# **Lesson Objectives**

1. Overview of an Inequality Relationship
2. **Remember** the **Reverse Rule** for Inequalities!
3. Basic Linear Inequalities
4. Compound (Three-Part) Linear Inequalities

# **Overview of an Inequality Relationship**

Let's examine a simple inequality relationship.

That's certainly **TRUE**: negative 2 is less than 3.

* If you multiply both sides by , for example:

updates to

So that new inequality relationship Is that still **TRUE**? YES, it is.

Now let's reset back to the original inequality:

* Let's examine what happens when we multiply by :

) updates to

Is this inequality relationship **TRUE** now? **NO!**

In order to keep the inequality **TRUE**, we need to **REVERSE** the direction of the inequality symbol. This preserves the smaller-bigger or bigger-smaller relationship:

Is this inequality relationship **TRUE** now? **YES!**

That is a *really, really* **BIG IDEA** when solving inequalities!

# Remember the **Reverse Rule** for Inequalities!

Whenever you **MULTIPLY** or **DIVIDE** an inequality by a **NEGATIVE** number, you must **remember** to **REVERSE** the direction of the **inequality symbol**!

This is true for *any* type of inequality, no matter how simple or complex.

You do **NOT** reverse the inequality when:

* Multiplying or dividing by a *positive* number
* Using the *Distributive Property* with a negative number (on one side of equation)
* Adding or subtracting

# **Basic Linear Inequalities**

Solving a linear inequality involves the same steps as solving a linear equation (Section 2.2), but you now must **Remember** the **Reverse Rule** and its possibility of being used.

Here is a revised checklist to solve basic linear inequalities:

1. **\*\*Combine Like Terms**, if you can.
2. **Undo Parentheses**, using the Distributive Property, then **\*\*** (see #1).
3. (if necessary) **Clear out fractions** – multiply all terms by the common denominator (also known as the Least Common Multiple, or LCM), then **\*\*** (see #1).

**Remember** the **Reverse Rule** – if you **MULTIPLY** by a **NEGATIVE** number, **REVERSE** it!

1. **Letters go LEFT** – use ADD or SUBTRACT to move variable terms to the LEFT side of the equation, then **\*\*** (see #1).
2. **Numbers go RIGHT** – use ADD or SUBTRACT to move constant terms to the RIGHT side of the equation, then **\*\*** (see #1).
3. **Divide** – last step is to DIVIDE by the coefficient of your variable and simplify.

**Remember** the **Reverse Rule** – if you **DIVIDE** by a **NEGATIVE** number, **REVERSE** it!

* **EXAMPLE:** Solve the inequality. Write the solution set in interval notation. [2.3.15]

We can’t combine like terms yet. There are no parentheses nor fractions to deal with.

**Letters go LEFT:**

**Combine like terms:**

**Numbers go RIGHT:**

**Combine like terms:**

**Divide** by coefficient:

**Remember** the **Reverse Rule!**

Simplify:

Is variable on the LEFT? YES

Graph:

Direction of shade? RIGHT

Is endpoint included? YES

Interval Notation:  **(solution)**

(go on to the next page)

* **EXAMPLE:** Solve the inequality symbolically. Express the solution in interval notation.

[2.3.21]

We can’t combine like terms at this point. There are no parentheses to deal with yet.

There is one fraction (denominator), which is – 2.

To clear out fractions, we **MULTIPLY** both sides by the – 2. **Remember** the **Reverse Rule**.

**MULTIPLY** both sides by – 2

**Remember** the **Reverse Rule!**

Simplify – **Divide out common factors**.

Use the **Distributive Property**.

**Letters go LEFT**.

Simplify – **Combine like terms**.

**Numbers go RIGHT**.

Simplify – **Combine like terms.**

**Divide** – **Remember** the **Reverse Rule!**

Simplify.

Is variable on the left? YES

Graph.

Direction to shade? LEFT

Is endpoint included? NO

Interval Notation:

(go on to the next page)

# **Compound (Three-Part) Linear Inequalities**

Recall the basic structure of an “in-between” inequality (or the Three-Part Inequality):

Here’s a summary of how it looks in interval notation. Assume *x* as our variable.

Let *a* represent the smaller number and let *b* represent the larger number.

|  |  |
| --- | --- |
| **Inequality** | **Interval Notation** |
|  |  |
|  |  |
|  |  |
|  |  |

When you solve a Three-Part Inequality, focus on the **middle**, where the variable is. Keep your variable in the middle, and UNDO anything attached to it:

* Undo addition or subtraction first
* Undo multiplication with division second – **Remember** the **Reverse Rule!**
* **EXAMPLE:** Solve the inequality symbolically. Express the solution set in interval notation.

[2.3-13]

We cannot combine like terms yet. There are no parentheses nor fractions to deal with.

Focus on the **middle**, where the variable is.

First, undo the subtract 8 with add 8 on all 3 sides:

Simplify – **Combine Like Terms**.

**Divide** by the coefficient.

**Remember** the **Reverse Rule!**

Simplify.

Inspect for proper format:

Is smaller number on left, larger on right? NO

Are inequality symbols pointing LEFT? NO

We need to “pivot” or reverse the entire inequality:

Interval Notation:

* **EXAMPLE:** Solve the inequality symbolically. Express the solution in interval notation.

[2.3.33]

(Simplify your answer. Use integers or decimals for any numbers in the expression.)

We cannot combine like terms yet. There are no parentheses to deal with, but there is a denominator of 6 that is controlling the middle. First, we will clear out fractions.

**Multiply** all three regions by 6:

Do we REVERSE the inequalities? NO

Simplify – **Divide out common factors**.

Undo positive 1 with subtract 1 all 3 sides.

Simplify – **Combine Like Terms**.

**Divide** by the coefficient.

**Remember** the **Reverse Rule!**

Simplify. (We’re using decimals)

Inspect for proper format:

Is smaller number on left, larger on right? NO

Are inequality symbols pointing LEFT? NO

We need to “pivot” or reverse the entire inequality:

Interval Notation:

Source Used:

1. Pearson MyLab Math *College Algebra with Modeling and Visualization, 6th Edition*, Rockswold