

Multi-Step Inequalities

Andrew Gloag
Eve Rawley
Anne Gloag

Say Thanks to the Authors

Click <http://www.ck12.org/saythanks>

(No sign in required)



To access a customizable version of this book, as well as other interactive content, visit www.ck12.org

AUTHORS

Andrew Gloag
Eve Rawley
Anne Gloag

CK-12 Foundation is a non-profit organization with a mission to reduce the cost of textbook materials for the K-12 market both in the U.S. and worldwide. Using an open-content, web-based collaborative model termed the **FlexBook®** textbook, CK-12 intends to pioneer the generation and distribution of high-quality educational content that will serve both as core text as well as provide an adaptive environment for learning, powered through the **FlexBook Platform®**.

Copyright © 2015 CK-12 Foundation, www.ck12.org

The names “CK-12” and “CK12” and associated logos and the terms “**FlexBook®**” and “**FlexBook Platform®**” (collectively “CK-12 Marks”) are trademarks and service marks of CK-12 Foundation and are protected by federal, state, and international laws.

Any form of reproduction of this book in any format or medium, in whole or in sections must include the referral attribution link <http://www.ck12.org/saythanks> (placed in a visible location) in addition to the following terms.

Except as otherwise noted, all CK-12 Content (including CK-12 Curriculum Material) is made available to Users in accordance with the Creative Commons Attribution-Non-Commercial 3.0 Unported (CC BY-NC 3.0) License (<http://creativecommons.org/licenses/by-nc/3.0/>), as amended and updated by Creative Commons from time to time (the “CC License”), which is incorporated herein by this reference.

Complete terms can be found at <http://www.ck12.org/about/terms-of-use>.

Printed: March 21, 2015

flexbook
next generation textbooks



CHAPTER

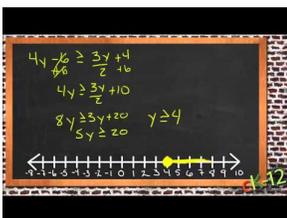
1

Multi-Step Inequalities

Here you'll learn how to solve inequalities that require several steps to arrive at the solution. You'll also graph their solution set.

What if you had an inequality with an unknown variable on both sides like $2(x - 2) > 3x - 5$? How could you isolate the variable to find its value? After completing this Concept, you'll be able to solve multi-step inequalities like this one.

Watch This



MEDIA

Click image to the left or use the URL below.

URL: <http://www.ck12.org/flx/render/embeddedobject/133213>

CK-12 Foundation: 0603S Solving Multi-Step Inequalities (H264)

Try This

For additional practice solving inequalities, try the online game at <http://www.aaamath.com/equ725x7.htm#section2>. If you're having a hard time with multi-step inequalities, the video at <http://www.schooltube.com/video/aa66df49e0af4f85a5e9/MultiStep-Inequalities> will walk you through a few.

Guidance

In the last two sections, we considered very simple inequalities which required one step to obtain the solution. However, most inequalities require several steps to arrive at the solution. As with solving equations, we must use the order of operations to find the correct solution. In addition, remember that **when we multiply or divide the inequality by a negative number, the direction of the inequality changes**.

The general procedure for solving multi-step inequalities is almost exactly like the procedure for solving multi-step equations:

1. Clear parentheses on both sides of the inequality and collect like terms.
2. Add or subtract terms so the variable is on one side and the constant is on the other side of the inequality sign.
3. Multiply and divide by whatever constants are attached to the variable. Remember to change the direction of the inequality if you multiply or divide by a negative number.

Example A

Solve the inequality $\frac{9x}{5} - 7 \geq -3x + 12$ and graph the solution set.

