3-5 Equations to Inequalities

Digital Resources

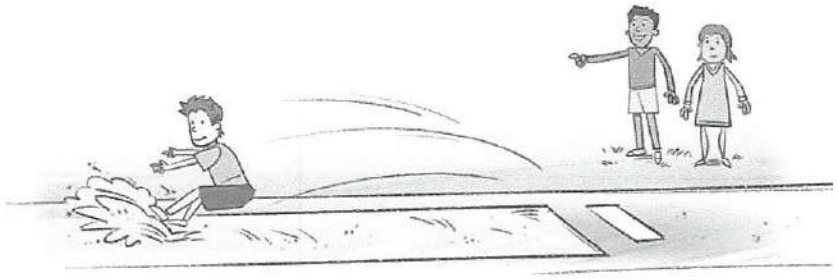
CCSS: 6.EE.B.8: Write an inequality ... to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

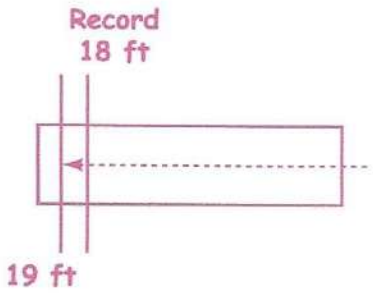
Launch

SAMPLE SOLUTIONS ARE SHOWN BELOW.

MP1, MP4, MP5

The long jump record at the local school is 18 feet. Describe a jump that could break the record in three different ways—using a picture, using words, and using symbols.



Picture	Words	Symbols
	19 feet is greater than 18 feet. So, 19 feet breaks the long jump record.	19 ft > 18 ft

Reflect How many jumps could tie the record? How many jumps could break the record?

Sample: Only 1 jump, an 18-foot jump, could tie the record. Any jump over 18 feet that is humanly possible would break the record.

Got It?

PART 1 Got It mc

Which situation(s) could be modeled by inequalities?

I. You must be 13 or older to buy a certain DVD.
II. You should not drive over the speed limit of 70 mi/h.

I and II

PART 2 Got It mc

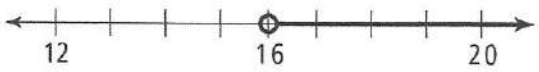
What inequality models the situation?

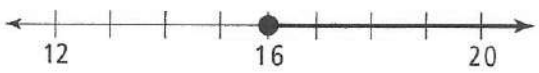
$m \leq 35$

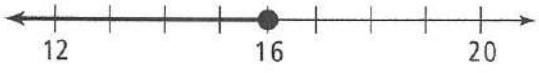
Got It?

PART 3 Got It (1 of 2) mc

Which is the graph of $x \geq 16$?

I. 

II. 

III. 

Graph II

PART 3 Got It (2 of 2)

Are the graphs of $x < 3$ and $x \leq 3$ the same? Explain.

Sample: No, the graph of $x < 3$ has an open circle at 3, and the graph of $x \leq 3$ has a closed circle at 3.

Close and Check

Focus Question

MP2, MP4

How does the concept of inequality help you describe situations?

Sample: Some situations describe multiple events or possibilities. Other situations describe only one event. An inequality describes a situation with many possibilities.

SAMPLE SOLUTIONS ARE SHOWN BELOW.

Do you know HOW?

1. Tell whether each statement can be written as an equality or an inequality. Write **E** for equality and **I** for inequality.

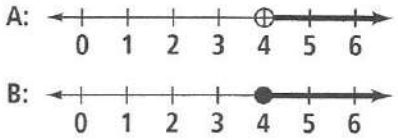
Statement	Equality or Inequality
The temperature will reach at least 72° today.	I
My puppy is six months old today.	E
There are no more than 31 days in any given month.	I
There are less than 28 students in each classroom.	I
There are the same number of boys as there are girls in my family.	E

2. Use the number line to graph the inequality.

$x \leq 6$

Do you UNDERSTAND?

