Chapter 7

Functions and Inequalities

Essential Question

HOW are symbols, such as <, >, and =, useful?

Common Core GPS

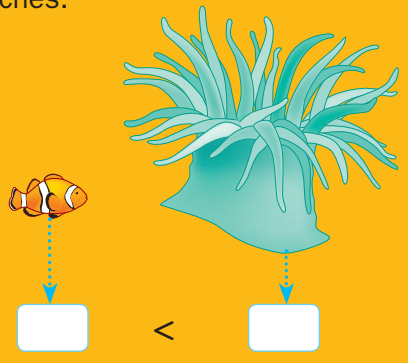
Content Standards
MCC6.EE.2, MCC6.EE.2c, MCC6.EE.5, MCC6.EE.6, MCC6.EE.8, MCC6.EE.9

Mathematical Practices
1, 2, 3, 4, 5, 6, 7, 8

Math in the Real World

Ocean Life In the ocean, clownfish and sea anemones benefit one another. Clownfish chase away different species of fish that eat the sea anemone. Sea anemones have tentacles that are coated in poison. These tentacles protect the clownfish from predators.

A clownfish can be up to 3.5 inches in length. Some species of sea anemones can be up to 39 inches wide. Compare 3.5 inches and 39 inches.



FOLDABLES® Study Organizer

1. Cut out the correct Foldable from the FL pages in the back of this book.
2. Place your Foldable on the Key Concept page toward the end of this chapter.
3. Use the Foldable throughout this chapter to help you learn about functions and inequalities.

What Tools Do You Need?

Vocabulary

arithmetic sequence
dependent variable
function
function rule
function table
geometric sequence
independent variable
inequality
linear function
sequence
term

Study Skill: Writing Math

Describe Data

When you *describe* something, you represent it in words.

Mark surveyed his class to find their favorite flavor of sugarless gum. Describe the data.

- Eight more people favor peppermint gum over cinnamon gum.
- The total number of people surveyed is 40.

These statements describe the data. What other ways can you describe the data? _____

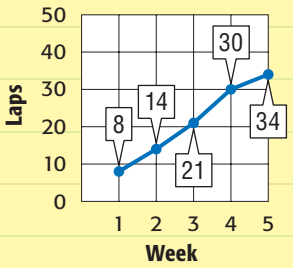
Favorite Flavor of Sugarless Gum	
Flavor	**Number**
Cinnamon	10
Peppermint	18
Watermelon	12

Describe the data below.

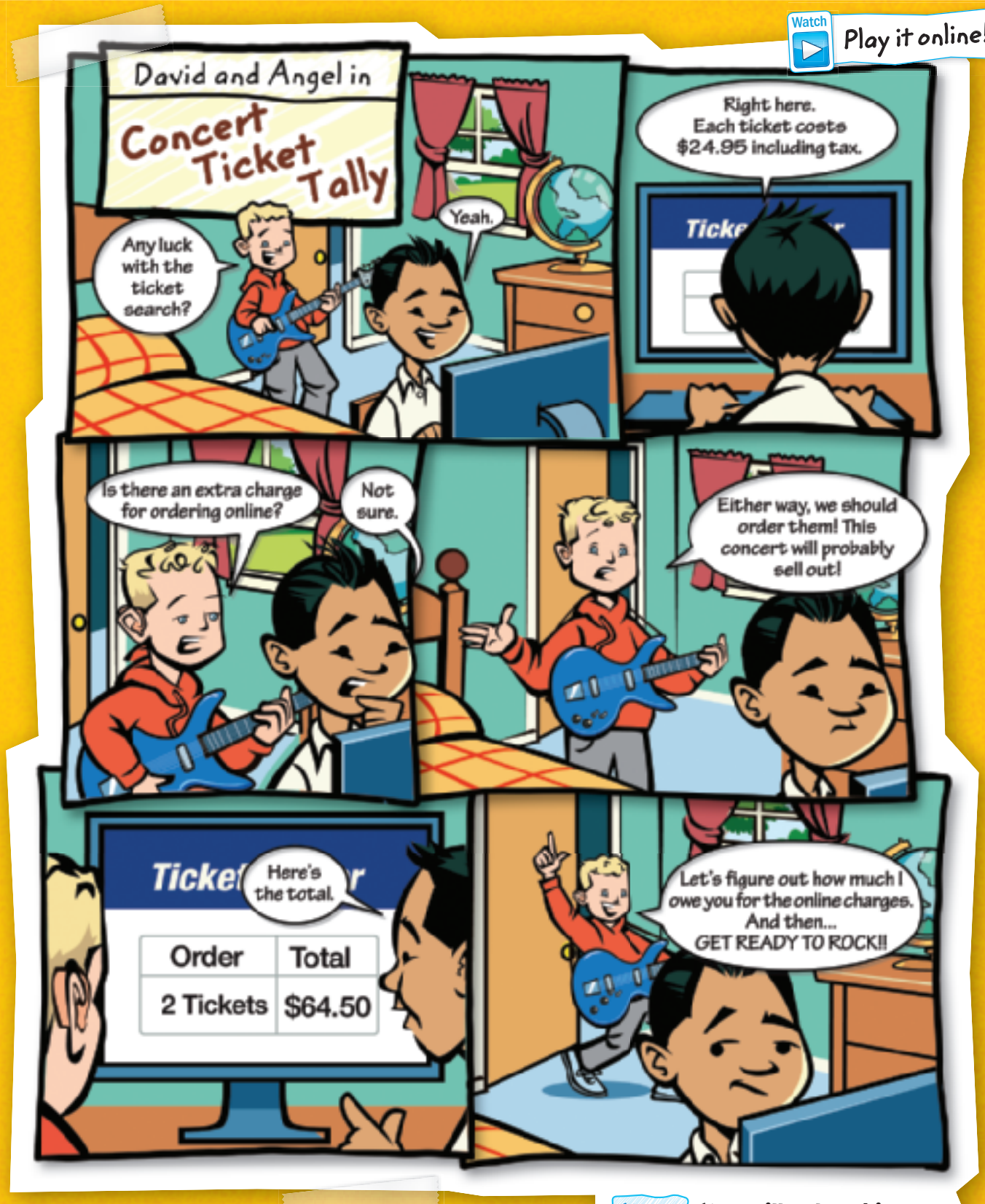
1.

Least Favorite "Bug"	
Kind	**Number**
Centipede	2
Cockroach	18
Spider	30

2.



When Will You Use This?



Watch Play it online!

Your Turn! You will solve this problem in the chapter.

Are You Ready?

Try the Quick Check below.
Or, take the Online Readiness Quiz.

Quick Review

Common Core Review MCC4.NBT.2, MCC6.EE.7

Example 1

Fill in the ◯ with <, >, or = to make a true statement.

71,238 ◯ 71,832

71,238 Use place value. Line up the digits.
71,832 Compare the hundreds place. 2 < 8

So, 71,238 < 71,832.

Example 2

Solve $54 + x = 180$.

$54 + x = 180$
$-54 \quad = -54$ Write the equation.
$x = 126$ Subtract.

Check $54 + 126 \stackrel{?}{=} 180$
$180 = 180$ ✓

Quick Check

Compare Numbers **Fill in each ◯ with <, >, or =, to make the inequality true.**

1. 302,788 ◯ 203,788

2. 54,300 ◯ 543,000

3. 892,341 ◯ 892,431

Show your work.

4. The table shows the number of bones in humans. Compare 300 and 206. _____

Bones in Humans	
Baby	300
Adult	206

Solve Equations **Solve each equation.**

5. $x + 44 = 90$ _____

6. $x - 7 = 18$ _____

7. $16m = 48$ _____

8. In the first two basketball games, Lee scored a total of 40 points. If he scored 21 points in the second game, how many points did he score in the first game?

_____

How Did You Do?

Which problems did you answer correctly in the Quick Check? Shade those exercise numbers below.

1 2 3 4 5 6 7 8

Lesson 1

Function Tables

What You'll Learn

Scan the lesson. List two headings you would use to make an outline of the lesson.

- _____
- _____

Essential Question

HOW are symbols, such as <, >, and =, useful?

Vocabulary

function
function rule
function table
independent variable
dependent variable

Common Core GPS

Content Standards
MCC6.EE.2, MCC6.EE.2c, MCC6.EE.9

Mathematical Practices
1, 3, 4, 5

Real-World Link

Watch

Science A ruby-throated hummingbird beats its wings about 52 beats per second.

1. Make a table showing show many times this bird beats its wings in 2 seconds.

Number of Seconds (s)	$s \cdot 52$	Wing Beats
2	$2 \cdot 52$	

2. Make a table to show how many times it beats its wings in 6 seconds.

Number of Seconds (s)	$s \cdot 52$	Wing Beats
6		

3. Make a table to show how many times it beats its wings in 20 seconds.

Number of Seconds (s)	$s \cdot 52$	Wing Beats

4. A Giant Hummingbird beats its wings about 10 times per second. Make a table to show how many times the Giant Hummingbird beats its wings in 3 seconds.

Number of Seconds (s)	$s \cdot 10$	Wing Beats

Work Zone

Find the Output for a Function Table

A **function** is a relation that assigns exactly one output value to one input value. The number of wing beats (output) depends on the number of seconds (input). The **function rule** describes the relationship between each input and output. You can organize the input-output values and the function rule in a **function table**.

In a function, the input value is also known as the **independent variable**, since it can be any number you choose. The value of the output depends upon the input value, so the output value is known as the **dependent variable**.

STOP and Reflect

What values were used for the independent variable in Example 1? Answer below.

Examples

Tutor

1. **The output is 7 more than the input. Complete a function table for this relation.**

The function rule is $x + 7$. Add 7 to each input.

Input (x)	$x + 7$	Output
10		
12		
14		

→

Input (x)	$x + 7$	Output
10	$10 + 7$	17
12	$12 + 7$	19
14	$14 + 7$	21

2. **The output is 5 times the input. Complete a function table for this relation.**

The function rule is $5x$. Multiply each input by 5.

Input (x)	$5x$	Output
8		
10		
12		

→

Input (x)	$5x$	Output
8	$5 \cdot$	
10	$5 \cdot$	
12	$5 \cdot$	

Got It? Do these problems to find out.

a.

Input (x)	$x - 4$	Output
4		
7		
10		

b.

Input (x)	$3x$	Output
0		
2		
5		

Find the Input for a Function Table

The input and output of a function table can be represented as a set of ordered pairs, or a *relation*. The input represents the *x*-values and the output represents the *y*-values.

Example

Tutor

3. **Find the input for the function table.**

Input (x)	$3x$	Output
		6
		15
		21

Use the *work backward* strategy to determine the input. If the output is found by multiplying by 3, then the input is found by dividing by 3.

The input values are 6 ÷ 3 or 2, 15 ÷ 3 or 5, and 21 ÷ 3 or 7.

Got It? Do these problems to find out.

c.

Input (x)	$2x - 1$	Output
		1
		3
		5

d.

Input (x)	$3x + 2$	Output
		17
		20
		29

Real World

Example

Tutor

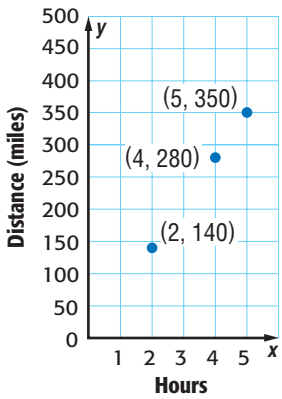
4. **The Gomez family is traveling at a rate of 70 miles per hour. The function rule that represents this situation is $70x$, where x is the number of hours. Make a table to find how many hours they have driven at 140 miles, 280 miles, and 350 miles. Then graph the function.**

Input (x)	$70x$	Output (y)
2	70(2)	140
4	70(4)	280
5	70(5)	350

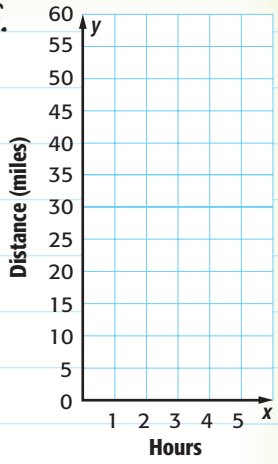
Use the *work backward* strategy. Divide each output by 70.

The missing input values are 140 ÷ 70 or 2, 280 ÷ 70 or 4, and 350 ÷ 70 or 5.

The input and output values are the ordered pairs (x, y). Plot each ordered pair on the graph.



f.



Got It? Do this problem to find out.

e. Briana bikes 12 miles per hour. The function rule that represents this situation is $12x$, where is x is the number of hours. Make a table to find how many hours she has biked when she has gone 12, 36, and 48 miles. Then graph the function.

Input (x)	$12x$	Output (y)

Guided Practice

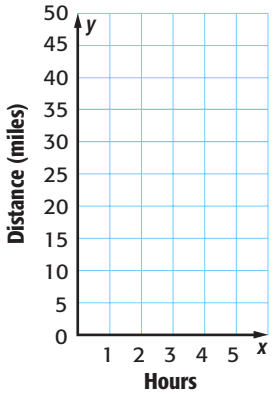
Check

1. Isaiah is buying jelly beans. In bulk, they cost \$3 per pound, and a candy dish costs \$2. The function rule, $3x + 2$ where x is the number of pounds, can be used to find the total cost of x pounds of jelly beans and 1 dish. Make a table that shows the total cost of buying 2, 3, or 4 pounds of jelly beans and 1 dish. (Examples 1 and 2)

Pounds (x)	$3x + 2$	Cost (\$) (y)

2. Jasper hikes 4 miles per hour. The function rule that represents this situation is $4x$, where x is the number of hours. Make a table to find how many hours he has hiked when he has gone 8, 12, and 20 miles. Then graph the function. (Examples 3 and 4)

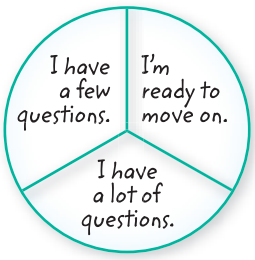
Hours (x)	$4x$	Miles (y)



3. **Building on the Essential Question** How can a function table help you find input or output?

Rate Yourself!

Are you ready to move on? Shade the section that applies.



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Tutor

FOLDABLES Time to update your Foldable!

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Use Math Tools **Complete each function table.** (Examples 1–3)

1

Input (x)	$3x + 5$	Output
0		
3		
9		

2.

Input (x)	$x - 4$	Output
4		
8		
11		

3.

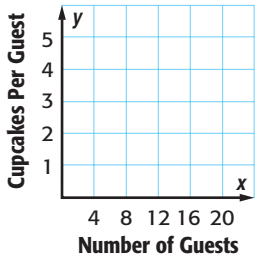
Input (x)	$x + 2$	Output
		2
		3
		8

4.

