

# BARTLETT

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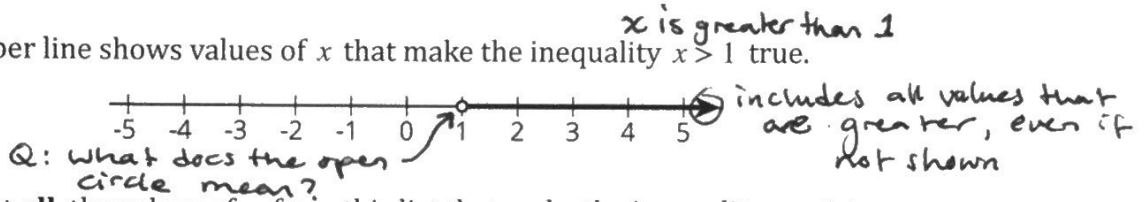
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## Unit 6, Lesson 13: Reintroducing Inequalities

Let's work with inequalities.

3 mins. 1 min. think, 1 min. pair 1 min. discuss  
 13.1: Greater Than One

The number line shows values of  $x$  that make the inequality  $x > 1$  true.



1. Select **all** the values of  $x$  from this list that make the inequality  $x > 1$  true.

1. 3                      3. 1                      5. 1.05  
 2. -3                      4. 700

If students don't think this is a solution, discuss the arrow at the end of the number line.

2. Name two more values of  $x$  that are solutions to the inequality.

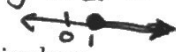
4, 10, etc.

Q: Would 1 be a solution? Why or why not?  
 No, needs to say  $x \geq 1$

### 13.2: The Roller Coaster

10 mins. 3 mins. work time, then partner, then review

A sign next to a roller coaster at an amusement park says, "You must be at least 60 inches tall to ride." Noah is happy to know that he is tall enough to ride.



1. Noah is  $x$  inches tall. Which of the following can be true?

- $x > 60$ ,  $x = 60$  or  $x < 60$ ?

"At least" means that Noah must be 60 inches or taller.

2. Noah's friend is 2 inches shorter than Noah. Can you tell if Noah's friend is tall enough to go on the ride?

No, we can't tell since we don't know exactly how tall Noah is - he could be 60 or 61 inches.

3. List one possible height for Noah that means that his friend is tall enough to go on the ride, and another that means that his friend is too short for the ride.

A) Noah could be 63 inches tall, which means his friend is 61 & can ride.

B) Noah is 61 inches & his friend is 59 & can't ride.



If struggling with 1-3, look @ number line on the back.

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4. On the number line below, plot the points for all the possible heights that Noah's friend could be.



5. Noah's friend is  $y$  inches tall. Use  $y$  and any of the symbols  $<$ ,  $=$ ,  $>$  to express this height.

$y > 58$  or  $y = 58$

13.3: Is the Inequality True or False?

5 mins.

The table shows four inequalities and four possible values for  $x$ . Decide whether each value makes each inequality true, and complete the table with "true" or "false." Discuss your thinking with your partner. If you disagree, work to reach an agreement.

Pay attention to which side of the inequality the variable  $x$  is on

$x$	0	100	-100	25
$x \leq 25$	T	F	T	T
* $100 < 4x$	F	T	F	F
$-3x > -75$	T	F	T	F
* $10 \geq 35 - x$	F	T	F	T

\* substitute 25 for  $x$  in these inequalities  
 $100 < 100$  (F)       $10 \geq 10$  (F)

Unit 6, Lesson 14: Finding Solutions to Inequalities in Context

Let's solve more complicated inequalities.

More negative coefficients

not as simple as solving equations

5 mins

14.1: Solutions to Equations and Solutions to Inequalities

- Solve  $-x = 10$       use -10 as a check  
 $x = -10$
- Find two solutions to  $-x > 10$   
 $x = -12, -28.7, -209$  (any value less than -10)
- Solve  $2x = -20$   
 $x = -10$
- Find 2 solutions to  $2x > -20$   
 $x = -9, 0, 82\frac{3}{4}$  (any value greater than -10)

test values to check validity

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10 mins.  
**14.2: Earning Money for Soccer Stuff**

1. Andre has a summer job selling magazine subscriptions. He earns \$25 per week plus \$3 for every subscription he sells. Andre hopes to make at least enough money this week to buy a new pair of soccer cleats.