3. Writing Which of the following graphs includes 4 in its solution set? Explain.



Graph B contains the solution 4 because it has a closed circle at 4.

4. Reasoning For safety, riders of an amusement park roller coaster must be at least 4 ft 6 in. tall. Write the inequality to show this. Then describe why an inequality represents this situation better than an equation.

The inequality $h \geq 4.5$ best represents all possible heights of riders. An equation identifies only one possible solution.

Name _____ Class _____ Date _____

Practice 3-5

Equations to Inequalities

1. Which of these situations have exactly one solution?

1. To make some cookies, John needs 4 eggs.
2. Karen went to more than 5 baseball games last year.
3. Last year, a teacher gave one test for each of the 8 chapters in the textbook.
4. Some friends spent more than 3 hours playing their favorite board game.

a) Check all that apply.

- ❑ A. situation 4
- ❑ B. situation 3
- ❑ C. situation 1
- ❑ D. situation 2

b) Check all of the situations that have more than one solution.

- ❑ A. situation 2
- ❑ B. situation 4
- ❑ C. situation 3
- ❑ D. situation 1

2. Which situations can you represent with an equation?

1. Two friends live 7 blocks apart.
2. A girl earned $26 babysitting on Saturday night.
3. Each class must have fewer than 23 students.
4. The homework took 4 hours to complete.

a) Check all of the situations that apply.

- ❑ A. situation 1
- ❑ B. situation 2
- ❑ C. situation 3
- ❑ D. situation 4

b) Check all of the situations that you can represent with an inequality.

- ❑ A. situation 2
- ❑ B. situation 3
- ❑ C. situation 1
- ❑ D. situation 4

3. The restaurant can seat no more than 171 people. If p is the restaurant's capacity, which of the following inequalities models the given situation?

- ○ A. $p \leq 171$
- ○ B. $p > 171$
- ○ C. $p \geq 171$
- ○ D. $p < 171$

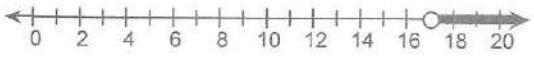
4. Which of these situations can you represent with the inequality $x \geq 45$?

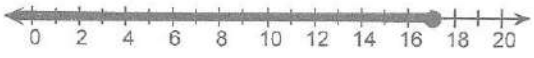
1. You must be at least 45 inches tall to go on this ride.
2. A loaf of bread must be baked for no more than 45 minutes.
3. You have at least 45 minutes left on a parking meter.
4. The bill at a restaurant was no more than $45.

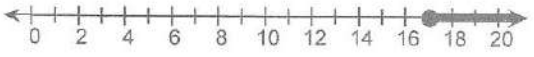
Check all of the situations that you can represent with the inequality $x \geq 45$.

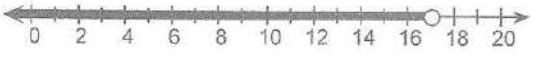
- ❑ A. situation 4
- ❑ B. situation 1
- ❑ C. situation 3
- ❑ D. situation 2

5. Two cities are less than 17 miles apart. Choose the correct graph that models the situation.

○ A. 

○ B. 

○ C. 

○ D. 

6. Which inequality has this graph?

○ A. $x \leq 5$
○ B. $x < 5$
○ C. $x \geq 5$
○ D. $x > 5$
○ E. $x \neq 5$

7. a) **Multiple Representations** For the following situation, decide if there is exactly one or more than one solution. Make one or more drawings to support your answer. A glass holds 9 ounces of juice. A boy overfills the glass and spills some juice. How much juice could he spill?

b) How many solutions are there?

○ A. exactly one
○ B. more than one

8. **Writing** Simon has fewer than 8 photographs in an art show. Decide if you can represent this situation with an equation or inequality. Explain your answer.

9. a) **Open-Ended** Describe a situation that you could represent with the inequality $x > 17$.

b) Is 22 a solution of your situation?

○ A. Yes
○ B. No

10. a) **Reasoning** Graph the inequalities $x > 2$ and $x < 2$.

b) Are the graphs the same?