Input (x)	$2x + 4$	Output
		18
		22
		34

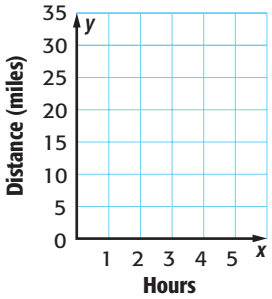
5 Whitney has a total of 30 cupcakes for her guests. The function rule, $30 \div x$ where x is the number of guests, can be used to find the number of cupcakes per guest. Make a table of values that shows the number of cupcakes each guest will get if there are 6, 10, or 15 guests. Then graph the function. (Examples 1 and 2)

Number of Guests (x)	$30 \div x$	Cupcakes per Guest (y)



6. Bella rollerblades 8 miles in one hour. The function rule that represents this situation is $8x$, where x is the number of hours. Make a table to find how many hours she has skated when she has traveled 16, 24, and 32 miles. Then graph the function. (Examples 3 and 4)

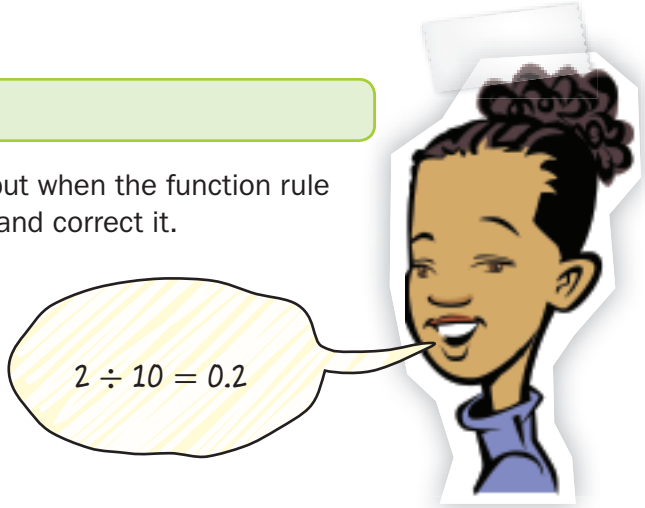
Hours (x)	$8x$	Miles (y)



7. Refer to Exercise 6. How many miles would Bella travel if she skated for 7 hours? _____

H.O.T. Problems Higher Order Thinking

8. **Find the Error** Daniella is finding the output when the function rule is $10 \div x$ and the input is 2. Find her mistake and correct it.



9. **Persevere with Problems** Around 223 million Americans keep containers filled with coins in their home. Suppose each of the 223 million people started putting their coins back into circulation at a rate of $10 per year. Create a function table that shows the amount of money that would be recirculated in 1, 2, and 3 years.

10. **Reason Inductively** Explain how to find the input given a function rule and output.

Georgia Test Practice

11. Misu is making 28 muffins for his sister's class. Using the table as a guide, how many eggs will Misu need to make 28 muffins?

Eggs Needed for Muffins	
Number of Muffins	Number of Eggs
7	1
14	2

Ⓐ 3
Ⓑ 4
Ⓒ 5
Ⓓ 6

Name _____ My Homework _____

Extra Practice

Use Math Tools **Complete each function table.**

12.

Homework Help

Input (x)	$x + 3$	Output
0	0 + 3	3
2	2 + 3	5
4	4 + 3	7

13.

Input (x)	$4x + 2$	Output
1		
3		
6		

14.

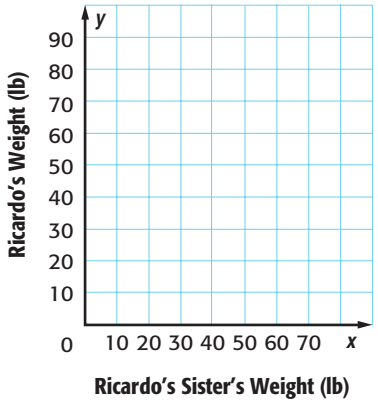
Input (x)	$x - 1$	Output
		0
		2
		4

15.

Input (x)	$2x - 6$	Output
		0
		6
		12

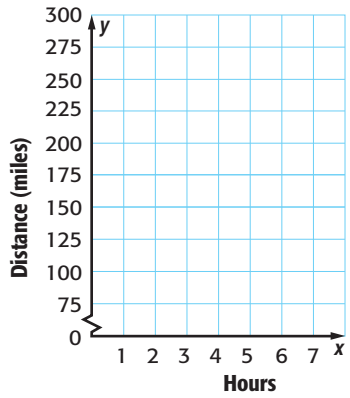
16. Ricardo weighs 2 pounds more than twice his sister's weight. The function rule, $2x + 2$ where x is his sister's weight, can be used to find Ricardo's weight. Make a table of values that show Ricardo's weight when his sister is 20, 30, and 40 pounds. Then graph the function.

Ricardo's Sister's Weight (x)	$2x + 2$	Ricardo's Weight (y)



17. The Quinn family drove at a rate of 55 miles per hour. The function rule that represents this situation is $55x$, where x is the number of hours. Make a table to find how many hours they have traveled when they have driven 165, 220, and 275 miles. Then graph the function.

Hours (x)	$55x$	Miles (y)



Georgia Test Practice

18. Which of the following sets of values completes the function table?

Input (x)	$3x - 5$	Output (y)
5	3(5) – 5	■
6	3(6) – 5	■
7	3(7) – 5	■

Ⓐ 15, 16, 17
Ⓑ 10, 13, 16
Ⓒ 10, 11, 12
Ⓓ 0, 1, 2

19. Manuel has a total of 42 photos to place in an album. The function rule, $42 \div x$, where x is the number of pages in the album, can be used to find the number of photos per page. How many photos per page will there be if the album has 14 pages?

Ⓕ 3
Ⓖ 6
Ⓗ 14
Ⓘ 588

20. Short Response In football, a touchdown is worth 6 points. Complete the table that shows the point value after scoring 1, 2, and 3 touchdowns.

Number of Touchdowns (x)	$6x$	Points (y)
1		
2		
3		

Common Core Review

Find the next number in the pattern using the given rule. MCC5.OA.3

21. Add 3: 2, 5, 8, 11, . . . _____

22. Subtract 2: 10, 8, 6, 4, . . . _____

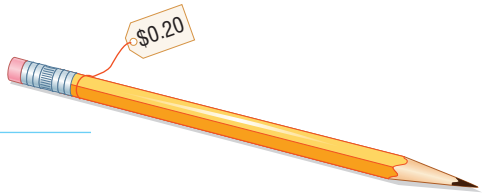
23. Multiply by 2: 2, 4, 8, 16 . . . _____

24. Subtract 7: 84, 77, 70, 63, . . . _____

25. Multiply by 2: 3, 6, 12, 24, . . . _____

26. Add 15: 12, 27, 42, 57, . . . _____

27. Ms. Chen is buying pencils for her class. What is the cost if she buys 24 pencils? MCC5.NBT.7 _____



28. Gino and Abby both start a saving account in May. Gino saves $2 each month and Abby saves $4 each month. What do you notice about the amount in each account each month? MCC5.OA.3

_____

Month	Gino's Account ($)	Abby's Account ($)
May	2	4
June	4	8
July	6	12

Function Rules

What You'll Learn

Scan the lesson. Predict two things you will learn about function rules.

- _____
- _____

Essential Question

HOW are symbols, such as <, >, and =, useful?

Vocabulary

sequence
term
arithmetic sequence
geometric sequence

Common Core GPS

Content Standards
MCC6.EE.2, MCC6.EE.2c, MCC6.EE.6, MCC6.EE.9

Mathematical Practices
1, 3, 4, 7

Vocabulary Start-Up

A **sequence** is a list of numbers in a specific order. Each number in the list is called a **term** of the sequence.

Arithmetic sequences can be found by adding the same number to the previous term. In a **geometric sequence**, each term is found by multiplying the previous term by the same number.

Compare arithmetic sequences and geometric sequences.

arithmetic sequence	geometric sequence
Definition: _____	Definition: _____
Example:	Example:

Nacivet/Getty Images

Real-World Link

Delivery The China Palace sells lunch specials for $6 with a delivery charge of $5 per order. Fill in the table with the next three numbers in the sequence.

Specials	1	2	3	4	5	6	7
Cost ($)	11	17	23	29			

Work Zone

Arithmetic and Geometric Sequences

Determining if a sequence is arithmetic or geometric can help you find the pattern. When you know the pattern, you can continue the sequence to find missing terms.

Examples

Tutor

1. **Describe the relationship between the terms in the arithmetic sequence 7, 14, 21, 28, ... Then write the next three terms.**

$$7, \underset{+7}{\frown} 14, \underset{+7}{\frown} 21, \underset{+7}{\frown} 28, \ldots$$

Each term is found by adding 7 to the previous term. Continue the pattern to find the next three terms.

$28 + 7 = 35$ $35 + 7 = 42$ $42 + 7 = 49$

The next three terms are 35, 42, and 49.

2. **Describe the relationship between the terms in the geometric sequence 2, 4, 8, 16, ... Then write the next three terms.**

$$2, \underset{\times 2}{\frown} 4, \underset{\times 2}{\frown} 8, \underset{\times 2}{\frown} 16, \ldots$$

Each term is found by multiplying the previous term by two. Continue the pattern to find the next three terms.

$16 \times 2 = 32$ $32 \times 2 = 64$ $64 \times 2 = 128$

The next three terms are 32, 64, and 128.

Got It? **Do these problems to find out.**

a. 0, 15, 30, 45, ...

b. 4.5, 4, 3.5, 3, ...

c. 1, 3, 9, 27, ...

d. 3, 6, 12, 24, ...

Show your work.

a. _____

b. _____

c. _____

d. _____

Find a Rule

A sequence can also be shown in a table. The table gives both the position of each term in the list and the value of the term.

List

8, 16, 24, 32, ...

Table

Position	1	2	3	4
Value of Term	8	16	24	32

You can write an algebraic expression to describe a sequence. The value of each term can be described as a function of its position in the sequence.

In the table above, the position can be considered the input, and the value of the term as the output.

Example

Tutor

3. **Use words and symbols to describe the value of each term as a function of its position. Then find the value of the tenth term.**

Position	1	2	3	4	n
Value of Term	3	6	9	12	■

Notice that the value of each term is 3 times its position number. So, the value of the term in position n is $3n$.

Position	Multiply by 3	Value of Term
1	$1 \times \mathbf{3}$	3
2	$2 \times \mathbf{3}$	6
3	$3 \times \mathbf{3}$	9
4	$4 \times \mathbf{3}$	12
n	$n \times \mathbf{3}$	$\mathbf{3}n$

Now find the value of the tenth term.

$3n = 3 \cdot 10$ Replace n with 10.

$= 30$ Multiply.

The value of the tenth term in the sequence is 30.

Work Backward

You can check your rule by working backward. Divide each term by 3 to check the position.

Got It? **Do these problems to find out.**

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the eighth term.

e.

Position	2	3	4	5	n
Value of Term	12	18	24	30	■

f.

Position	3	4	5	6	n
Value of Term	7	8	9	10	■

Show your work.

e. _____

f. _____

Example

4. **The table shows the number of necklaces Ari can make, based on the number of hours she works. Write a function rule to find the number of necklaces she can make in x hours.**

Hours (x)	Number of Necklaces
1	5
2	7
3	9
x	■

To find the rule, determine the function.

Notice that the values 5, 7, 9, … increase by 2, so the rule includes $2x$. If the rule were simply $2x$, then the number of necklaces in 1 hour would be 2. But this value is 5, which is three more than $2x$.

To test the rule $2x + 3$, use the *guess, check, and revise* strategy.

Row 1: $2x + 3 = 2(1) + 3 = 2 + 3$ or 5

Row 3: $2x + 3 = 2(3) + 3 = 6 + 3$ or 9

The rule $2x + 3$ represents the function table.

STOP and Reflect

Find the rule for the following sequence: 5, 9, 13, 17. . . .

Guided Practice

1. Describe the relationship between the terms in the sequence 13, 26, 52, 104, … Then write the next three terms in the sequence. (Examples 1 and 2)

_____

2. Use words and symbols to describe the value of each term as a function of its position. Then find the value of the fifteenth term in the sequence. (Example 3)

Position	1	2	3	4	n
Value of Term	2	4	6	8	■

_____

_____

3. The table at the right shows the fee for overdue books at a library, based on the number of weeks the book is overdue. Write a function rule to find the fee for a book that is x weeks overdue. (Example 4) _____

Weeks Overdue (x)	Fee ($)
1	3
2	5
3	7
4	9
x	■

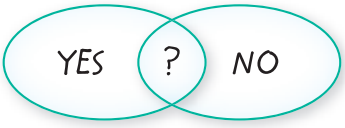
4. **Building on the Essential Question** What is the difference between an arithmetic sequence and a geometric sequence? _____

_____

_____

Rate Yourself!

Are you ready to move on? Shade the section that applies.



For more help, go online to access a Personal Tutor.

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the twelfth term in the sequence. (Examples 1–3)

1

Position	3	4	5	6	n
Value of Term	12	13	14	15	■

_____

_____

2.

Position	2	3	4	5	n
Value of Term	24	36	48	60	■

_____

_____

3. Describe the relationship between the terms in the sequence 6, 18, 54, 162, … . Then write the next three terms in the sequence. (Example 2)

_____

_____

4. The table shows the amount it costs to rock climb at an indoor rock climbing facility, based on the number of hours. What is the rule to find the amount charged to rock climb for x hours? (Example 4)

_____

_____

Time (x)	Amount ($)
1	13
2	21
3	29
4	37
x	■

CCSS **Identify Structure** **Determine how the next term in each sequence can be found. Then find the next two terms in the sequence.**

5. 4, 16, 28, 40, …

Show your work.

_____

6. 1.5, 3.9, 6.3, 8.7, …

_____

7. $2\frac{1}{4}, 2\frac{3}{4}, 3\frac{1}{4}, 3\frac{3}{4}, \ldots$

_____

Find the missing number in each sequence.

8. 30, _____, 19, $13\frac{1}{2}$, …

9. 43.8, 36.7, _____, 22.5, …

State whether each sequence is arithmetic or geometric. Then find the next two terms in the sequence.

10. 1, 6, 36, 216

11. 0.75, 1.75, 2.75, 3.75

12. 0, 13, 26, 39

13 Jay is stacking cereal boxes to create a store display. The number of boxes in each row are shown in the table. Is the pattern an example of an arithmetic sequence or a geometric sequence? Explain. How many boxes will be in row 5?

Row	Number of Boxes
1	4
2	6
3	8
4	10
5	■

H.O.T. Problems Higher Order Thinking

14. **Reason Inductively** Create a sequence in which $1\frac{1}{4}$ is added to each number.

15. **Persevere with Problems** Use words and symbols to generalize the relationship of each term as a function of its position. Then determine the value of the term when $n = 100$.

Position	1	2	3	4	5	n
Value of Term	1	4	9	16	25	■

Georgia Test Practice

16. What is the rule to find the value of the missing term in the sequence below?

Ⓐ $4x - 3$

Ⓑ $2x + 1$

Ⓒ $x + 4$

Ⓓ $3x$

Position, x	Value of Term
1	1
2	5
3	9
4	13
5	17
x	■

Name _____ My Homework _____

Extra Practice

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the twelfth term in the sequence.

17.

Position	6	7	8	9	*n*
Value of Term	2	3	4	5	■

Homework Help

subtract 4 from the position number; $n - 4$; 8

Look at position 6 and the value of the term. 2 is 4 less than 6, so try subtracting 4 from the other position numbers listed. The function rule is $n - 4$. $12 - 4 = 8$

18.