Solution

Original problem: $\frac{9x}{5} - 7 \geq -3x + 12$

Add $3x$ to both sides: $\frac{9x}{5} + 3x - 7 \geq -3x + 3x + 12$

Simplify: $\frac{24x}{5} - 7 \geq 12$

Add 7 to both sides: $\frac{24x}{5} - 7 + 7 \geq 12 + 7$

Simplify: $\frac{24x}{5} \geq 19$

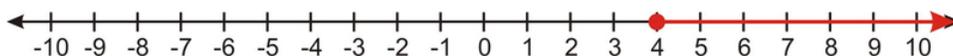
Multiply 5 to both sides: $5 \cdot \frac{24x}{5} \geq 5 \cdot 19$

Simplify: $24x \geq 95$

Divide both sides by 24: $\frac{24x}{24} \geq \frac{95}{24}$

Simplify: $x \geq \frac{95}{24}$ **Answer**

Graph:



Example B

Solve the inequality $-25x + 12 \leq -10x - 12$ and graph the solution set.

Solution:

Original problem: $-25x + 12 \leq -10x - 12$

Add $10x$ to both sides: $-25x + 10x + 12 \leq -10x + 10x - 12$

Simplify: $-15x + 12 \leq -12$

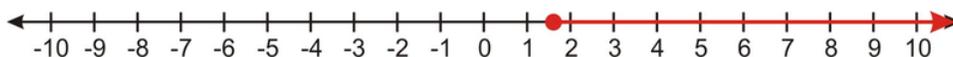
Subtract 12: $-15x + 12 - 12 \leq -12 - 12$

Simplify: $-15x \leq -24$

Divide both sides by -15 : $\frac{-15x}{-15} \geq \frac{-24}{-15}$ *flip the inequality sign*

Simplify: $x \geq \frac{8}{5}$ **Answer**

Graph:



Example C

Solve the inequality $4x - 2(3x - 9) \leq -4(2x - 9)$.

Solution:

Original problem: $4x - 2(3x - 9) \leq -4(2x - 9)$

Simplify parentheses: $4x - 6x + 18 \leq -8x + 36$

Collect like terms: $-2x + 18 \leq -8x + 36$

Add $8x$ to both sides: $-2x + 8x + 18 \leq -8x + 8x + 36$

Simplify: $6x + 18 \leq 36$

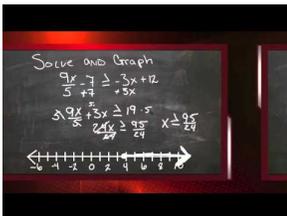
Subtract 18: $6x + 18 - 18 \leq 36 - 18$

Simplify: $6x \leq 18$

Divide both sides by 6: $\frac{6x}{6} \leq \frac{18}{6}$

Simplify: $x \leq 3$ **Answer**

Watch this video for help with the Examples above.



MEDIA

Click image to the left or use the URL below.

URL: <http://www.ck12.org/flx/render/embeddedobject/133214>

CK-12 Foundation: Solving Multi-Step Inequalities

Vocabulary

- The answer to an **inequality** is usually an **interval of values**.
- Solving inequalities works just like solving an equation. To solve, we isolate the variable on one side of the equation.
- When multiplying or dividing both sides of an inequality by a negative number, you need to **reverse the inequality**.

Guided Practice

Solve the inequality $\frac{5x-1}{4} > -2(x+5)$.

Solution:

Original problem: $\frac{5x-1}{4} > -2(x+5)$

Simplify parenthesis: $\frac{5x-1}{4} > -2x - 10$

Multiply both sides by 4: $4 \cdot \frac{5x-1}{4} > 4(-2x - 10)$

Simplify: $5x - 1 > -8x - 40$

Add 8x to both sides: $5x + 8x - 1 > -8x + 8x - 40$

Simplify: $13x - 1 > -40$

Add 1 to both sides: $13x - 1 + 1 > -40 + 1$

Simplify: $13x > -39$

Divide both sides by 13: $\frac{13x}{13} > -\frac{39}{13}$

Simplify: $x > -3$ **Answer**

Explore More

Solve each multi-step inequality.