○ A. No
○ B. Yes

11. Error Analysis Two students were told to find an inequality that has this graph.

Andrew says the inequality is $x > 7$. Lauren says the inequality is $x < 7$. Who is incorrect and why?

- ○ A. Andrew is incorrect. His inequality symbol points the wrong way.
- ○ B. Lauren is incorrect. Her inequality includes 7 as a solution.
- ○ C. Lauren is incorrect. Her inequality includes 7 as a solution, and her inequality symbol points the wrong way.
- ○ D. Lauren is incorrect. Her inequality symbol points the wrong way.
- ○ E. Andrew is incorrect. His inequality includes 7 as a solution, and his inequality symbol point the wrong way.
- ○ F. Andrew is incorrect. His inequality includes 7 as a solution.

12. Vehicle Speed Write an inequality that represents the situation. Use x for the speed of the truck.

The speed of the truck must be no less than 34 miles per hour.

- ○ A. $x > 34$
- ○ B. $x \geq 34$
- ○ C. $x \leq 34$
- ○ D. $x < 34$
- ○ E. $x \neq 34$

13. Graph the inequality that models the situation.

There are at most 33 books in a bookcase.

Choose the correct graph below.

- ○ A. 

- ○ B. 

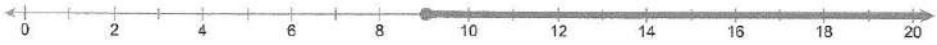
- ○ C. 

- ○ D. 

14. Think About the Process You have to graph the inequality $x < 12$. What is your first step?

The first step is to draw a closed circle/an open circle at 12.

15. Think About the Process You need to find an inequality that has this graph. What inequality symbol should you use?



Choose the correct inequality symbol below.

- ○ A. $>$
- ○ B. $\neq$
- ○ C. $<$
- ○ D. $\geq$

3-6 Solving Inequalities

Digital Resources

CCSS: 6.EE.B.5: ... Use substitution to determine whether a given number in a specified set makes an equation or inequality true. **6.EE.B.8:** ... Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions ... on number line diagrams.

Launch

SAMPLE SOLUTIONS ARE SHOWN BELOW.

MP1, MP6

You have $27 and want to invite the most friends possible to go to a concert. What is the greatest number of people, including you, that can go? Explain.

Only six people can go to the concert.

$6 \cdot \$4 = \$24$. $24 is less than $27.

$7 \cdot \$4 = \$28$. $28 is more than $27.

Reflect Could fewer friends go with you to the concert?

Sample: Yes, fewer friends could go. The total ticket cost would still be less than the $27 you have.

Got It?

PART 1 Got It (1 of 2) mc

Which numbers are solutions of the inequality $3k < 21$?

I. 4 II. 7 III. 12

I only

PART 1 Got It (2 of 2)

The balance in the account is $290. Suppose your aunt writes a check for $59. Could she write a second check for $60 and keep the balance above $150? Explain.

Yes; after my aunt writes a check for $59, the balance in the account is $231. Writing a check for $60 brings the balance to $171, which is above $150.

Discuss with a classmate

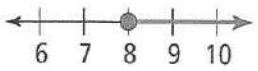
Read each other's explanation for the problem.
Is the explanation clear?
Underline any key vocabulary terms that were used in the explanation.
Discuss each of the words you underlined.
Revise the explanation if your original explanation did not use vocabulary correctly.

Got It?

PART 2 Got It mc

What is the solution of $x + 5 \geq 13$?

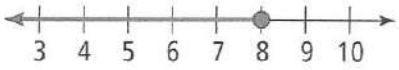
I. $x \geq 8$

II. 

both I and II

PART 3 Got It mc

Decide which statements are *true*.



I. The graph shows the solution of $2x \leq 8$.

II. The graph shows the solution of $24 \geq 3x$.

III. The graph shows the solution of both $x - 3 \leq 5$ and $x + 4 \leq 12$.

II and III

Close and Check

Focus Question

MP3, MP8

How is it possible for two different inequalities to describe the same situation? What does it mean for two inequalities to be equivalent?

