

6.3

Solve Multi-Step Inequalities

Goal • Solve multi-step inequalities.

Your Notes

Example 1 Solve a two-step inequality

Solve $4x + 6 \geq 54$. Graph your solution.

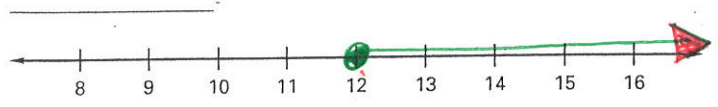
$$\begin{array}{r} -6 \quad -6 \\ \hline 4x \geq 48 \\ \hline \frac{4x}{4} \geq \frac{48}{4} \end{array}$$

Subtract 6 from each side.

$$x \geq 12$$

Divide each side by 4.

The solution:



Remember
When you
mult or
divide the
variable
by a negative
number then
reverse the
symbol

Example 2 Solve a multi-step inequality

Solve $-\frac{1}{3}(x + 21) < 2$.

$$\begin{array}{r} -\frac{1}{3}x - 7 < 2 \\ +7 \quad +7 \\ \hline \end{array}$$

Distributive property $(-\frac{1}{3})$

Add 7 to each side.

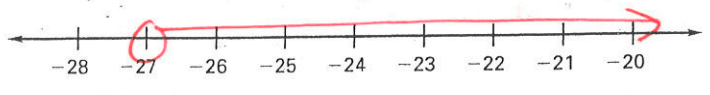
Multiply each side by -3.
Reverse the inequality
symbol.

MULT BY Reciprocal

$$-3 \left(-\frac{1}{3}x \right) < 9 \cdot -3$$



$$x > -27$$

The solution:



Your Notes

Checkpoint Solve the inequality. Graph your solution.

<p>1. $-5w - 2 \geq 23$</p> $\begin{array}{r} +2 \quad +2 \\ \hline -5w \geq 25 \\ \hline -5 \quad -5 \\ \hline w \leq -5 \end{array}$ 	<p>2. $2(y - 2.2) > 0$</p> $\begin{array}{r} 2y - 4.4 > 0 \\ +4.4 \quad +4.4 \\ \hline 2y > 4.4 \\ \hline y > 2.2 \end{array}$ 
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Example 3 Identify the number of solutions of an inequality


Solve the inequality, if possible.

SPECIAL CASES

Solution

a. $8x + 3 > 2(4x + 1)$

$$\begin{array}{r} 8x + 3 > 8x + 2 \\ -8x \quad -8x \\ \hline 3 > 2 \end{array}$$

ALL REAL NUMBERS are solutions because $3 > 2$ is TRUE. Graph: 

Write original inequality.

Distributive property

Subtract $8x$ from each side.

SOLUTION
 $X = \text{all real numbers}$
 $X = \mathbb{R}$

b. $3(8b - 1) \leq 24b - 4$

$$\begin{array}{r} 24b - 3 \leq 24b - 4 \\ -24b \quad -24b \\ \hline -3 \leq -4 \end{array}$$

There are NO SOLUTIONS because $-3 \leq -4$ is FALSE. Graph: \emptyset

Write original inequality.

Distributive property

Subtract $24b$ from each side.

X = NO SOLUTION
 $X = \emptyset$

NOTICE THE VARIABLE DROPPED OUT!

Checkpoint Solve the inequality, if possible.

3. $18 + 4w \geq \frac{1}{2}(8w + 36)$

$$\begin{aligned} 18 + 4w &\geq 4w + 18 \\ -4w &\quad -4w \\ \hline 18 &\geq 18 \quad (\text{T}) \\ \text{or} & \\ 0 &\geq 0 \quad (\text{T}) \end{aligned}$$

$X = \text{all real numbers}$

4. $-2(3z - 1) < 1 - 6z$

$$\begin{aligned} -6z + 2 &< 1 - 6z \\ +6z &\quad +6z \end{aligned}$$

$2 < 1 \quad (\text{F})$

$X = \text{NO SOLUTION}$

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Example 4 Solve a multi-step problem

Cell Phone Your cell phone plan is \$35 a month for 1000 minutes. You are charged \$.25 per minute for any additional minutes. What are the possible numbers of additional minutes you can use if you want to spend no more than \$50 on your monthly cell phone bill?

KEY INFO: **PLAN:** \$35/month - 1,000 minutes
PLUS .25¢/minute over 1,000 min
TOTAL SPENDING \leq \$50

DEFINE YOUR VARIABLE:

$M = \# \text{ of additional minutes}$

WRITE INEQUALITY:

$35 + .25m \leq 50$

SOLVE:

$$\begin{array}{r} -35 \quad -35 \\ \hline .25m \leq -15 \\ \hline .25 \quad .25 \\ \hline m \leq 60 \end{array}$$

$m \leq 60$

CHECK:

$\$35 + \overset{\$15}{.25(60)} = \$50 \checkmark$

DOES THE ANSWER MAKE SENSE?

ANSWER IN WORDS (UNITS)

You can use an additional 60 minutes or less to spend \$50 or less on phone bill

Add 3a

$x + 4 > 2(x + 2)$

$$\begin{aligned} x + 4 &> 2x + 4 \\ -2x &\quad -2x \\ \hline -x + 4 &> 4 \\ -4 &\quad -4 \\ \hline -x &> 0 \\ \hline x &< 0 \end{aligned}$$

$x < 0$



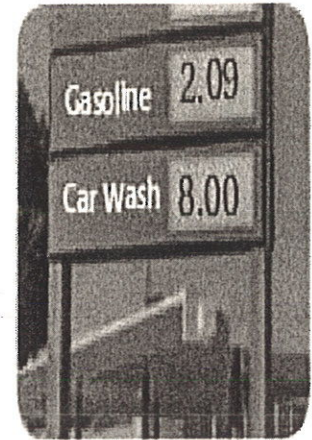
Remember it is the question
DON'T forget UNITS

Check Point 5

Follow steps in Example 4

Car Wash

Use the sign shown. A gas station charges \$.10 less per gallon of gasoline if a customer also gets a car wash. What are the possible amounts (in gallons) of gasoline that you can buy if you also get a car wash and can spend at most \$20?



KEY INFO: GAS \$2.09
\$.10 less with a car wash
CARWASH \$8
SPEND AT MOST \$20

VARIABLE: $X = \#$ of gallons of gas (remember UNITS)

EQUATION: $(2.09 - .10) \cdot X + 8 \leq 20$
 $1.99X + 8 \leq 20$

SOLVE:

$$\frac{1.99X}{1.99} \leq \frac{12}{1.99}$$

$$X \leq 6.03$$

Check: $1.99(6) + 8 = \$19.94 \leq \$20 \checkmark$

to see if answer
make sense

You can buy up to 6 GALLONS OF GAS
(OR 6.03 gallons).