Position	1	2	3	4	*n*
Value of Term	5	10	15	20	■

19. Describe the relationship between the terms in the sequence 4, 12, 36, 108, … Then write the next three terms in the sequence.

20. The table shows the cost of a pizza based on the number of toppings. Write a function rule to find the cost for a pizza with *x* toppings.

Number of Toppings (*x*)	Cost ($)
1	12
2	14
3	16
4	18

CCSPS **Identify Structure** **Determine how the next term in each sequence can be found. Then find the next two terms in the sequence.**

21. 1, 4, 7, 10, …

22. 2.3, 3.2, 4.1, 5.0, …

23. $1\frac{1}{2}$, 3, $4\frac{1}{2}$, 6, …

Find the missing number in each sequence.

24. 7, _____, 16, $20\frac{1}{2}$, …

25. 14.6, _____, 24, 28.7, …

Georgia Test Practice

26. In the fall, the number of cricket chirps in 5 seconds depends on the air temperature. The table below shows this relation. If the pattern continues, how many cricket chirps can be expected if the temperature is 65°F?

Cricket Chirps	
Temperature (°F)	**Cricket Chirps in 5 Seconds**
Less than 40	0
41–43	1
44–46	2
47–49	3
50–52	4

Ⓐ 8 Ⓒ 10

Ⓑ 9 Ⓓ 11

27. Which of the following statements is true about the sequence below?

8, 28, 48, 68…

Ⓕ This is a geometric sequence. Each term is found by multiplying the previous term by 3.

Ⓖ This is a geometric sequence. Each term is found by multiplying the previous term by 20.

Ⓗ This is an arithmetic sequence. Each term is found by adding 20 to the previous term.

Ⓘ This is an arithmetic sequence. Each term is found by adding 8 to the previous term.

28. Short Response The function table shows a relationship between the input x and the output. Write a function rule to represent the relation.

Input (x)	Output
0	1
1	5
2	9

_____

Common Core Review

Multiply. MCC5.NBT.5

29. 62 × 3 = _____

30. 12 × 7 = _____

31. 16 × 8 = _____

32. 11 × 23 = _____

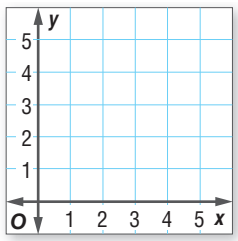
33. 9 × 18 = _____

34. 5 × 22 = _____

35. The table shows the cost to rent from Ray's Rentals. How much would it cost to rent a video game for 3 weeks? MCC5.NBT.7 _____

Rental	Cost per Week ($)
Movie	3.50
Video Game	4.50
Game System	20

36. Plot and label points $K(3, 4)$, $A(1, 3)$, and $J(4, 2)$ on the graph. MCC5.G.2



Functions and Equations

What You'll Learn

Scan the lesson. List two headings you would use to make an outline of the lesson.

- _____
- _____

Essential Question

HOW are symbols, such as <, >, and =, useful?

Vocabulary

linear function

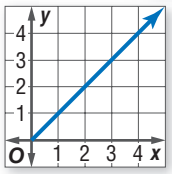
Common Core GPS

Content Standards
MCC6.EE.9

Mathematical Practices
1, 3, 4, 8

Vocabulary Start-Up

A **linear function** is a function whose graph is a line.

Linear	Everyday Definition of Function
What do you notice about the graph? 	Math Definition of Function

linear function

Real-World Link

Babysitting The table shows the amount of money Carli earns based on the number of hours she babysits.

1. Write a sentence that describes the relationship between the number of hours she babysits and her earnings.

2. Does she earn the same amount each hour?

   Explain. _____

Hours Babysitting	Earnings ($)
1	6
2	12
3	18
4	24

Work Zone

STOP and Reflect

In the equation $d = 36t$, where d is the distance traveled and t is the time, which variable is independent and which is dependent? Explain below.

Write an Equation to Represent a Function

You can use an equation to represent a function. The input, or independent variable, represents the x-value, and the output, or dependent variable, represents the y-value. An equation expresses the dependent variable in terms of the independent variable.

Example

Tutor

1. **Write an equation to represent the function shown in the table.**

Input, x	1	2	3	4	5
Output, y	9	18	27	36	45

Input, x	Multiply by 9	Output, y	
1	1×9	9	
2	2×9	18	+9
3	3×9	27	+9
4	4×9	36	+9
5	5×9	45	+9

The value of y is equal to 9 times the value of x. So, the equation that represents the function is $y = 9x$.

Got It? Do this problem to find out.

Show your work.

a. Write an equation to represent the function shown in the table.

Input, x	1	2	3	4	5
Output, y	16	32	48	64	80

a. _____

Graph Linear Functions

You can also graph a function. If the graph is a line, the function is then called a *linear equation*. When graphing the function, the input is the x-coordinate and the output is the y-coordinate.

(*input*, *output*) → (x, y)

Example

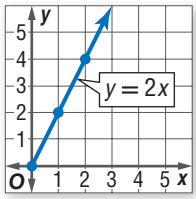
Tutor

2. **Graph $y = 2x$.**

Step 1 Make a table of ordered pairs. Select any three values for x. Substitute these values for x to find y.

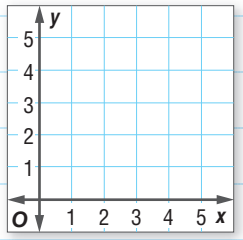
x	$2x$	y	(x, y)
0	2(0)	0	(0, 0)
1	2(1)	2	(1, 2)
2	2(2)	4	(2, 4)

Step 2 Graph each ordered pair. Draw a line through each point.

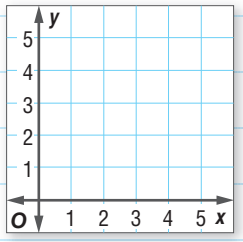


Show your work.

b.



c.



Got It? **Do these problems to find out.**

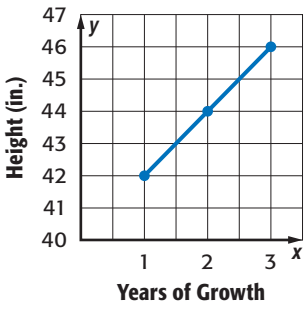
b. $y = x + 1$ **c.** $y = 3x + 2$

Examples

Tutor

Martino constructed the graph shown, which shows the height of his cactus after several years of growth.

Cactus Height



3. **Make a function table for the input-output values.**

The three input values are 1, 2, and 3. The corresponding output values are 42, 44, and 46.

Input (x)	Output (y)
1	42
2	44
3	46

4. **Write an equation from the graph that could be used to find the height y of the cactus after x years.**

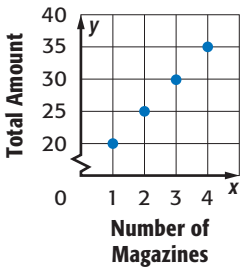
Since the output values increase by 2, the equation includes $2x$. Each output value is 40 more than twice the input. So, the equation is $y = 2x + 40$.

Show your work.

Magazines (x)	Total (y)

Got It? Do this problem to find out.

d. The graph shows the total amount y that you spend if you buy one book and x magazines. Make a function table for the input-output values. Write an equation from the graph that could be used to find the total amount y if you buy one book and x magazines.



d. _____

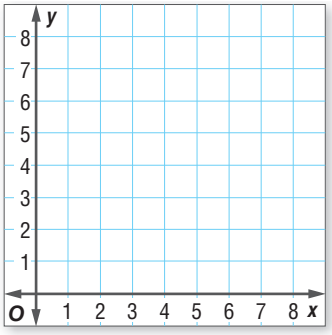
Guided Practice

Check

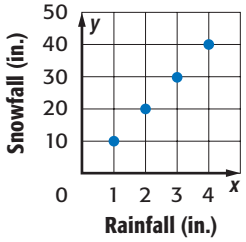
1. Write an equation to represent the function shown in the table. (Example 1)

Input (x)	0	1	2	3	4
Output (y)	0	4	8	12	16

2. Graph the function $y = x + 3$. (Example 2)



3. The graph below shows the number of inches of rainfall x equivalent to inches of snow y. Make a function table for the input-output values. Write an equation from the graph that can be used to find the total inches of snow y equivalent to inches of rain x. (Examples 3 and 4)



Rain (x)	Snow (y)

4. **Building on the Essential Question** How are ordered pairs of a function used to create the graph of the function?

Rate Yourself!

How confident are you about finding the equation of a function? Check the box that applies.

For more help, go online to access a Personal Tutor.

Tutor

FOLDABLES Time to update your Foldable!

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Write an equation to represent each function. (Example 1)

1.

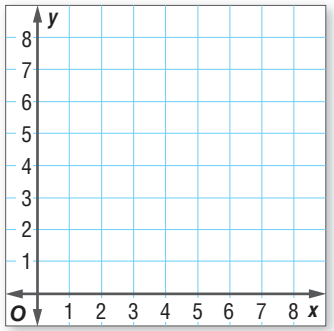
Input (x)	1	2	3	4	5
Output (y)	6	12	18	24	30

2.

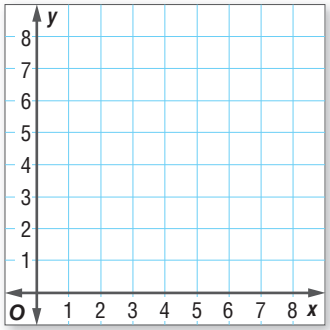
Input (x)	0	1	2	3	4
Output (y)	0	15	30	45	60

Graph each equation. (Example 2)

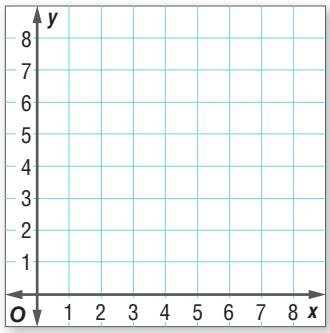
3 $y = x + 4$



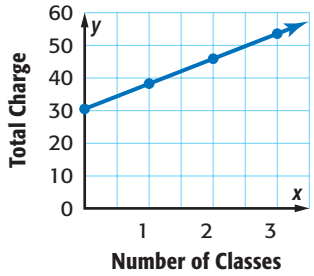
4. $y = 2x + 0.5$



5. $y = 0.5x + 1$

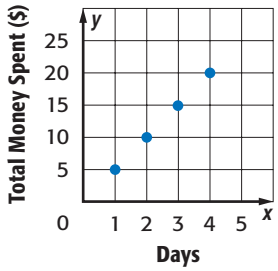


6. The graph shows the charges for a health club in a month. Make a function table for the input-output values. Write an equation that can be used to find the total charge y for the number of x classes. (Examples 3 and 4)



Input (x)				
Output (y)				

7 The graph shows the amount of money Pasha spent on lunch. Make a function table for the input-output values. Write an equation that can be used to find the money spent y for any number of days x. (Examples 3 and 4)



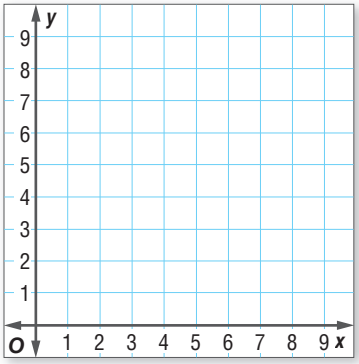
Input (x)				
Output (y)				

8. **Multiple Representations** The table shows the area of a square with the given side length.

Side Length (x)	Area of Square (y)
1	1
2	4
3	9
4	16

a. Variables Write an equation that could represent the function table.

b. Graphs Graph the function.



c. Words Is this a linear function? Explain.

H.O.T. Problems Higher Order Thinking

9. **Model with Mathematics** Write about a real-world situation that can be represented by the equation $y = 7x$. Be sure to explain what the variables represent in the situation.

10. **Persevere with Problems** Write an equation to represent the function in the table.

Input (x)	6	8	10	12	14	16
Output (y)	0	1	2	3	4	5

Georgia Test Practice

11. Which equation represents the function?

Input (x)	1	2	3	4
Output (y)	4	5	6	7

Ⓐ $y = 2x + 1$
Ⓑ $y = x + 3$
Ⓒ $y = 3x - 1$
Ⓓ $y = 3x$

Name _____ My Homework _____

Extra Practice

Identify Repeated Reasoning **Write an equation to represent each function.**

12.

Input (x)	0	1	2	3	4
Output (y)	0	11	22	33	44

Homework Help

$y = 11x$

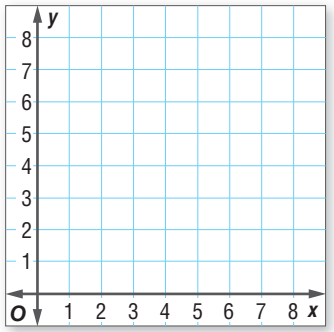
Each output y is 11 times each input x.

13.

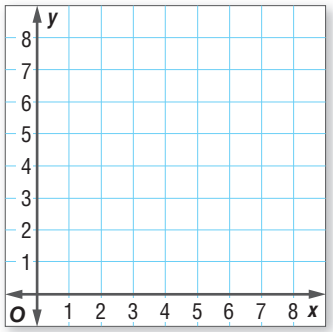
Input (x)	1	2	3	4	5
Output (y)	10	20	30	40	50

Graph each equation.

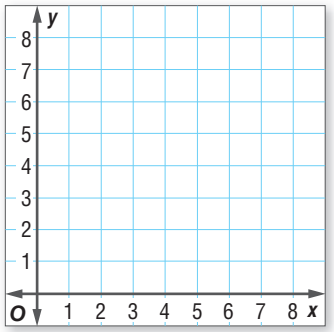
14. $y = 4x$



15. $y = 0.5x$

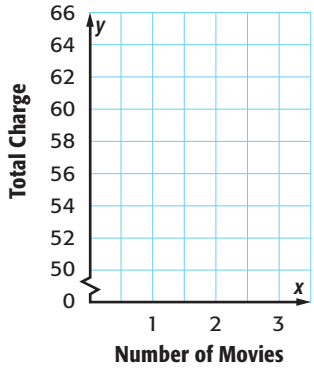


16. $y = x + 0.5$

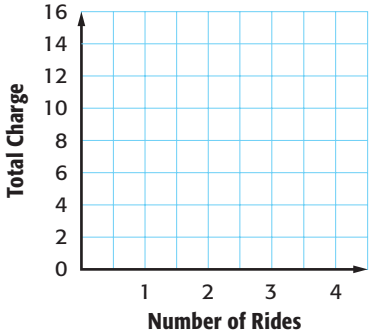


17. A company charges \$50 per month for satellite television service plus an additional \$5 for each movie ordered. The equation $y = 50 + 5x$ describes the total amount y a customer will pay if they order x movies. Graph the function.

Show your work.



18. A fair charges an admission fee of \$8. Each ride is an additional \$2. The equation $t = 8 + 2r$ describes the total charge t for the number of rides r. Graph the function.



Georgia Test Practice

19. The table shows admission prices at a zoo based on the number of guests.

Number of Guests, x	Total Admission ($), y
1	7
2	14
3	21
4	28

Which equation can be used to find y, the total admission for x guests?