Sample: Often the inequality you write to describe a situation can be rewritten as a simpler, equivalent inequality. Both the original inequality and the rewritten, simpler inequality describe the situation.

SAMPLE SOLUTIONS ARE SHOWN BELOW.

Do you know HOW?

1. Circle the inequalities that have 25 as a solution.

$72 + x < 100$ $216 \geq 4x$ $x + 13 < 38$

$45 - x > 131$ $x \div 7 \leq 9$

2. Complete the steps to solve the inequality.

$$h \div 4 > 6$$

$$h \div 4 \cdot \boxed{4} > 6 \cdot \boxed{4}$$

$$h > \boxed{24}$$

3. Graph the inequalities on the number lines.

$2x > 4$

$x + 3 > 5$

Do you UNDERSTAND?

4. Reasoning Are the inequalities in Exercise 3 equivalent? How do you know?

Yes, the inequalities are equivalent because the graphs show that the solutions are the same.

5. Error Analysis The following inequalities are displayed in your class.

$y > 4$ $g < 8$

Your classmate says that the inequalities are equivalent because 5 is a solution of both. Is she correct? Explain your reasoning.

No, she is not correct. Equivalent inequalities need all solutions to be the same, and these inequalities only share some solutions.

Name _____ Class _____ Date _____

Practice 3-6

Solving Inequalities

1. Solve the inequality $p - 5 > 9$. Fill in the answer line to complete your choice.

   ○ A. $p <$ _____ ○ C. $p >$ _____

   ○ B. $p \geq$ _____ ○ D. $p \leq$ _____

2. Solve the inequality $y + 3 < 5$. Fill in the answer line to complete your choice.

   ○ A. $y \leq$ _____ ○ C. $y <$ _____

   ○ B. $y >$ _____ ○ D. $y \geq$ _____

3. Solve the inequality $x \div 3 \leq 4$. Fill in the answer line to complete your choice.

   ○ A. $x >$ _____ ○ C. $x \leq$ _____

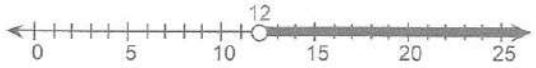
   ○ B. $x <$ _____ ○ D. $x \geq$ _____

4. Solve the inequality $3x > 18$. Fill in the answer line to complete your choice.

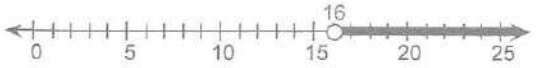
   ○ A. $x <$ _____ ○ C. $x >$ _____

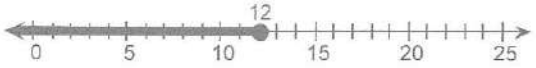
   ○ B. $x \geq$ _____ ○ D. $x \leq$ _____

5. Choose the graph that shows the solutions of the inequality $x - 2 < 14$.

   ○ A. 

   ○ B. 

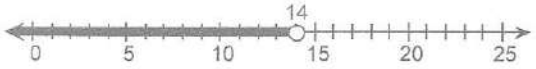
   ○ C. 

   ○ D. 

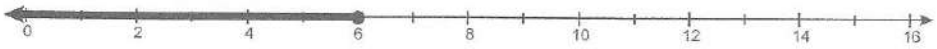
   ○ E. 

   ○ F. 

   ○ G. 

   ○ H. 

6. Check all the inequalities with solutions that have this graph.



- ❑ A. $x \div 3 \leq 2$
- ❑ B. $x + 5 \leq 6$
- ❑ C. $2x \leq 12$
- ❑ D. $x \div 3 > 6$
- ❑ E. $2x \leq 3$
- ❑ F. $x - 2 \leq 4$
- ❑ G. $x + 5 \leq 11$
- ❑ H. $x - 2 < 6$

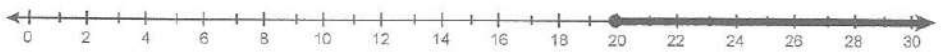
7. a) **Writing** Explain what inverse operations are.

   b) Show how to use inverse operations to solve the inequality $x + 16 \leq 19$.

   c) Solve the inequality $x + 16 \leq 19$. Fill in the answer line to complete your choice.

