Lesson 5-7
Solve Multi-Step Inequalities

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I can...
solve inequalities that require multiple steps.

Explore It!

Charlene has 2 flash drives of the same size that she uses to store pictures and videos. Each drive is holding the same number of GB of data, *d*. She wants to move everything to a memory card that can hold up to 8 GB.

A. Charlene is going to delete 1 GB of data from each flash drive. How can the total amount of data left on the two flash drives be represented as an expression?

B. How can the expression you wrote be used to write an inequality that shows the maximum amount of data each flash drive can have on it in order to have all the data transfer to the 8 GB memory card?

Focus on math practices

Reasoning If each flash drive has 5 GB of memory, can all of the data be transferred to the memory card? Explain.

295

Essential Question How is solving a multi-step inequality similar to and different from solving a multi-step equation

EXAMPLE 1 Write and Solve Multi-Step Inequalities

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Gabriela likes to make people guess her age. She gives them this clue:

Add 13 to the product of 3 and the sum of my age and 2, and you get a number greater than my height in inches.

What are possible ages for Gabriela? Graph the solution.

STEP 1 Write an inequality to represent Gabriela's age, *x*.

Multiply by 3	The sum of Gabriela's age and 2	Add 13	>	Gabriela's height
3	· $(x + 2)$	+ 13	>	55

STEP 2 Solve the inequality. Then graph the solution.

$3(x + 2) + 13 > 55$

$3x + 6 + 13 > 55$ Use the Distributive Property.

$3x + 19 > 55$

$3x + 19 - 19 > 55 - 19$ Use the Subtraction and Division Properties of Inequality to isolate the variable.

$\frac{3x}{3} > \frac{36}{3}$

$x > 12$

Gabriela is more than 12 years old.

Try It!

Twice the difference of Felipe's age, *f*, and 4 is at least 2.
What are possible values for Felipe's age? Graph the solution.

Write the inequality. ☐ (☐) ○ ☐

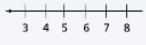
Use the Distributive Property to rewrite the inequality as $2f -$ ☐ ≥ 2.

Solve the inequality.

$2f \geq$ ☐

$f \geq$ ☐

Graph the solution.



Convince Me! Describe the similarity between the process of solving an inequality with two steps and solving an inequality with more than two steps.

EXAMPLE 2 Solve More Multi-Step Inequalities

Solve the inequality $-3(x + 4) + 3 \geq 9$. Then graph the solution.

$-3(x + 4) + 3 \geq 9$ — Remember to use the Distributive Property.

$-3x - 12 + 3 \geq 9$

$-3x - 9 \geq 9$

$-3x \geq 18$

$\frac{-3x}{-3} \leq \frac{18}{-3}$ — Remember: When multiplying or dividing by a negative value, the inequality symbol is reversed.

$x \leq -6$

EXAMPLE 3 Solve Multi-Step Inequalities by Combining Like Terms

Solve the inequality $2(3.5t - 2) + 6t \geq -2$. Then graph the solution.

$2(3.5t - 2) + 6t \geq -2$ — Distribute and then combine like terms.

$7t - 4 + 6t \geq -2$

$13t - 4 \geq -2$

$13t - 4 + 4 \geq -2 + 4$

$13t \geq 2$ — Use the Division Property of Inequality.

$t \geq \frac{2}{13}$

Try It!

Solve the inequality $-1 - 6(6 + 2x) < 11$. Then graph the solution.

Solve the inequality $3(4 - 6) + 2 \geq 2(-t + 3) + 4$. Then graph the solution.

KEY CONCEPT

Solving multi-step inequalities is similar to solving multi-step equations. You may need to use the Distributive Property, combine like terms, and use inverse relationships and properties to solve them.

$4(y - 4) + 8 \leq 20$

$4y - 16 + 8 \leq 20$

$4y - 8 \leq 20$

$4y - 8 + 8 \leq 20 + 8$

$4y \leq 28$

$\frac{4y}{4} \leq \frac{28}{4}$

$y \leq 7$

Do You Understand?

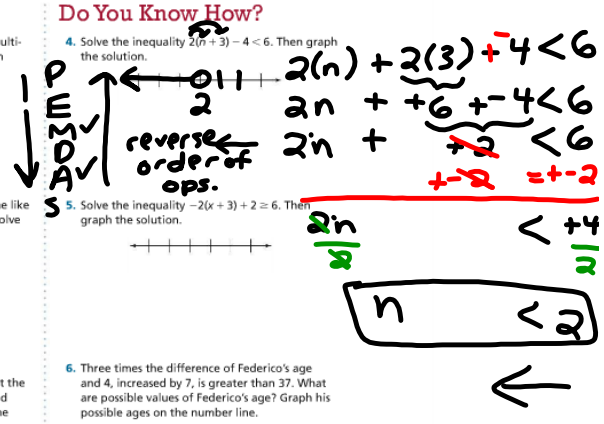
1. **Essential Question** How is solving a multi-step inequality similar to and different from solving a multi-step equation?

2. **Be Precise** Explain how you would combine like terms and use properties of operations to solve the inequality $5(2t + 3) - 3t < 16$.

3. **Critique Reasoning** Gloria's solution to a multi-step inequality is $r > 7$. She states that the graph will have an open dot at 7 and extend with an arrow to the right indefinitely. Is she correct? Explain.

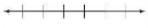
Do You Know How?

4. Solve the inequality $2(n + 3) - 4 < 6$. Then graph the solution.



5. Solve the inequality $-2(x + 3) + 2 \geq 6$. Then graph the solution.

6. Three times the difference of Federico's age and 4, increased by 7, is greater than 37. What are possible values of Federico's age? Graph his possible ages on the number line.



Name:

Practice & Problem Solving

7. Use the inequality $18 < -3(4x - 2)$

a. Solve the inequality for x.

b. Which graph shows the solution to the inequality?

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8. Michelle says that the solution to the inequality $2(4y - 3) > -22$ is $y > -3.5$. Her work is shown.

$$2(4y - 3) > -22$$
$$8y > -28$$
$$y > -3.5$$

a. What was Michelle's mistake?

b. What is the solution to the inequality?

9. **Model with Math** The length of a picture frame is 7 inches more than the width. For what values of x is the perimeter of the picture frame greater than 154 inches?

10. **Critique Reasoning** Sierra says that she can simplify the left side of the inequality $2(-3 + 5) + 2 \geq -4(x - 2) - 3$ by combining the terms within the parentheses, but that she can't do the same on the right side. Is Sierra correct? Explain.

11. a. Solve the inequality $30 \geq 6\left(\frac{2}{3}z + \frac{1}{3}\right)$.

b. Solve the inequality $15.6 < 2.7(z - 1) - 0.6$.

c. Are there any values of z that solve both inequalities? Use a number line to support your answer.

12. Mr. Lin baked banana bread for a bake sale to raise money for the math team. He said that he added a spoonful of walnuts for each of the students in his three classes, and that he added more than 250 walnuts. He used the inequality $16w + 24w + 10w > 250$ to represent the situation, where w represents the number of walnuts in each spoonful. How many walnuts could be in each spoonful?

13. Use both the Addition and Multiplication Properties of Inequality to solve the inequality. Graph the solutions on a number line.

$2(3y - 5) < -16$

14. **Higher Order Thinking** Solve each of the given inequalities for z. Which of the inequalities has 5 as a solution?

Inequality 1	Inequality 2
$4(2.8z + 1.75) > -26.6$	$2(1.9z + 1.5) \leq 18.2$

Assessment Practice

15. Solve the inequality. Explain how you found your answer.

$4(x + 2) - 3 \geq -3(-2 + 6) + 2$