios to compare the pesos received



Mathematical Practices

How could you confirm that the values in the table have a linear relationship?

The ratio of pesos received to dollars traded is constant at 13 Mexican pesos per U.S. dollar. This is a proportional relationship.

YOUR TURN

Determine if the linear relationship represented by each table is a proportional or nonproportional relationship.

9.

Х	у
2	30
8	90
14	150

10.

X	у
5	1
40	8
65	13





Comparing Proportional and Nonproportional Situations

You can use what you have learned about proportional and nonproportional relationships to compare similar real-world situations that are given using different representations.

A laser tag league has the choice of two arenas for a tournament. In both cases, x is the number of hours and y is the total charge.

EXAMPLE 4



COMMON CORE 8.F.2

Math Talk

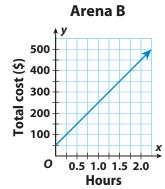
Mathematical Practices

How might graphing the equation for Arena A help you to compare the situations?

Compare and contrast these two situations.

Arena A

$$y = 225x$$



- Arena A's equation has the form y = mx + b, where b = 0. So, Arena A's charges are a proportional relationship. The hourly rate, \$225, is greater than Arena B's, but there is no additional fee.
- Arena B's graph is a line that does not include the origin. So, Arena B's charges are a nonproportional relationship. Arena B has a \$50 initial fee but its hourly rate, \$200, is lower.
- **B** Jessika is remodeling and has the choice of two painters. In both cases, x is the number of hours and y is the total charge. Compare and contrast these two situations.

Painter A

$$y = $45x$$

Painter A's equation has the form y = mx + b, where b = 0. So, Painter A's charges are proportional. The hourly rate, \$45, is greater than Painter B's, but there is no additional fee.

Painter B

X	0	1	2	3
у	20	55	90	125

Painter B's table is a nonproportional relationship because the ratio of *y* to *x* is not constant. Because the table contains the ordered pair (0, 20), Painter B charges an initial fee of \$20, but the hourly rate, \$35, is less than Painter A's.

11. Compare and contrast the following two situations.

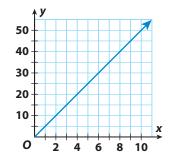
Test-Prep Center A	Test-Prep Center B
The cost for Test-Prep Center A is given by $c = 20h$, where c is the cost in dollars and h is the number of hours you attend.	Test-Prep Center B charges \$25 per hour to attend, but you have a \$100 coupon that you can use to reduce the cost.

Guided Practice

Determine if each relationship is a proportional or nonproportional situation. Explain your reasoning.

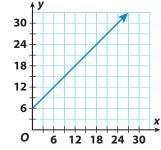
(Explore Activity Example 1, Example 2, Example 4)

1.



Look at the origin.

2.



3. $q = 2p + \frac{1}{2}$



Compare the equation with y = mx + b.

The tables represent linear relationships. Determine if each relationship is a proportional or nonproportional situation. (Example 3, Example 4)

5.

X	у
3	12
9	36
21	84

6

X	у
22	4
46	8
58	10

Find the quotient of *y* and *x*.

7. The values in the table represent the numbers of households that watched three TV shows and the ratings of the shows. The relationship is linear. Describe the relationship in other ways. (Example 4)

Number of Households that Watched TV Show	TV Show Rating
15,000,000	12
20,000,000	16
25,000,000	20

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ESSENTIAL QUESTION CHECK-IN

8. How are using graphs, equations, and tables similar when distinguishing between proportional and nonproportional linear relationships?

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4.4 Independent Practice



COMMON 8.F.2, 8.F.3, 8.F.4

9. The graph shows the weight of a cross-country team's beverage cooler based on how much sports drink it contains.

a. Is the relationship proportional or nonproportional? Explain.



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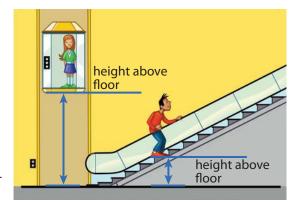
Assessment and

Intervention

b. Identify and interpret the slope and the *y*-intercept.

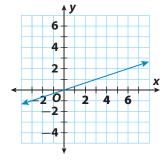
In 10–11, tell if the relationship between a rider's height above the first floor and the time since the rider stepped on the elevator or escalator is proportional or nonproportional. Explain your reasoning.

10. The elevator paused for 10 seconds after you stepped on before beginning to rise at a constant rate of 8 feet per second.