   - ○ A. $x \geq$ _____
   - ○ B. $x \leq$ _____
   - ○ C. $x <$ _____
   - ○ D. $x >$ _____

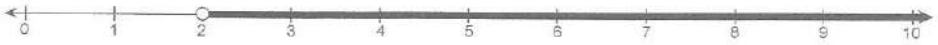
8. **Reasoning** The number line shows the solutions of an inequality.



Is $x + 7 \geq 27$ equivalent to the inequality whose solutions are shown?

- ○ A. No
- ○ B. Yes

9. **Error Analysis** Pierre drew the graph of $5x < 10$ as shown.



What did Pierre do wrong? Check all that apply.

- ❑ A. He shaded on the wrong side of 2.
- ❑ B. He did not include 2 as a solution.
- ❑ C. He used 2 as the endpoint instead of 10.
- ❑ D. He used 2 as the endpoint instead of 5.

10. **Greenhouse** The temperature in a greenhouse should be 65 degrees or higher. One morning, the heater stopped working. The temperature dropped 5 degrees before someone fixed the heater. The temperature was still at least 65 degrees when the heater started working again. How can you best describe the temperature in the greenhouse before the heater stopped working?

11. **Estimation** What is the easiest way to estimate the solutions of the inequality $x \div 9 < 69$?

- ○ A. Multiply 69 by 10 to get $x > 690$.
- ○ B. Multiply 69 by 8 to get $x < 552$.
- ○ C. Multiply 70 by 10 to get $x < 700$.
- ○ D. Multiply 9 by 70 to get $x < 630$.
- ○ E. Multiply 70 by 10 to get $x > 700$.

12. Solve the inequality.

$21 \geq 3x$

- ○ A. $x \leq$ _____
- ○ B. $x <$ _____
- ○ C. $x \geq$ _____
- ○ D. $x >$ _____

13. Solve the inequality.

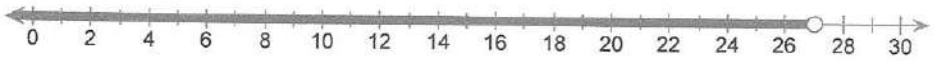
$x + 32 \geq 47$

- ○ A. $x \leq$ _____
- ○ B. $x <$ _____
- ○ C. $x >$ _____
- ○ D. $x \geq$ _____

14. Think About the Process You want to solve the inequality $6z \leq 54$. What is the first step?

- ○ A. Subtract 6 from each side of the inequality.
- ○ B. Add 6 to each side of the inequality.
- ○ C. Subtract $5z$ from each side of the inequality.
- ○ D. Divide each side of the inequality by z.
- ○ E. Divide each side of the inequality by 6.
- ○ F. Multiply each side of the inequality by 6.

15. Think About the Process Boris knows that the solutions of $x < 27$ are shown on the number line. His teacher asks for an inequality that requires multiplying by 9 to find the solutions shown. What should he do to $x < 27$ to meet the teacher's request? What is the result?



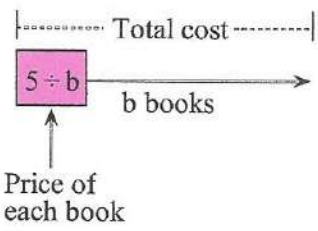
- ○ A. He should add 9 to each side of the inequality. The result is $x + 9 < 36$.
- ○ B. He should divide each side of the inequality by 9. The result is $x \div 9 < 3$.
- ○ C. He should multiply each side of the inequality by 9. The result is $9x < 243$.
- ○ D. He should subtract 9 from each side of the inequality. The result is $x - 9 < 18$.