Ⓐ $x = 7y$ Ⓒ $y = 7x$

Ⓑ $y = 7 + x$ Ⓓ $x = 7 + y$

20. Which equation represents the function displayed in the table?

Input (x)	Output (y)
1	5
2	10
3	15
4	20

Ⓕ $y = 4x + 1$ Ⓗ $y = x + 5$

Ⓖ $y = 5x$ Ⓘ $y = 5x - 1$

21. Short Response Omari wants to rent a video game system that costs $8 to rent for four days. Each game costs $5 per day to rent. Complete the table to show how many dollars Omari will have to spend to rent the video game system and one game for the number of days given.

Number of Days	Total Cost
4	
8	
12	

Common Core Review

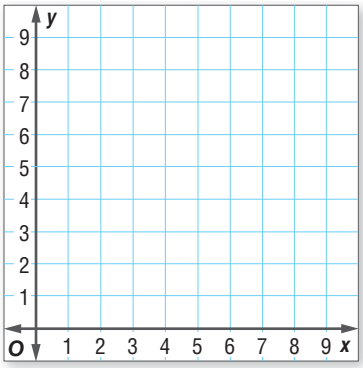
Graph and label each point. MCC5.G.2

22. $A(3, 7)$ **23.** $B(4, 3)$

24. $C(8, 2)$ **25.** $D(6, 5)$

26. $E(3, 1)$ **27.** $F(9, 4)$

28. $G(4, 8)$ **29.** $H(2, 6)$



30. Shana studied 20 minutes on Monday, 45 minutes on Tuesday, 30 minutes on Wednesday, and 45 minutes on Thursday. Organize this information in the table. How long did she study these four days? MCC4.MD.2 _____

Day	Time Studied (min)

31. Pablo bought 3 notebooks for $5.85. How much did each notebook cost? MCC5.NBT.7 _____

Multiple Representations of Functions

What You'll Learn

Scan the lesson. List two headings you would use to make an outline of the lesson.

- _____
- _____

Essential Question

HOW are symbols, such as <, >, and =, useful?

Common Core GPS

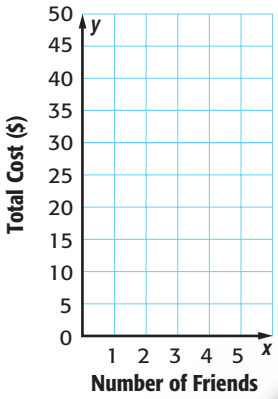
Content Standards
MCC6.EE.9

Mathematical Practices
1, 2, 3, 4

Real-World Link

Museum A group of friends are going to the museum. Each friend must pay an admission price of $9.

Total Cost of Admission	
Number of Friends (n)	Total Cost ($)
1	9
2	
3	
4	



1. Complete the table and graph the ordered pairs (number of friends, total cost).

2. Describe the graph.

_____

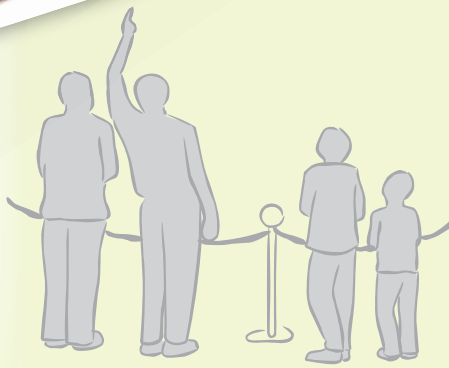
3. Write an equation to find the cost of n tickets.

_____

_____

4. List the ordered pair for the cost when 5 friends go to the museum. Describe the location.

_____



Key Concept

Represent Functions Using Words and Equations

Work Zone

Words	A runner's distance in a marathon is equal to 8 miles per hour times the number of hours.
Equation	$d = 8t$

Words and equations can be used to describe functions. For example, when a rate is expressed in words, it can be written as an equation with variables. When you write an equation, determine what variables to use to represent different quantities.

Examples

Tutor

1. **The drama club is holding a bake sale. They are charging $5 for each pie they sell. Write an equation to find the total amount earned *t* for selling *p* pies.**

Words	Total earned equals $5 times the number of pies sold.
Variable	Let t represent the total earned and p represent the number of pies sold.
Equation	$t = 5 \cdot p$

So, the equation is $t = 5p$.

2. **In a science report, Mia finds that the average adult breathes 14 times each minute when not active. Write an equation to find the total breaths *b* a non-active person takes in *m* minutes.**

Let b represent the total breaths and m represent the number of minutes.

The number of total breaths equals 14 times the number of minutes.

So, the equation is $b = 14m$.

Show your work.

Got It? **Do these problems to find out.**

a. _____

b. _____

a. A mouse can travel 8 miles per hour. Write an equation to find the total distance d a mouse can travel in h hours.

b. Samantha can make 36 cookies each hour. Write an equation to find the total number of cookies c that she can make in h hours.

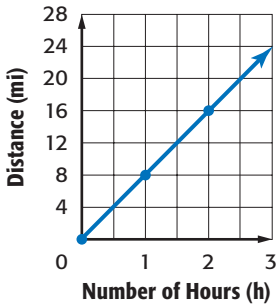
Represent Functions Using Tables and Graphs

Key Concept

Table

Time (h)	Distance (mi)
0	0
1	8
2	16

Graph



STOP and Reflect

What are the independent and dependent variables in Example 3? Explain below.

Tables and graphs can also be used to represent functions.

Examples

Tutor

The Student Council is holding a car wash to raise money. They are charging $7 for each car they wash.

3. **Write an equation and make a function table to show the relationship between the number of cars washed *c* and the total amount earned *t*.**

Cars Washed, *c*	7*c*	Total Earned ($), *t*
1	1 × 7	7
2	2 × 7	14
3	3 × 7	21
4	4 × 7	28

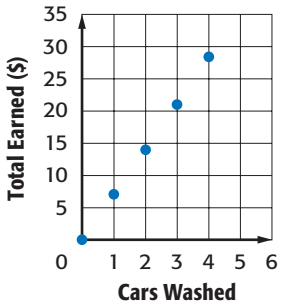
Using the assigned variables, the total earned t equals $7 times the number of cars washed c. So, the equation is $t = 7c$.

The total earned (output) is equal to $7 times the number of cars washed (input).

Write $7c$ in the middle column of the table.

4. **Graph the ordered pairs. Analyze the graph.**

Find the ordered pairs (c, t). The ordered pairs are (1, 7), (2, 14), (3, 21), and (4, 28). Now graph the ordered pairs.



The graph is linear because the amount earned increases by $7 for each car washed.

Show your work.

c. _____

d. _____

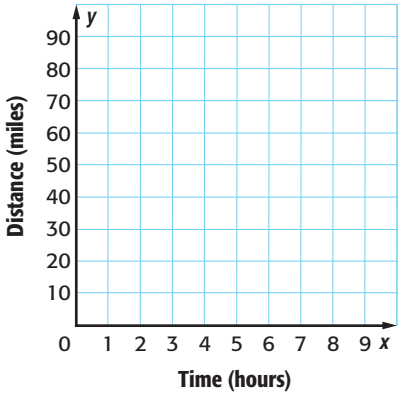
Got It? Do these problems to find out.

While in normal flight, a bald eagle flies at an average speed of 30 miles per hour.

c. Write an equation and make a function table to show the relationship between the total distance d that a bald eagle can travel in h hours.

d. Graph the ordered pairs of the function. Analyze the graph.

Number of Hours, h			
Distance (miles), d			



Guided Practice

Check

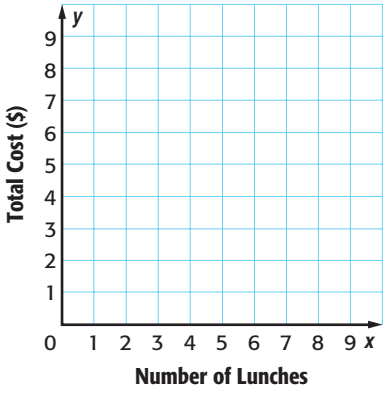
1. The school cafeteria sells lunch passes that allow a student to purchase any number of lunches in advance for $3 per lunch. (Examples 1–4)

a. Write an equation to find t, the total cost in dollars for a lunch pass with n lunches. _____

b. Make a function table to show the relationship between the number of lunches n and the cost t.

c. Graph the ordered pairs. Analyze the graph.

Number of Lunches, n			
Total Cost ($), t			



2. **Building on the Essential Question** Why do you represent functions in different ways?

Rate Yourself!

How well do you understand the different ways to represent functions? Circle the image that applies.

For more help, go online to access a Personal Tutor.

Tutor

FOLDABLES Time to update your Foldable!

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

1 An African elephant eats 400 pounds of vegetation each day. (Examples 1–4)

a. Write an equation to find v, the number of pounds of vegetation an African elephant eats in d days. _____

b. Make a table to show the relationship between the number of pounds v an African elephant eats in days d.

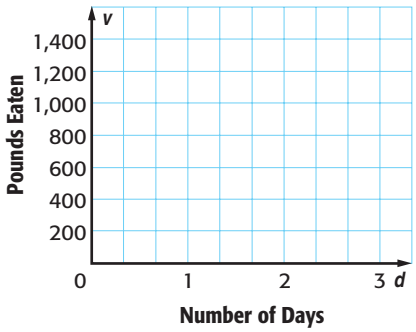
Number of Days, d			
Pounds Eaten, v			

c. Graph the ordered pairs. Analyze the graph.

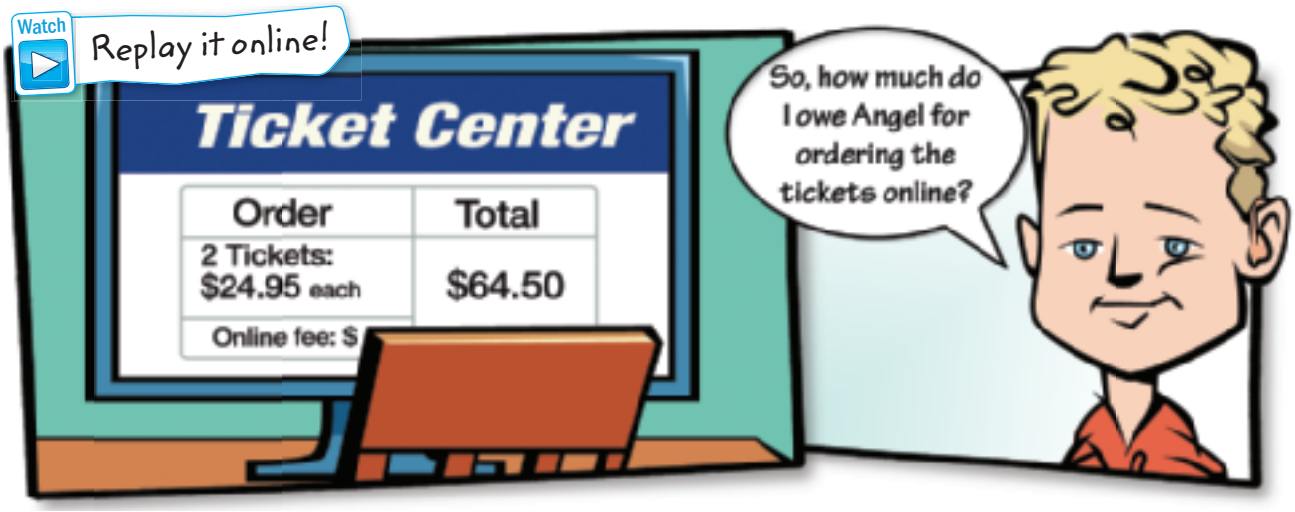
_____

_____

_____



2. CCSS **Model with Mathematics** Refer to the graphic novel frame below for Exercises a–c.



a. Let f represent the cost of ordering each ticket online. Write an equation that could be used to find the cost of ordering each ticket online.

_____

b. Solve the equation from part a. _____

c. Another friend wants to go to the concert. What is the total cost of ordering three tickets online?

_____

3 Maurice receives $3 per week for allowance and earns an additional $1.75 for each chore he completes.

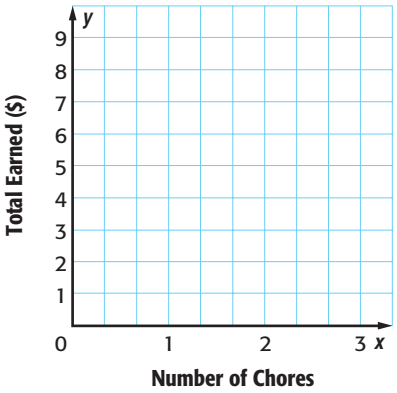
a. Write an equation to find t, the total amount earned for c chores in one week. _____

_____

b. Make a function table to show the relationship between the number of chores completed c and the total amount earned t in one week.

Number of Chores, c			
Total Earned ($), t			

c. Graph the ordered pairs.



d. How much will Maurice earn if he completes 5 chores in one week? _____

_____

H.O.T. Problems Higher Order Thinking

4. **Reason Abstractly** What would the graph of $y = x$ look like? Name three ordered pairs that lie on the line. _____

_____

5. **Persevere with Problems** Boards 4 U charges $10 per hour to rent a snowboard while Slopes charges $12 per hour. Will the cost to rent snowboards at each place ever be the same for the same number of hours after zero hours? If so, for what number of hours? _____

_____

6. **Model with Mathematics** Write a real-world problem in which you could graph a function. _____

Georgia Test Practice

7. A movie rental club charges a one time fee of $25 to join and $2 for every movie rented. Which equation represents the cost of joining the club and renting any number of movies?

Ⓐ $c = 2 + 25m$ Ⓒ $c = 25 + 2m$

Ⓑ $c = 2m$ Ⓓ $c = 25m$

Name _____ My Homework _____

Extra Practice

8. In a video game, each player earns 5 points for reaching the next level and 15 points for each coin collected.

Homework Help

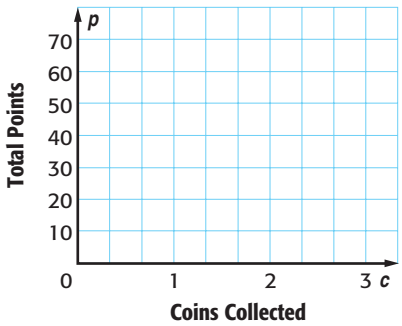
a. Write an equation to find p, the total points for collecting c coins after reaching the next level. $p = 5 + 15c$

Total points p equals 15 times the number of coins c collected plus 5 points for reaching the next level. So, the equation is $p = 5 + 15c$.

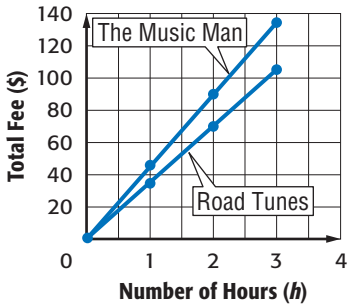
b. Make a table to show the relationship between the number of coins collected c and the total points p.

Number of Coins, c			
Total Points, p			

c. Graph the ordered pairs. Analyze the graph.