1. Let  $n$  represent the number of magazine subscriptions Andre sells this week. Write an expression for the amount of money he makes this week.

$$3n + 25$$

check for understanding →

2. The least expensive pair of cleats Andre wants costs \$68. Write and solve an equation to find out how many magazine subscriptions Andre needs to sell to buy the cleats.

$$\begin{array}{r} 3n + 25 = 68 \\ -25 \quad -25 \\ \hline 3n = 43 \\ \frac{3n}{3} = \frac{43}{3} \\ \boxed{n = 14\frac{1}{3}} \end{array}$$

3. If Andre sold 16 magazine subscriptions this week, would he reach his goal? Explain your reasoning.

Yes.  $16 > 14\frac{1}{3}$

He made \$73, which is more than enough to buy the cleats.

4. What are some other numbers of magazine subscriptions Andre could have sold and still reached his goal?

15, 17, 100 (any whole number greater than 14)

5. Write an *inequality* expressing that Andre wants to make at least \$68.

$$3n + 25 \geq 68$$

6. Write an inequality to describe the number of subscriptions Andre must sell to reach his goal.

$$n \geq 14\frac{1}{3}$$

Q: Could Andre

~~sell~~ sell exactly

14  $\frac{1}{3}$

subscriptions?  
No

If Andre wants to make more money, he needs to sell more magazines, not fewer.

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2. Diego has budgeted \$35 from his summer job earnings to buy shorts and socks for soccer. He needs 5 pairs of socks and a pair of shorts. The socks cost different amounts in different stores. The shorts he wants cost \$19.95.

1. Let  $x$  represent the price of one pair of socks. Write an expression for the total cost of the socks and shorts.

$$5x + 19.95$$

2. Write and solve an equation that says that Diego spent exactly \$35 on the socks and shorts.

$$\begin{array}{r} 5x + 19.95 = 35.00 \\ -19.95 \quad -19.95 \\ \hline 5x = 15.05 \\ \frac{5x}{5} = \frac{15.05}{5} \\ x = 3.01 \end{array}$$

Diego paid \$3.01 for each pair of socks.

use equation to predict inequality

Q: What do solutions to equations

Substitute values that are greater or less to check

3. List some other possible prices for the socks that would still allow Diego to stay within his budget.

Any price under \$3.01

4. Write an inequality to represent the amount Diego can spend on a single pair of socks.

Q: Could Diego pay exactly 3.01?  
yes

$$x \leq 3.01$$

If Diego wants to spend less than \$35 he needs to spend less, not more.

10 mins.

14.3: Granola Bars and Savings

1. A teacher wants to buy 9 boxes of granola bars for a school trip. Each box usually costs \$7, but many grocery stores are having a sale on granola bars this week. Different stores are selling boxes of granola bars at different discounts.

1. If  $x$  represents the dollar amount of the discount, then the amount the teacher will pay can be expressed as  $9(7 - x)$ . In this expression, what does the quantity  $7 - x$  represent?

~~the difference a kid's account balance~~  
the price of 1 box after the discount.

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2. The teacher has \$36 to spend on the granola bars. The equation  $9(7 - x) = 36$  represents a situation where she spends all \$36. Solve this equation.

Distribute

$$\begin{array}{r} 9(7-x) = 36 \\ 63 - 9x = 36 \\ \underline{-63} \quad \underline{-63} \end{array}$$

$$\begin{array}{r} -9x = -27 \\ \underline{-9} \quad \underline{-9} \end{array}$$

$$\boxed{x = 3}$$

$$\frac{9(7-x)}{9} = \frac{36}{9}$$

Divide

$$\begin{array}{r} 7-x = 4 \\ \underline{-7} \quad \underline{-7} \end{array}$$

$$\begin{array}{r} -x = -3 \\ \underline{-1} \quad \underline{-1} \end{array}$$

$$\boxed{x = 3}$$

3. What does the solution mean in this situation?

If the discount is \$3, then the teacher will pay exactly \$36 for the granola bars.