Student: _____	**Instructor:** Pearson School	**Assignment:** 3-5 Mixed Review
Date: _____	**Course:** digits - grade 6	
Time: _____	**Book:** digits, grade 6 (Middle Grades Math)	

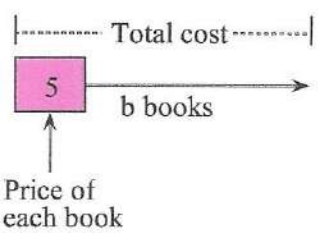
1. Suppose a bookstore sells b copies of a book. The price of the book is $5. Draw a bar diagram for the total cost of the b books. Then write an algebraic expression for the total cost.

Which bar diagram models the total cost of the b books?

A.



B.



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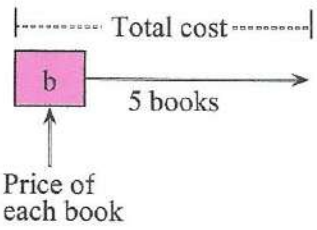
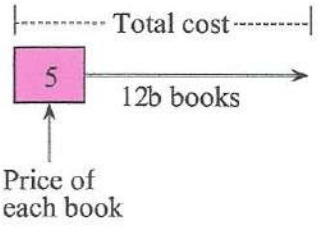


D.



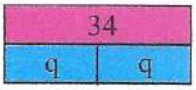
An algebraic expression for the total cost is ☐.

2. What is a numerical expression for the word phrase below?

30 minus 14

A numerical expression for "30 minus 14" is ☐.

3. The bar diagram models the equation $2q = 34$. Solve this equation.



The solution of the equation is ☐.
(Type the value of q.)

4. Express the given statement as an algebraic expression.

The height, h, increased by 12 inches

The algebraic expression is ☐.

5. What is the value of x^3y if $x = 2$ and $y = 7$?

$x^3y =$ ☐

Student: _____	**Instructor:** Pearson School	**Assignment:** 3-6 Mixed Review
Date: _____	**Course:** digits - grade 6	
Time: _____	**Book:** digits, grade 6 (Middle Grades Math)	

1. Jennifer is taking a taxi to the airport. The taxi charges an initial fee of $4 and then $2 per mile. Write an algebraic expression for the cost of a taxi ride of m miles. Then evaluate the expression to find how much a 7-mile taxi ride would cost Jennifer.

Write an algebraic expression for the cost of a taxi ride of m miles. Choose the correct answer below.

- ○ A. $2m$
- ○ B. $4+2m$
- ○ C. $4m-2m$
- ○ D. $2+4m$

A 7-mile taxi ride would cost Jennifer $☐.

2. Which situations can you represent with an equation? With an inequality?

1. Two friends live 9 blocks apart.
2. A girl earned $27 babysitting on Saturday night.
3. Each class must have more than 25 students.
4. The homework took 4 hours to complete.

Select all of the situations that you can represent with an equation.

- ☐ A. Situation 1
- ☐ B. Situation 2
- ☐ C. Situation 4
- ☐ D. Situation 3

Select all of the situations that you can represent with an inequality.

- ☐ A. Situation 3
- ☐ B. Situation 1
- ☐ C. Situation 2
- ☐ D. Situation 4

3. Which number is a solution of $13-c=5$?

7, 2, 4, 8, or 9

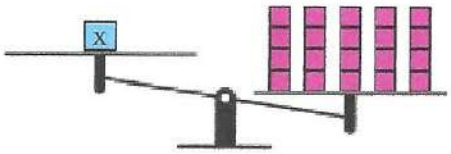
A solution is ☐.
(Type the value of c.)

4. Evaluate $(2y-2) \div x$ for $x = 2$ and $y = 6$.

$(2y-2) \div x =$ ☐

(Type a whole number.)

5. This scale balanced with x on one side and 4 blocks on the other side. Your friend changed the scale, but had to leave before restoring the balance.



Find the number to multiply by on the left that makes the scale balance. Then complete the equation.

___ $\cdot x = 20$

Multiplying by what number will make the scale balance?

Multiply the ☐ side of the scale by ☐.

Complete the equation.

☐ $\cdot x = 20$