9. Two disc jockeys charge different rates. The Music Man charges \$45 per hour and Road Tunes charges \$35 per hour. Write equations to represent the total cost t of hiring either disc jockey for any number of hours n. _____



Copy and Solve **For Exercise 10, show your work on a separate piece of paper.**

10. CCSPS **Construct an Argument** A catering service offers lasagna and chicken parmesan. Each pan of lasagna serves 24 people.

a. Write an equation to represent the number of people n served by any number of pans p of lasagna.

b. Make a function table to show the relationship between the number of pans p and the number of people served n.

c. Graph the ordered pairs.

d. The same catering company offers chicken parmesan that serves 16 people per pan. How many more people would 5 pans of lasagna serve than 5 pans of chicken parmesan? Explain your reasoning to a classmate.

Georgia Test Practice

11. The table shows a relationship between x and y. Which of the following equations is true for each of the ordered pairs in the table?

x	y
0	1
1	3.5
2	6
3	8.5
4	11

Ⓐ $y = 2x + 1$
Ⓑ $y = 3.5x$
Ⓒ $y = 2.5x + 1$
Ⓓ $y = 4x - 0.5$

12. For each table Ariella waits on at a restaurant, she is paid \$4.00 plus 18% of the total bill. If x equals the total bill, which of the following equations could be used to represent the amount of money m Ariella is paid for any total bill?

Ⓕ $m = 0.18x - 4$
Ⓖ $m = 0.18x + 4$
Ⓗ $m = 4 - 0.18x$
Ⓘ $m = 0.18(x + 4)$

13. **Short Response** A science test has multiple choice questions and short answer questions. Each multiple choice question is worth 2 points and each short answer is worth 5 points. Write an equation to represent the total points possible for the test.

Common Core Review

Fill in each ◯ with $<$ or $>$ to make a true statement.
MCC4.NBT.2, MCC5.NBT.3b

14. 116 ◯ 161

15. 63 ◯ 61

16. 105 ◯ 115

17. 50 ◯ 500

18. 12 ◯ 1.2

19. 44 ◯ 49

20. The table shows the ticket sales for three days. On which day(s) were the ticket sales greater than 50? MCC4.NBT.2

Day	Number of Tickets Sold
Wednesday	50
Thursday	56
Friday	41

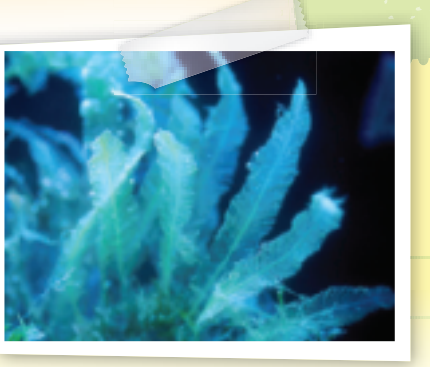
Make a Table

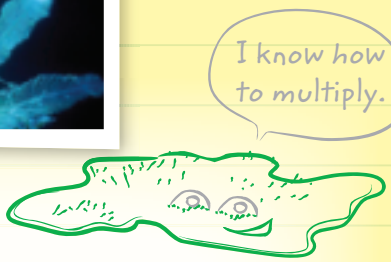
Content Standards
MCC6.EE.9
Mathematical Practices
1, 3, 4

Case #1 Splitting Up

Blue-green algae is a type of bacteria that can double its population by splitting up to four times in one day.

If it grows at this rate, how many bacteria will be formed at the end of one day?





1 Understand *What are the facts?*

- Blue-green algae can double its population up to four times in one day.

2 Plan *What is your strategy to solve this problem?*

Make a table to display and organize the information.

3 Solve *How can you apply the strategy?*

Follow the pattern to find the total number of bacteria after 1 day.

Day Number	Number of Times Split	Total Number of Bacteria	
1	0	1	← ×2
1	1	2	← ×2
1	2		← ×2
1	3		← ×2
1	4		← ×2

4 Check *Does the answer make sense?*

Use the equation $t = 2^n$ where n represents the number of times the bacteria split and t represents the total number of bacteria. $2^4 = 16$

Analyze the Strategy

Tutor

Justify Conclusions If the bacteria continue to grow at this rate, would the number of bacteria be over 1,000 within a week? Explain. _____

_____

Case #2 Game On!

Miguel and Lauren are testing two versions of a new video game. In Miguel's version he receives 25 points at the start of the game, plus 1 point for each level he completes. In Lauren's version she receives 20 points at the start of the game, and 2 points for each level she completes.

At what level will they both have the same number of points?

1 Understand

Read the problem. What are you being asked to find?

I need to find _____.

Underline key words and values in the problem.
What information do you know?

Miguel starts with ☐ points and earns ☐ point for each level.

Lauren starts with ☐ points and earns ☐ points for each level.

2 Plan

Choose a problem-solving strategy.

I will use the _____ strategy.

3 Solve

Use your problem-solving strategy to solve the problem.

	Start	Level 1	Level 2	Level 3	Level 4	Level 5
Miguel						
Lauren						

So, Miguel and Lauren will have the same score after completing Level ☐.

4 Check

Place the level number answer in each box and evaluate to check your answer.

Miguel: $25 + (1 \times \square) =$ _____

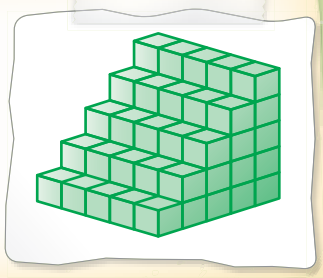
Lauren: $20 + (2 \times \square) =$ _____

Collaborate Work with a small group to solve the following cases. Show your work on a separate piece of paper.

Case #3 Geometry

Determine how many cubes are used in each step.

Make a table to find the number of cubes in the seventh step.



Case #4 Car Rental

Anne Marie needs to rent a car for 9 days to take on vacation. The cost of renting a car is $66 per day.

Make a table to find the total cost of her rental car.

Case #5 Patterns

Make a table to find the number of toothpicks needed to create Figure 8 in the pattern below.

Figure 1 Figure 2 Figure 3

Circle a strategy below to solve the problem.

- *Act it out.*
- *Solve a simpler problem.*
- *Guess, check, and revise.*
- *Look for a pattern.*

Case #6 Money

The admission for a fair is $6 for adults, $4 for children, and $3 for senior citizens. Twelve people paid a total of $50 for admission.

If 8 children attended, how many adults and senior citizens attended?

Mid-Chapter Check

Vocabulary Check

1. Define *sequence*. Give an example of an arithmetic and a geometric sequence. (Lesson 2)

2. Fill in the blank in the sentence below with the correct term. (Lesson 1)

A _____ is a relation that assigns exactly one output value to one input value.

Skills Check and Problem Solving

Complete each function table. (Lesson 1)

3.

Input (x)	$2x + 6$	Output
0		
1		
2		

4.

Input (x)	$3x + 1$	Output
0		
1		
2		

CCGPS **Identify Structure** **Find the rule for each function table.** (Lesson 2)

5.

Input (x)	Output
3	6
4	8
5	10

6.

Input (x)	Output
1	3
2	7
3	11

7.

Input (x)	Output
2	8
3	11
4	14

8. Arnold reads an average of 21 pages each day. Write an equation to represent the number of pages read after any number of days. (Lesson 4)

9. **Georgia Test Practice** The table shows the cost of renting an inner tube to use at the Wave-a-Rama Water Park. Suppose an equation of the form $y = ax$ is written for the data in the table. What is the value of a? (Lesson 3)

Input (x)	Cost (y)
1	$5.50
2	$11.00
3	$16.50

Ⓐ 5 Ⓒ 6

Ⓑ 5.5 Ⓓ 6.5

Inquiry Lab
Inequalities

Inquiry **HOW can bar diagrams help you to compare quantities?**

Content Standards
MCC6.EE.5, MCC6.EE.8

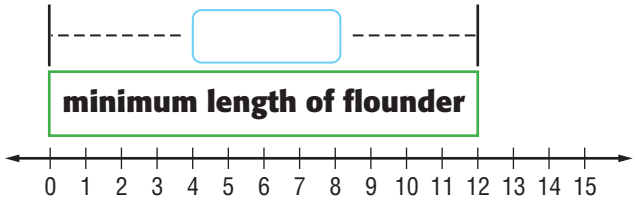
Mathematical Practices
1, 3, 4

Fishing In saltwater fishing, any flounder that is caught may be kept if it is greater than or equal to 12 inches long. Any flounder shorter than that must be released back into the water. Pat caught a flounder that is 14 inches long. He wants to know if he can keep the fish.

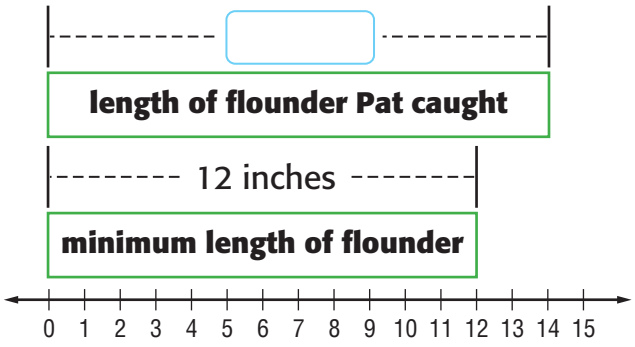
Investigation

An *inequality* is a mathematical sentence that compares quantities. An inequality like $x < 7$ or $x > 5$ can be written to express how a variable compares to a number.

Step 1 Label the minimum length of flounders that may be kept.



Step 2 Label the length of the flounder Pat caught on the top bar diagram.



The bar representing Pat's fish is _____ than the bar representing the minimum length that can be kept.

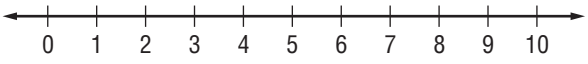
So, Pat _____ keep the fish.

Collaborate

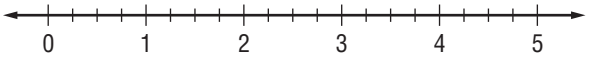
Model with Mathematics **Work with a partner. Draw bar diagrams to solve each problem.**

1. In order to win a prize, Ephram needs to read at least 9 books. Ephram read 8 books. Will he win a prize? _____

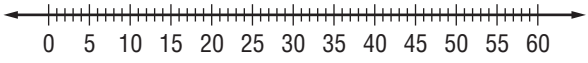
Show your work.



2. Eliza needs $4\frac{3}{4}$ cups of flour. The canister has 4 cups of flour. Will Eliza have enough flour? _____

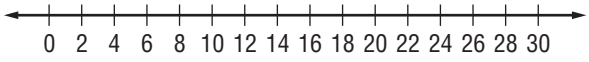


3. For flights within the United States, luggage must be no more than 50 pounds. Imelda's luggage weighs 53 pounds. Can she take the luggage on her flight? _____



4. Byron needs at least 20 minutes between the end of his soccer practice and the start of his dentist appointment. His practice ends at 4:30 and his appointment is at 5:00.

Does he have enough time? _____



5. Refer to Exercise 1. If b represents the number of books Ephram read, write an inequality that compares the number of books he read to the minimum number of books he needs to read. _____

6. Refer to Exercise 3. If w represents the weight in pounds of Imelda's luggage, write an inequality that compares the weight of her luggage to the maximum weight of luggage allowed. _____

Reflect

7. **Reason Inductively** Write a rule for determining possible values of a variable in an inequality. _____

8. Inquiry HOW can bar diagrams help you to compare quantities?

Lesson 5

Inequalities

What You'll Learn

Scan the lesson. Predict two things you will learn about inequalities.

- _____
- _____

Essential Question

HOW are symbols, such as <, >, and =, useful?

Vocabulary

inequality

Common Core GPS

Content Standards
MCC6.EE.5, MCC6.EE.8

Mathematical Practices
1, 2, 3, 4, 6, 7

Vocabulary Start-Up

An **inequality** is a mathematical sentence that compares quantities.

Definition	Symbols
inequality	
Example	Nonexample

Real-World Link

Compare the following using < or >.

1. the score after 2 goals is ◯ the score after 3 goals
2. the cost to download 10 songs is ◯ the cost to download 2 songs
3. the outside temperature in summer is ◯ the outside temperature in winter
4. the height of a 1st grade student is ◯ the height of a 6th grade student
5. the time to eat lunch is ◯ the time to brush your teeth

Key Concept

Inequalities

Symbols	$<$	$>$	$\leq$	$\geq$
Words	• is less than • is fewer than	• is greater than • is more than	• is less than or equal to • is at most	• is greater than or equal to • is at least
Examples	$3 < 5$	$8 > 4$	$7 \leq 10$	$12 \geq 9$

Work Zone

Inequalities can be solved by finding values of the variables that make the inequality true.

Example

Tutor

1. **Of the numbers 6, 7, or 8, which is a solution of the inequality $f + 2 < 9$?**

Replace f with each of the numbers.

$f + 2 < 9$ Write the inequality.

$6 + 2 \stackrel{?}{<} 9$ Replace f with 6.

$8 < 9$ ✓ This is a true statement.

$f + 2 < 9$ Write the inequality.

$7 + 2 \stackrel{?}{<} 9$ Replace f with 7.

$9 < 9$ ✗ This is not a true statement.

$f + 2 < 9$ Write the inequality.

$8 + 2 \stackrel{?}{<} 9$ Replace f with 8.

$10 < 9$ ✗ This is not a true statement.

Since the number 6 is the only value that makes a true statement, 6 is a solution of the inequality.

Show your work.

Got It? **Do this problem to find out.**

a. Of the numbers 8, 9, or 10, which is a solution of the inequality $n - 3 > 6$?

a. _____

Determine Solutions of an Inequality

Since an inequality uses greater than and less than symbols, one-variable inequalities have infinitely many solutions. For example, any rational number greater than 4 will make the inequality $x > 4$ true.

Examples

Tutor

Is the given value a solution of the inequality?

2. $x + 3 > 9, x = 4$

$x + 3 > 9$ Write the inequality.

$4 + 3 \stackrel{?}{>} 9$ Replace x with 4.

$7 \not> 9$ Simplify.

Since 7 is not greater than 9, 4 is not a solution.

3. $12 \leq 18 - y, y = 6$

$12 \leq 18 - y$ Write the inequality.

$12 \stackrel{?}{\leq} 18 - 6$ Replace y with 6.

$12 \leq 12$ Simplify.

Since $12 = 12$, 12 is a solution.

4. $17 \geq 11 + x, x = 8$

$17 \geq 11 + x$ Write the inequality.

$17 \stackrel{?}{\geq} 11 +$ ☐ Replace x with ☐.

$17 \not\geq$ ☐ Simplify.

Since ☐ is not greater than or equal to ☐, ☐ is not a solution.

Got It? Do these problems to find out.

b. $a + 7 > 15, a = 9$

c. $22 \leq 15 + b, b = 6$

d. $n - 4 < 6, n = 10$

e. $12 \geq 5 + g, g = 7$

STOP and Reflect

Name two solutions of the inequality $12 > 6 + y$.