4. The teacher does not have to spend all \$36. Write an inequality relating 36 and  $9(7 - x)$  representing this situation.

$$9(7-x) \leq 36$$

$$36 \geq 9(7-x)$$

The solution to this inequality must either look like  $x \geq 3$  or  $x \leq 3$ . Which do you think it is? Explain your reasoning.

$x \geq 3$  because a discount higher than \$3 per box will mean the teacher will pay a lower price.

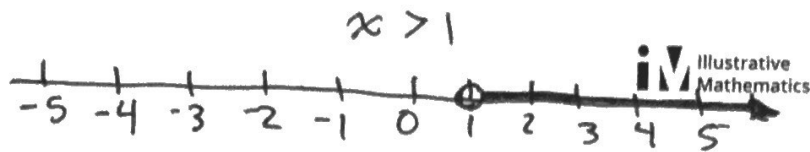
2. Kiran has \$100 saved in a bank account. (The account doesn't earn interest.) He asked Clare to help him figure out how much he could take out each month if he needs to have at least \$25 in the account a year from now.

1. Clare wrote the inequality  $-12x + 100 \geq 25$ , where  $x$  represents the amount Kiran takes out each month. What does  $-12x$  represent?

The difference in Kiran's account balance after one year (because there are 12 months in one year).

2. Find some values of  $x$  that would work for Kiran.

1, 2, 6. Any value less than or equal to 6.25.



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using color.

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Plot the negative value of  $x$  to examine directionality.

→ follow up with  $-x > 1$

3. We could express *all* the values that would work using either  $x \leq \_\_$  or  $x \geq \_\_$ . Which one should we use? Why?

$x \leq \_\_$

Kiran should use the less than sign because he must draw <sup>with</sup> less than a certain amount each month to still have \$25 at the end of the year.

4. Write the answer to Kiran's question using mathematical notation.

$x \leq 6.25$

$$\begin{array}{r} -12x + 100 = 25 \\ -100 \quad -100 \end{array}$$

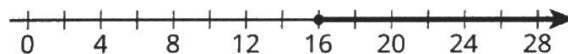
$$\begin{array}{r} -12x = -75 \\ \frac{-12x}{-12} = \frac{-75}{-12} \end{array}$$

$x = 6.25$

Q: What if  $x$  were  $-10$ ?  
What does that mean?  
Kiran is depositing money.

**Lesson 13 Summary**

We use inequalities to describe a range of numbers. In many places, you are allowed to get a driver's license when you are at least 16 years old. When checking if someone is old enough to get a license, we want to know if their age is at least 16. If  $h$  is the age of a person, then we can check if they are allowed to get a driver's license by checking if their age makes the inequality  $h > 16$  (they are older than 16) or the equation  $h = 16$  (they are 16) true. The symbol  $\geq$ , pronounced "greater than or equal to," combines these two cases and we can just check if  $h \geq 16$  (their age is greater than or equal to 16). The inequality  $h \geq 16$  can be represented on a number line:



see if you can write an inequality where  $-5$  is a solution.

**Lesson 14 Summary**

Multiplying/Dividing by a negative

Suppose Elena has \$5 and sells pens for \$1.50 each. Her goal is to save \$20. We could solve the equation  $1.5x + 5 = 20$  to find the number of pens,  $x$ , that Elena needs to sell in order to save *exactly* \$20. Adding  $-5$  to both sides of the equation gives us  $1.5x = 15$ , and then dividing both sides by  $1.5$  gives the solution  $x = 10$  pens.

What if Elena wants to have some money left over? The inequality  $1.5x + 5 > 20$  tells us that the amount of money Elena makes needs to be *greater* than \$20. The solution to the previous equation will help us understand what the solutions to the inequality will be. We know that if she sells 10 pens, she will make \$20. Since each pen gives her more money, she needs to sell *more* than 10 pens to make more than \$20. So the solution to the inequality is  $x > 10$ .

Algorithm - whenever you multiply or divide by a negative, flip the inequality