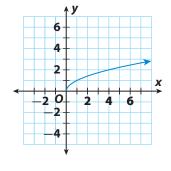


- **11.** Your height, h, in feet above the first floor on the escalator is given by h = 0.75t, where t is the time in seconds.
- **12.** Analyze Relationships Compare and contrast the two graphs.

Graph A $y = \frac{1}{3}x$



Graph B
$$y = \sqrt{x}$$



13. Represent Real-World Problems Describe a real-world situation where the relationship is linear and nonproportional.

Work Area



FOCUS ON HIGHER ORDER THINKING

- **14. Mathematical Reasoning** Suppose you know the slope of a linear relationship and one of the points that its graph passes through. How can you determine if the relationship is proportional or nonproportional?
- **15. Multiple Representations** An entrant at a science fair has included information about temperature conversion in various forms, as shown. The variables *F*, *C*, and *K* represent temperatures in degrees Fahrenheit, degrees Celsius, and kelvin, respectively.

	Equation A $F = \frac{9}{5}C + 32$	Table C		
		Degrees Celsius	kelvin	
	Equation B	8	281.15	
		15	288.15	
	K = C + 273.15	36	309.15	

a. Is the relationship between kelvins and degrees Celsius proportional? Justify your answer in two different ways.

b. Is the relationship between degrees Celsius and degrees Fahrenheit proportional? Why or why not?

Ready to Go On?



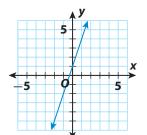
4.1 Representing Linear Nonproportional Relationships

1. Complete the table using the equation y = 3x + 2.

X	-1	0	1	2	3
у					

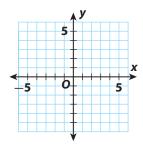
4.2 Determining Slope and y-intercept

2. Find the slope and *y*-intercept of the line in the graph.



4.3 Graphing Linear Nonproportional Relationships

3. Graph the equation y = 2x - 3 using slope and *y*-intercept.



4.4 Proportional and Nonproportional Situations

4. Does the table represent a proportional or a nonproportional linear relationship?

X	1	2	3	4	5
у	4	8	12	16	20

- **5.** Does the graph in Exercise 2 represent a proportional or a nonproportional linear relationship?
- ____
- **6.** Does the graph in Exercise 3 represent a proportional or a nonproportional relationship?

ESSENTIAL QUESTION

7. How can you identify a linear nonproportional relationship from a table, a graph, and an equation?

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Assessment Readiness

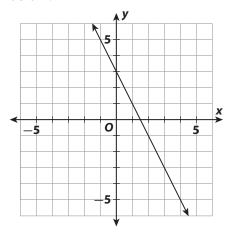


Selected Response

1. The table below represents which equation?

X	-1	0	1	2
y	-10	-6	-2	2

- (A) y = -x 10 (C) y = 4x 6
- (B) y = -6x (D) y = -4x + 2
- 2. The graph of which equation is shown below?



- (A) y = -2x + 3
- (c) y = 2x + 3
- **(B)** y = -2x + 1.5 **(D)** y = 2x + 1.5
- **3.** The table below represents a linear relationship.

X	2	3	4	5
y	4	7	10	13

What is the *y*-intercept?

- \bigcirc -4
- **(C)** 2
- **B** -2
- **(D)** 3
- **4.** Which equation represents a nonproportional relationship?

 - (A) y = 3x + 0 (C) y = 3x + 5
 - **(B)** y = -3x **(D)** $y = \frac{1}{3}x$

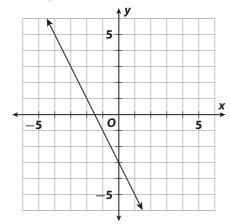
5. The table shows a proportional relationship. What is the missing y-value?

X	4	10	12
у	6	15	?

- (A) 16
- **(C)** 18
- **(B)** 20
- **(D)** 24
- **6.** What is 0.00000598 written in scientific notation?
 - \bigcirc 5.98 \times 10⁻⁶
- (c) 59.8×10^{-6}
- **(B)** 5.98×10^{-5}
- **(D)** 59.8×10^{-7}

Mini-Task

7. The graph shows a linear relationship.



- **a.** Is the relationship proportional or nonproportional?
- **b.** What is the slope of the line?
- **c.** What is the *y*-intercept of the line?
- **d.** What is the equation of the line?