Show your work.

b. _____

c. _____

d. _____

e. _____

Example

Tutor

5. **Luisa works at a gift shop. She receives a bonus if she makes more than 20 balloon bouquets in a month. Which months did Luisa receive a bonus? Use the inequality $b > 20$, where b represents the number of balloon bouquets made each month, to solve.**

Balloon Sales	
Month	**Number Sold**
July	25
August	12
September	18
October	32

Use the *guess, check, and revise* strategy.

Try 25.
$b > 20$
$25 > 20$ Yes

Try 12.
$b > 20$
$12 > 20$ No

Try 18.
$b > 20$
$18 > 20$ No

Try 32.
$b > 20$
$32 > 20$ Yes

So, Luisa received a bonus in July and October.

Guided Practice

Check

Determine which number is a solution of the inequality. (Example 1)

1. $9 + a < 17$; 7, 8, 9 _____

Show your work.

2. $b - 10 > 5$; 14, 15, 16 _____

Is the given value a solution of the inequality? (Examples 2–4)

3. $x - 5 < 5, x = 15$

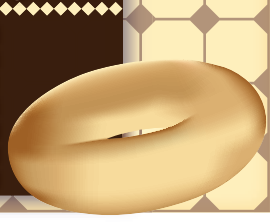
_____

4. $32 \geq 8n, n = 3$

_____

5. If the bakery sells more than 45 bagels in a day, they make a profit. Use the inequality $b > 45$ to determine which days the bakery makes a profit. (Example 5)

Day	Number of Bagels Sold
Monday	18
Tuesday	25
Wednesday	21
Thursday	36
Friday	50
Saturday	48
Sunday	40



_____

6. **Building on the Essential Question** How can mental math help you find solutions to inequalities?

_____

Rate Yourself!

☐ I understand how to solve inequalities.

Great! You're ready to move on!

☐ I still have some questions about solving inequalities.

No Problem! Go online to access a Personal Tutor. Tutor

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Determine which number is a solution of the inequality. (Example 1)

1. $1 + f < 7$; 5, 6, 7 _____

Show your work.

2. $g - 3 > 4$; 6, 7, 8 _____

Is the given value a solution of the inequality? (Examples 2–4)

3. $q - 2 > 16, q = 20$ _____

4. $t - 7 < 10, t = 28$ _____

5. The table shows the number of different types of roller coasters in the United States. An amusement park wants to build a new roller coaster. They will only build a roller coaster if there are less than 10 of that type in the United States. Use the inequality $r < 10$, where r is the number of a certain type of roller coaster, to determine which type(s) can be built. (Example 5)

Type	Number
Sit down (steel)	460
Sit down (wood)	111
Inverted	42
Flying	9
Stand up	7
Suspended	5

6. The table shows the number of different types of movies in Lavar's collection. He wants to buy a new movie to add to his collection. He only wants to buy a movie if he already has more than 15 movies of that type. Use the inequality $m > 15$, where m is the number of the type of movie, to determine which type(s) he can buy. (Example 5)

Movie Type	Number
Action	18
Comedy	24
Drama	12
Thriller	15

7. The number of text messages Lelah sent each month is shown in the table. She can send no more than 55 messages each month without being charged. Use the inequality $t \leq 55$, where t is the number of text messages in a month, to determine in which months she exceeded her limit. If each additional text costs $0.25, how much was Lelah charged from January to April?

Month	Text Messages
Jan.	56
Feb.	57
Mar.	55
Apr.	51

8. **Identify Structure** Use one-variable equations and inequalities to fill in the graphic organizer.

	Equation	Inequality
Example		
Number of Solutions		

H.O.T. Problems Higher Order Thinking

9. **Reason Inductively** State three numbers that are solutions to the inequality $x + 1 \leq 5$.

10. **Persevere with Problems** If $x = 2$, is the following inequality *true* or *false*? Explain.

$$\frac{112}{8} + x \geq 15 + 4x - 7$$

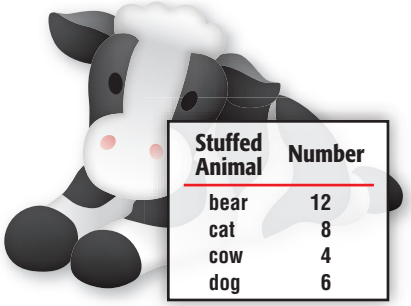
11. **Reason Abstractly** If $a > b$ and $b > c$, what is true about the relationship between a and c? Explain your reasoning.

12. **Construct an Argument** Explain why inequalities of the form $x > c$ or $x < c$, where c is any rational number, have infinitely many solutions.

Georgia Test Practice

13. The table shows the number of stuffed animals Lucita has. She is donating the stuffed animals if she has 8 or more of a type. Use the inequality $s \geq 8$ to determine which type of animals she is donating. Select the answer choice that shows what Lucita is donating.

Ⓐ bear
Ⓑ cat and dog
Ⓒ cow and dog
Ⓓ bear and cat



Stuffed Animal	Number
bear	12
cat	8
cow	4
dog	6

Name _____ My Homework _____

Extra Practice

Determine which number is a solution of the inequality.

14. $5 - h \geq 2$; 3, 4, 5 3

Homework Help

Try 3. $5 - 3 \stackrel{?}{\geq} 2$ $2 \geq 2$ ✓

Try 4. $5 - 4 \stackrel{?}{\geq} 2$ $1 \geq 2$ ✗

Try 5. $5 - 5 \stackrel{?}{\geq} 2$ $0 \geq 2$ ✗

15. $j + 8 \leq 8$; 0, 1, 2 _____

Is the given value a solution of the inequality?

16. $25 \geq 5u$, $u = 5$ _____

17. $13 \leq 4v$, $v = 3$ _____

18. Mrs. Crane recorded the number of sandwiches sold in her deli on one day. If she sells more than 25 of a type of sandwich, she orders more meat from the butcher. Use the inequality $s > 25$, where s is the number of sandwiches sold, to determine which meats she needs to order. _____

Sandwich	Number Sold
Club	25
Ham	30
Roast beef	22
Turkey	28

19. The height of each member of a family is listed in the table. In order to ride a certain roller coaster at an amusement park, you must be at least 54 inches tall. Use the inequality $h \geq 54$, where h is a family member's height, to determine who can ride the roller coaster.

Name	Height (in.)
Carmen	66
Eliot	54
Isabella	49
Jackson	52
Ryan	71

20. CCSS **Be Precise** Pedro subscribes to a service where he can download up to five free ringtones each month. Each ringtone after that costs $3.50 each. During which months did Pedro exceed the plan? How much is Pedro's additional cost in 6 months? _____

Month	Ringtones
January	5
February	6
March	4
April	8
May	5
June	4

Georgia Test Practice

21. The number of moons for some of the planets are shown below.

Planets	Moons
Earth	1
Mars	2
Neptune	13
Uranus	27
Saturn	47
Jupiter	63

In the inequality $m > 27$, m represents the number of moons for each planet. Which planets have a number of moons that are solutions of the inequality?

Ⓐ Saturn and Jupiter

Ⓑ Uranus and Saturn

Ⓒ Uranus and Jupiter

Ⓓ Saturn and Neptune

22. A movie theater is recording the number of online ticket sales as shown below.

Week	Number of Tickets
1	1,200
2	1,450
3	1,150
4	1,450
5	1,750

In the inequality $n > 1{,}450$, n represents the number of online tickets sold. Which week had a number of sales that is a solution of the inequality?

Ⓕ Week 2

Ⓖ Week 3

Ⓗ Week 4

Ⓘ Week 5

Common Core Review

Write an expression to represent each situation. MCC5.OA.2

23. Alexis had 5 stickers and her sister gave her 3 stickers. _____

24. There were 7 lemons on the lemon tree. Then 2 fell off the tree. _____

25. Gavin had 5 packages of hotdogs that each contained 8 hotdogs. _____

26. The distance 4 friends walked is shown in the table. Graph the numbers on the number line. Who walked the shortest distance?
MCC4.NBT2, MCC5.NBT.3b

Name	Miles Walked
Corrine	2.5
Makenna	1.5
Noah	3
Tristan	2

27. In one week, Carson read 4 books and Henry read 6 books. Fill in the blanks to compare the number of books they read. MCC4.NBT.2

_____ > _____

Lesson 6

Write and Graph Inequalities

What You'll Learn

Scan the lesson. List two headings you would use to make an outline of the lesson.

- _____
- _____

Essential Question

HOW are symbols, such as <, >, and =, useful?

Common Core GPS

Content Standards
MCC6.EE.6, MCC6.EE.8

Mathematical Practices
1, 3, 4, 5, 6

Real-World Link

Fair Look at the situations below. Circle the numbers that are possible answers in each situation.

1. Jessica spent more than $5 at the arcade.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

2. Less than 6 people rang the bell on the mallet game.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

3. There were less than 10 people in line for the Ferris wheel.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

4. It costs more than 6 tokens to ride the bumper cars.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

5. There are less than 8 lemonade stands.

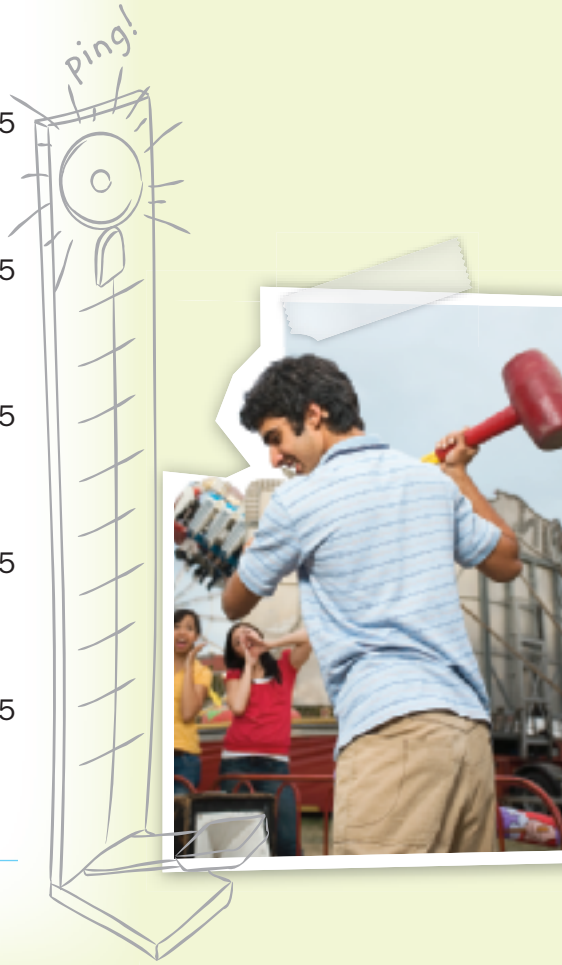
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

6. There are more than 12 different flavors of taffy.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

7. Describe any patterns you see in Exercises 1–6.

_____



Erik Isakson/Getty Images

Work Zone

Write Inequalities

You can write an inequality to represent a situation.

Examples

Tutor

Write an inequality for each sentence.

1. You must be over 12 years old to ride the go-karts.

Words	Your age	is over	12.
Variable		Let a = your age.	
Inequality	a	$>$	12

The inequality is $a > 12$.

2. A pony is less than 14.2 hands tall.

Words	A pony	is less than	14.2.
Variable		Let p = the height of the pony	
Inequality	p	$<$	14.2

The inequality is $p < 14.2$.

3. You must be at least 16 years old to have a driver's license.

Words	Your age	is at least	16 years.
Variable		Let a = your age.	
Inequality	a	$\geq$	16

The inequality is $a \geq 16$.

STOP and Reflect

Which inequality symbol represents "is at most"?

Got It? Do these problems to find out.

Write an inequality for each sentence.

a. You must be older than 13 to play in the basketball league.

b. To use one stamp, your domestic letter must weigh under 3.5 ounces.

c. You must be over 48 inches tall to ride the roller coaster.

d. You must be at least 18 years old to vote.

a. _____

b. _____

c. _____

d. _____

Show your work.

Graph an Inequality

Inequalities can be graphed on a number line. Sometimes, it is impossible to show all the values that make an inequality true. The graph helps you see the values that make the inequality true.

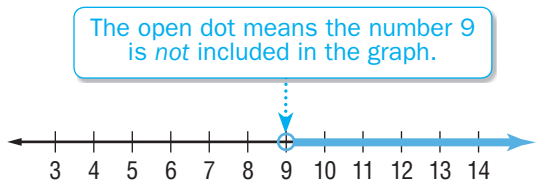
Examples

Tutor

Graph each inequality on a number line.

4. $n > 9$

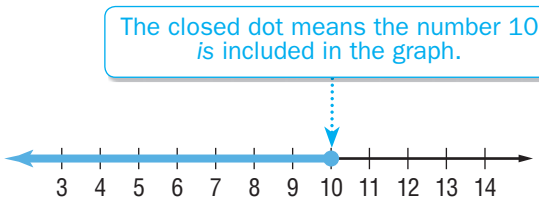
Place an open dot at 9. Then draw a line and an arrow to the right.



The values that lie on the line make the sentence true. All numbers greater than 9 make the sentence true.

5. $n \leq 10$

Place a closed dot at 10. Then draw a line and an arrow to the left.



All numbers 10 and less make the sentence true.

Got It? Do these problems to find out.

e. $a < 15$

f. $b \geq 7$

Graphing Inequalities

When inequalities are graphed, an open dot means the number is not included ($<$ or $>$) and a closed dot means it is included ($\leq$ or $\geq$).

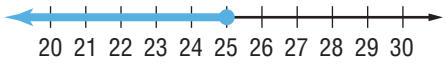
Example

6. **Traffic on a residential street can travel at speeds of no more than 25 miles per hour. Write and graph an inequality to describe the possible speeds on the street.**

Let s represent the speed on the street.

The inequality is $s \leq 25$.

Place a closed dot at 25. Then draw a line and an arrow to the left. All numbers 25 and less make the sentence true.



Guided Practice

Write an inequality for each sentence. (Examples 1–3)

1. The movie will be no more than 90 minutes in length. _____

2. The mountain is at least 985 feet tall. _____

Graph each inequality on a number line. (Examples 4 and 5)

3. $a \leq 6$

4. $b > 4$

5. Tasha can spend no more than $40 on new boots. Write and graph an inequality to describe how much she can spend. (Example 6) _____

6. **Building on the Essential Question** How can graphing an inequality help to solve it? _____

_____

Rate Yourself!

How confident are you about writing and graphing inequalities? Shade the ring on the target.

For more help, go online to access a Personal Tutor.

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Write an inequality for each sentence. (Examples 1–3)

1. Swim practice will be no more than 35 laps. _____
2. Kevin ran for less than 5 miles. _____
3. The occupancy of the room must be less than 437 people. _____

Graph each inequality on a number line. (Examples 4 and 5)

4. $f > 1$

5. $x \leq 5$

6. $y \geq 4$

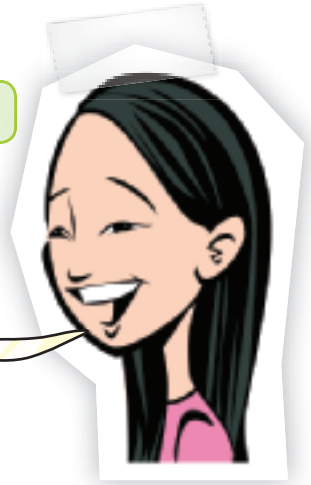
7. A rewritable compact disc must have less than 20 songs on it. Write and graph an inequality to describe how many songs can be on the disc. (Example 6)

_____

8. CCSS **Be Precise** Fill in the information in the table. The first is done for you.

Symbol	Words	Open or closed dot on number line?
>	greater than	open dot
	greater than or equal to	
	less than	
≤		

H.O.T. Problems Higher Order Thinking



9. **Find the Error** Mei is writing an inequality for the expression *at least 10 hours of community service.* Find her mistake and correct it.

10. **Persevere with Problems** Name three solutions of the inequality $w \leq \frac{4}{5}$. Then justify your response using a number line.

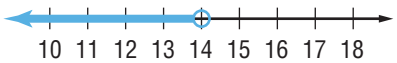
11. **Justify Conclusions** Explain the difference between graphing an inequality with a closed dot and one with an open dot. Use examples to support your reasoning.

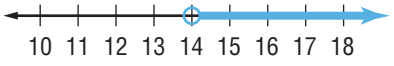
Georgia Test Practice

12. To enter the school dance, you may not be older than 14. Which answer choice represents this inequality?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Name _____ My Homework _____

Extra Practice

Write an inequality for each sentence.

13. You cannot spend more than 50 dollars. $s \leq 50$

Homework Help

Let s represent what you can spend. Cannot spend more means you can spend less than or equal to 50 dollars.

14. More than 800 fans attended the opening soccer game. _____

15. The heavyweight division is greater than 200 pounds. _____

Graph each inequality on a number line.

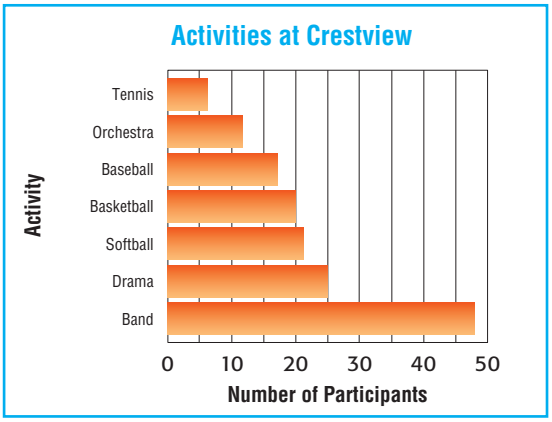
16. $g < 6$

17. $z > 18$

18. $h \geq 3$

19. On a certain day, the temperature in Bismarck, North Dakota, was below 4 °F. Write and graph an inequality to describe the possible temperatures.

20. CCSS **Use Math Tools** The graph shows the number of students who participate in some of the activities offered at Crestview Middle School.



a. Which activities have more than 20 participants? at least 20? fewer than 19?

b. Write an inequality comparing the number of orchestra participants and the number of tennis participants.

Georgia Test Practice

21. **Short Response** The table below shows the number of different kinds of sports equipment sold in the City Sports Store.

Type	Number Sold in Store
Football	8
Basketball	n
Baseball	33
Hockey puck	3
Softball	21

The number of basketballs sold is greater than the total number of softballs sold. Write and graph an inequality to describe the number of basketballs that could have been sold.

22. Which of the following graphs represents the inequality?

$x \geq 5$

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

23. Jason has less than 65 pages of his book left to read. Which inequality represents this situation?

Ⓕ $p > 65$ Ⓗ $p < 65$

Ⓖ $p \geq 65$ Ⓘ $p \leq 65$

Common Core Review

Evaluate each expression. MCC5.OA.1

24. $8(2) - 11 =$ _____

25. $7 + 2(2) =$ _____

26. $3(5) - 7 =$ _____

27. $19 - 2(3) =$ _____

28. $3(4) - 7 =$ _____

29. $28 - 4(4) =$ _____

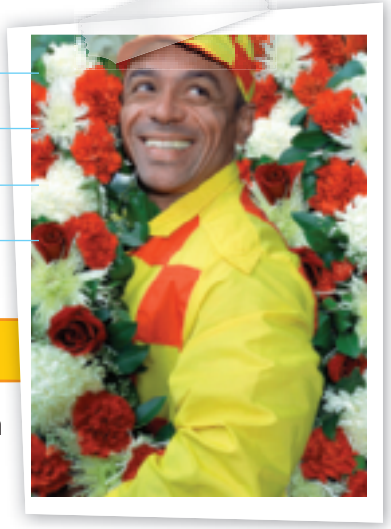
Inquiry Lab
Solve One-Step Inequalities

Inquiry **HOW can you use bar diagrams to solve one-step inequalities?**

Content Standards MCC6.EE.5, MCC6.EE.8

Mathematical Practices 1, 3, 4

Jockeys In a recent Kentucky Derby, the total weight a horse could carry was less than 126 pounds. A jockey weighs a certain number of pounds and his equipment weighs 9 pounds. How much could the jockey weigh?



What do you know? _____

_____

What do you need to find? _____

_____

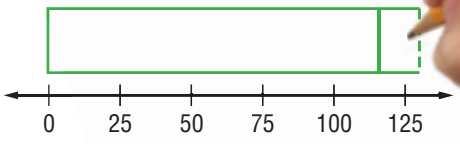
Investigation

You already learned that you can add or subtract the same quantity to each side of an equation when solving it. This is also true for inequalities.

Step 1 Solve the inequality $x + 9 < 126$ using a bar diagram. Place a dashed line on 126.

Step 2 The symbol is $<$, so a box is drawn to the left of 126.

Step 3 The bar represents $x +$ ☐. Label the bar diagram below.

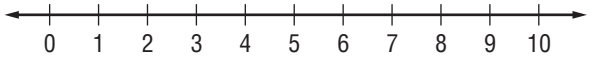


The section of the bar labeled x must be less than ☐ for the inequality to be true. So, $x <$ ☐.

Collaborate

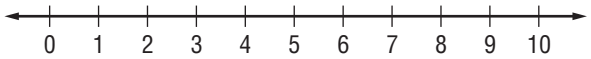
Work with a partner to solve each problem by using a model.

1. Regina sent x text messages before lunch. She sent another 4 text messages after lunch. She sent less than 7 text messages today. How many text messages could she have sent before lunch? Write your answer as an inequality. _____



2. A player with five personal fouls cannot stay in the game. Dylan has already earned two personal fouls. How many more personal fouls x could he earn and still stay in the game? Write your answer as an inequality.

_____



Work with a partner to solve by using the *guess, check, and revise* strategy. Find the least or greatest number that makes the inequality true.

3. $x - 5 \leq 1$ _____

4. $x + 3 \geq 8$ _____

Analyze

5. **Reason Inductively** Explain how you could solve the inequality $x + 7 \leq 12$ using the *guess, check, and revise* strategy. Then solve. _____

_____

Reflect

6. **Model with Mathematics** Write and solve a word problem using the inequality $x + 6 \leq 25$. _____

_____

7. HOW can you use bar diagrams to solve one-step inequalities?

_____

Lesson 7

Solve One-Step Inequalities

What You'll Learn

Scan the lesson. Predict two things you will learn about solving one-step inequalities.

- _____

_____

- _____

_____

Essential Question

HOW are symbols, such as <, >, and =, useful?

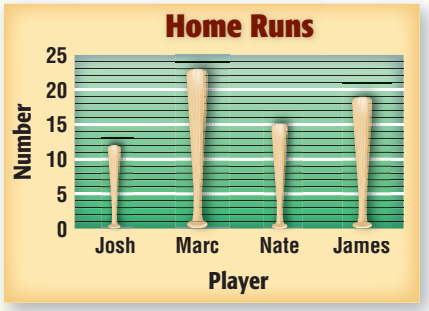
Common Core GPS

Content Standards
MCC6.EE.5, MCC6.EE.6, MCC6.EE.8

Mathematical Practices
1, 3, 4

Real-World Link

Baseball The graph shows the number of home runs that the top hitters on the baseball team hit last season.



1. Write an inequality that compares the number of home runs Nate hit to the number of home runs Josh hit.

_____ > _____

2. Write an inequality that compares the number of home runs James hit to the number of home runs Marc hit.

_____ < _____

3. Suppose James and Marc each hit 3 more home runs. Write a new inequality that compares the number of home runs James and Marc hit.

_____ < _____

Key Concept

Use Addition and Subtraction Properties to Solve Inequalities

Work Zone

Words When you add or subtract the same number from each side of an inequality, the inequality remains true.

Example

$$\begin{array}{rr} 5 < 9 & 11 > 6 \\ +4 \quad +4 & -3 \quad -3 \\ \hline 9 < 13 & 8 > 3 \end{array}$$

These properties are also true for $\leq$ and $\geq$.

Examples

Tutor

1. **Solve $x + 7 \geq 10$. Graph the solution on a number line.**

$x + 7 \geq 10$ Write the inequality.

$-7 \quad -7$ Subtract 7 from each side.

$x \quad \geq 3$ Simplify.

The solution is $x \geq 3$. To graph it, draw a closed dot at 3 and draw an arrow to the right on the number line.

2. **Solve $x - 3 < 9$. Graph the solution on a number line.**

$x - 3 < 9$ Write the inequality.

$+3 \quad +3$ Add 3 to each side.

$x \quad < 12$ Simplify.

The solution is $x < 12$. To graph it, draw an open dot on 12 and draw an arrow to the left on the number line.

Got It? **Do these problems to find out.**

Show your work.

a. $n + 2 \leq 5$

a. _____

b. $y - 3 > 9$

b. _____

Use Multiplication and Division Properties to Solve Inequalities

Key Concept

Words When you multiply or divide each side of an inequality by the same *positive* number, the inequality remains true.

Example

$5 < 10$

$5 \times 2 < 10 \times 2$

$10 < 20$

$16 > 12$

$\frac{16}{2} > \frac{12}{2}$

$8 > 6$

These properties are also true for $\leq$ and $\geq$.

Examples

Tutor

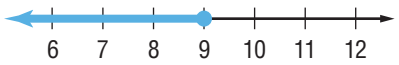
3. **Solve $5x \leq 45$. Graph the solution on a number line.**

$5x \leq 45$ Write the inequality.

$\frac{5x}{5} \leq \frac{45}{5}$ Divide each side by 5.

$x \leq 9$ Simplify.

The solution is $x \leq 9$.



4. **Solve $\frac{x}{8} > 3$. Graph the solution on a number line.**

$\frac{x}{8} > 3$ Write the inequality.

$\frac{x}{8}(8) > 3(8)$ Multiply each side by 8.

$x > 24$ Simplify.

The solution is $x > 24$.

Got It? Do these problems to find out.

c. $10x < 80$

d. $\frac{x}{6} \geq 7$

Checking Solutions

You can check your solutions by substituting numbers into the inequality and testing to verify that it holds true.

Show your work.

c. _____

d. _____

Words to Symbols
Remember, at most translates to ≤, while at least translates to ≥.

Example

Watch Tutor

5. **Laverne is making bags of party favors for each of the 7 friends attending her birthday party. She does not want to spend more than $42 on the party favors. Write and solve an inequality to find the maximum cost for each party favor bag.**

Let c represent the cost for each bag of party favors.

7 times the cost of each bag must be no more than $42.

$7c \leq 42$ Write the inequality.

$\frac{7c}{7} \leq \frac{42}{7}$ Divide each side by 7.

$c \leq 6$ Simplify.

Laverne can spend a maximum of $6 on each party favor bag.

Guided Practice

Check

Solve each inequality. Graph the solution on a number line. (Examples 1–4)

1. $h - 6 \geq 13$ _____

Show your work.

2. $5y > 30$ _____

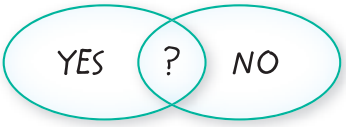
3. Johanna's parents give her $10 per week for lunch money. She cannot decide whether she wants to buy or pack her lunch. If a hot lunch at school costs $2, write and solve an inequality to find the maximum number of times per week Johanna can buy her lunch. (Example 5)

4. Tino's Pizza charges $9 for a cheese pizza. Eileen has $45 to buy pizza for the Spanish Club. Write and solve an inequality to find the maximum number of pizzas that Eileen can buy. (Example 5)

5. **Building on the Essential Question** How is solving an inequality similar to solving an equation?

Rate Yourself!

Are you ready to move on? Shade the section that applies.



For more help, go online to access a Personal Tutor. Tutor

Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Solve each inequality. Graph the solution on a number line. (Examples 1–4)

1. $2 + y \leq 3$ _____

Show your work.

2. $w - 1 < 4$ _____

3 $7x > 56$ _____

4. $\frac{d}{3} \leq 2$ _____

5 A company charges \$0.10 for each letter engraved. Bobby plans to spend no more than \$5.00 on the engraving on a jewelry box. Write and solve an inequality to find the maximum number of letters he can have engraved. (Example 5)

_____

6. CCSS **Model with Mathematics** Refer to the graphic novel frame below for Exercises a–b.

a. Suppose David has \$65 to spend on his ticket and some shirts. He already spent \$32.25 on his ticket and fee. Write an inequality that could be used to find the maximum number of shirts he can buy.

_____

b. What is the maximum number of shirts he can buy?

_____

Solve each inequality. Graph the solution on a number line.

7 $p - \frac{7}{12} > \frac{3}{10}$ _____

8. $f + 0.3 < 1.7$ _____

H.O.T. Problems Higher Order Thinking

9. **Model with Mathematics** Write a word problem that would have the solution $p \leq 21$.

10. **Persevere with Problems** In three math tests, you score 91, 95, and 88 points. How many points must you score on the fourth test to have an A average, or at least 90 points? _____

11. **Construct an Argument** Does the order of the quantities in an inequality matter? Explain.

Georgia Test Practice

12. Which of the following number lines shows the solution to the inequality?

$$7x > 28$$

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Name _____ My Homework _____

Extra Practice

Solve each inequality. Graph the solution on a number line.

13. $a + 4 < 9$ $a < 5$

Homework Help

$a + 4 < 9$
$-4 \quad -4$
$a < 5$

14. $x - 8 \geq 13$ _____

15. $d + 13 \geq 22$ _____

16. $25t \leq 100$ _____

17. $\frac{g}{2} < 6$ _____

18. $\frac{r}{9} > 8$ _____

19. A community needs to raise at least $5,000 to build a new skateboarding park. They are selling backpacks for $25 each to raise the money. Write and solve an inequality to determine the minimum number of backpacks they need to sell in order to reach this goal.

_____

20. A sales associate at a computer store receives a bonus of $100 for every computer he sells. He wants to make $2,500 in bonuses next month. Write and solve an inequality to find the minimum number of computers he must sell. _____

CCSS **Model with Mathematics** **Solve each inequality. Graph the solution on a number line.**

21. $n + \frac{2}{7} \geq \frac{1}{2}$ _____

22. $0.2g > 1.8$ _____

Georgia Test Practice

23. The table shows a gym class's average results for boys and girls participating in the long jump.

Gender	Distance
Male	10 ft 6 in.
Female	8 ft 4 in.

Susan could jump no farther than 4 inches more than the average distance for females. If j represents the distance Susan could jump, which of the following best represents that sentence?

Ⓐ $j \leq 8$ ft 8 in. Ⓒ $j \leq 8$ ft

Ⓑ $j \geq 8$ ft 8 in. Ⓓ $j \geq 8$ ft

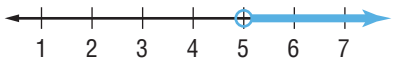
24. Which of the following values of x make the inequality a true statement?

$$x + 8 > 14$$

Ⓕ $x > 6$ Ⓗ $x \leq 22$

Ⓖ $x \geq 6$ Ⓘ $x < 22$

25. Which of the following inequalities represents the number line?



Ⓐ $y + 1 > 6$ Ⓒ $y + 1 \geq 5$

Ⓑ $y + 1 < 6$ Ⓓ $y + 1 \leq 5$

26. Short Response Look at the inequalities shown below. What value, to the hundredths place, could n represent to make both inequalities true statements?

$n > 0.45$ $n < 0.47$

_____

Common Core Review

Multiply. MCC4.NBT.5, MCC5.NBT.7

27. $12 \times 12 =$ _____

28. $9 \times 13 =$ _____

29. $16 \times 12 =$ _____

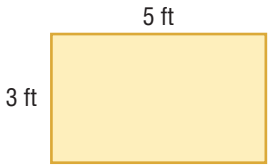
30. $8.5 \times 6 =$ _____

31. $13.2 \times 5 =$ _____

32. $7 \times 11.5 =$ _____

33. Mitchell is painting several boards for scenery for the school play.

What is the area of the board shown? MCC4.MD.3 _____



34. Daphne is painting her room. She knows that three of her bedroom walls are a total of 305 square feet. The fourth wall in her room measures 8 feet wide and 10 feet tall. How much total area will

Daphne need to paint? MCC4.MD.3 _____

21ST CENTURY CAREER in Atmospheric Science

Meteorologist

Have you ever wondered how forecasters can predict severe storms such as hurricanes before they occur? Keeping track of changes in air pressure is one method that they use. Meteorologists study Earth's air pressure, temperature, humidity, and wind velocity. They use complex computer models to process and analyze weather data and to make accurate forecasts. In addition to understanding the processes of Earth's atmosphere, meteorologists must have a solid background in mathematics, computer science, and physics.

College & Career READINESS

Explore college and careers at ccr.mcgraw-hill.com

Is This the Career for You?

Are you interested in a career as a meteorologist? Take some of the following courses in high school.

- Algebra
- Calculus
- Earth and Its Environment
- Environmental Science
- Physics

Turn the page to find out how math relates to a career in Atmospheric Science.

The Pressure is On!

Use the information in the diagram and the table to solve each problem.

1. Write an inequality representing the temperature t of the ocean water during the formation of a hurricane. _____

2. Write an inequality representing the depth d of the water that must be greater than 80°F in order for a hurricane to form. _____

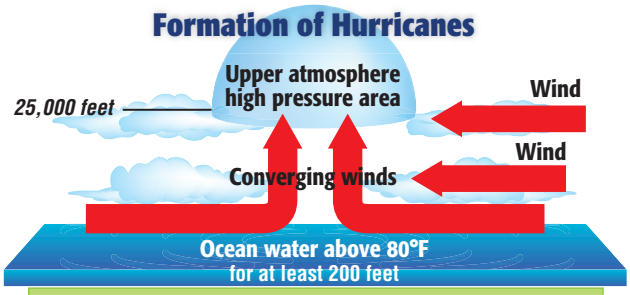
3. The air needs to be humid up to about 18,000 feet for a hurricane to form. Write an inequality to represent this altitude a of the air above the ocean. _____

4. Air pressure decreases during a storm. The difference between the normal air pressure n and the air pressure during the 1935 Florida Keys hurricane was greater than 121 millibars. Write and solve an inequality to find the normal air pressure in the Florida Keys before the hurricane.

   _____

5. The air pressure of Hurricane Katrina at landfall was greater than 17 millibars plus the air pressure p before landfall. Write and solve an inequality to find the air pressure of the storm before landfall.

   _____



Top 5 Most Intense Hurricanes at Landfall in the U.S.

Rank	Hurricane	Pressure (millibars)
1	Florida Keys, (Labor Day), 1935	892
2	Hurricane Camille, 1969	909
3	Hurricane Katrina, 2005	920
4	Hurricane Andrew, 1992	922
5	Texas (Indianola), 1886	925

Career Project

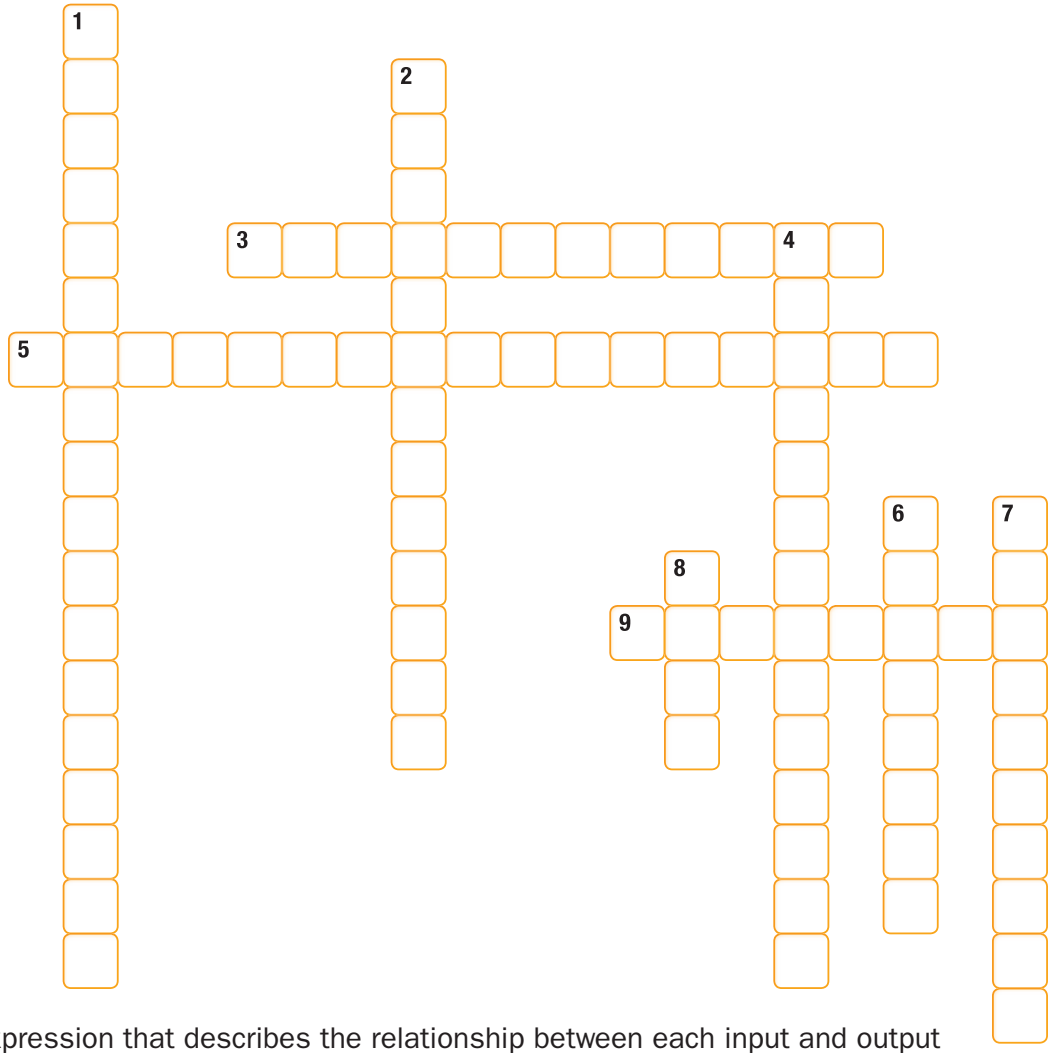
It's time to update your career portfolio! Interview a meteorologist at a local television station. Be sure to ask what he or she likes most about being a meteorologist and what is most challenging. Include all the interview questions and answers in your portfolio.

What skills would you need to improve to succeed in this career?

- _____
- _____
- _____
- _____
- _____

Vocabulary Check

Write the correct term for each clue in the crossword puzzle.



Across

3. an expression that describes the relationship between each input and output

5. found by multiplying the previous term by the same number

9. a list of numbers in a specific order

Down

1. found by adding the same number to the previous term

2. a table organizing the input, rule, and output of a function

4. a function that forms a line when graphed

6. a relationship that assigns exactly one output value to one input value

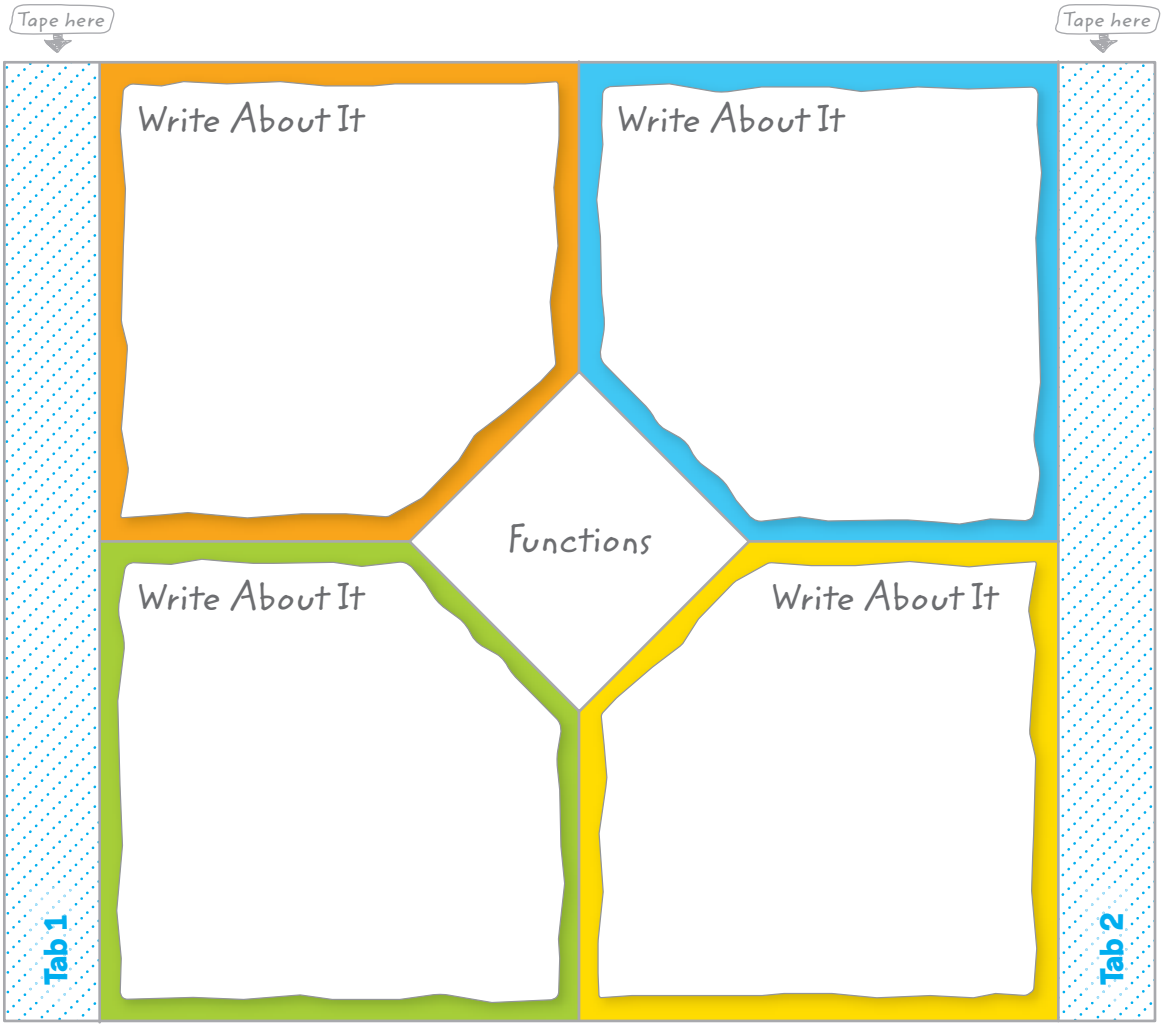
7. a mathematical sentence indicating that two quantities are not equal

8. each number in a sequence

Key Concept Check

Use Your FOLDABLES

Use your Foldable to help review the chapter.



Got it?

Circle the correct term or number to complete each sentence.

1. The next number in the sequence 12, 15, 18, 21, . . . is (24, 27).
2. The output of a function is the (independent, dependent) variable.
3. A(n) (arithmetic, geometric) sequence can be found by multiplying each previous term by the same number.
4. The input of a function is the (independent, dependent) variable.
5. A(n)(inequality, function) is a relation that assigns exactly one output value to one input value.

Problem Solving

1. A bowling alley charges $4 per game. The function rule that represents this situation is $4n$, where n is the number of games. Make a table to find how much it would cost to bowl 1, 2, and 3 games. (Lesson 1)

Games (n)	$4(n)$	Cost (t)

2. Tina drove 60 miles per hour to Tucson. Write a function rule that relates the number of miles traveled to the hours driven. (Lesson 2) _____

_____

3. The Pizza Place is running a special for large pizzas. The cost of different numbers of pizzas is shown in the table. Write an equation to find the total cost t for a number of pizzas p. (Lesson 3) _____

Number of Pizzas, p	1	2	3	4
Total Cost, t ($)	10	20	30	40

_____

4. A baker used 16 ounces of butter for every batch of dough pretzels. Make a function table to show the relationship between the amount of butter b and the total batches of pretzels p. Write an equation to represent the situation. (Lesson 4)

Batches of Pretzels (p)	Butter (b)

_____

_____

5. Valerie earns $25 a day plus $3 for each dog she washes. Make a function table to show the relationship between the number of dogs she washed d and the total amount earned t in one day. Write an equation to represent the situation. (Lesson 4)

Number of Dogs Washed (d)	Total Earned (t)

_____

_____

6. In order for an entire class to fit into a certain theater, there must be less than 34 students in the class. Use the inequality $c < 34$, where c is the class size to determine which classes fit in the theater. (Lesson 5)

Homeroom	Size
101	34
102	30
103	32
104	35

_____

7. **Reason Abstractly** Vincent spends $4 to play a ring toss game at the fair. If he has at most $12, write and solve an inequality to find how many games of ring toss he can play. (Lessons 6 and 7)

_____

Reflect

Answering the Essential Question

Use what you learned about inequalities to complete the graphic organizer.

Essential Question

HOW are symbols, such as <, >, and =, useful?

<	>	=
What does it mean?	What does it mean?	What does it mean?
Mathematical Example	Mathematical Example	Mathematical Example
Real-World Example	Real-World Example	Real-World Example

Answer the Essential Question. HOW are symbols, such as <, >, and =, useful?