# **Lesson Objectives**

1. Solve a linear inequality (in one variable) graphically.
2. Solve a linear inequality (in two variables) graphically.
3. Solve a system of 2 linear inequalities graphically.

# **Solve a Linear Inequality (in One Variable) Graphically**

* **EXAMPLE:** Use the given graph of to solve each equation and inequality in interval notation. [2.3.55]

|  |  |  |
| --- | --- | --- |
|  |  |  |

1. The table below describes what’s happening graphically in the equation

|  |  |  |  |
| --- | --- | --- | --- |
| **LEFT side of the equation** | **symbol** | **RIGHT side of the equation** |  |
|  |  | 0 |
| *y*1 |  | *y*2 |
| The line you’re given | **ON** | the *x*-axis |

**Big Idea:** “**Equals** zero” (*something* = 0) means “**ON** the *x*-axis.”

**WHERE** (what value of *x*) is **the graph ON the *x*-axis**? The solution set is .

1. The table below describes what’s happening graphically in the inequality

|  |  |  |  |
| --- | --- | --- | --- |
| **LEFT side of the equation** | **symbol** | **RIGHT side of the equation** |  |
|  |  | 0 |
| *y*1 |  | *y*2 |
| The line you’re given | **BELOW** | the *x*-axis |

**Big Idea:** “**Less** than zero” (*something* < 0) means “**BELOW** the *x*-axis.”

**WHERE** (what values of *x*) is **the graph BELOW the *x*-axis**?

The graph is BELOW the *x*-axis if you go to the **RIGHT** of the intersection point, .

In English: to the RIGHT of As inequality: Interval Notation:

1. The table below describes what’s happening graphically in the inequality

|  |  |  |  |
| --- | --- | --- | --- |
| **LEFT side of the equation** | **symbol** | **RIGHT side of the equation** |  |
|  |  | 0 |
| *y*1 |  | *y*2 |
| The line you’re given | on or  **ABOVE** | the *x*-axis |

**Big Idea:** “**Greater** than zero” (*something* > 0) means “**ABOVE** the *x*-axis.”

**WHERE** (what values of *x*) is **the graph on or ABOVE the *x*-axis**?

The graph is BELOW the *x*-axis if you go to the **LEFT** of the intersection point, , with the **included**.

In English: to the LEFT of [included] As inequality:

Interval Notation:

* **EXAMPLE:** Use the given graphs of *y*1 and *y*2 to solve each inequality. Write the solution set in interval notation. [2.3.73]

|  |  |  |
| --- | --- | --- |
|  |  |  |

1. The table below describes what’s happening graphically in the equation

|  |  |  |  |
| --- | --- | --- | --- |
| (left side) | (symbol) | (right side) |  |
|  |  |  |
| blue line |  | redline |
| BLUE | **ON** | RED |

**WHERE** (what value of *x*) is **BLUE ON RED**? The solution set for is .

1. The table below describes what’s happening graphically in the equation

|  |  |  |  |
| --- | --- | --- | --- |
| (left side) | (symbol) | (right side) |  |
|  |  |  |
| blue line |  | redline |
| BLUE | **ABOVE** | RED |

**WHERE** (what values of *x*) is **BLUE ABOVE RED**?

To the **LEFT** of . Inequality:

The solution set (in interval notation) for is:

1. The table below describes what’s happening graphically in the equation

|  |  |  |  |
| --- | --- | --- | --- |
| (left side) | (symbol) | (right side) |  |
|  |  |  |
| blue line |  | redline |
| BLUE | on or  **BELOW** | RED |

**WHERE** (what values of *x*) is **BLUE on or BELOW RED**?

To the **RIGHT** of (included). Inequality: .

The solution set (in interval notation) for is:

# **Solve a Linear Inequality (in Two Variables) Graphically**

**How to graph a linear inequality in two variables:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Step 1** | (If possible) Get your inequality into **slope-intercept** form.  (Be ready to REVERSE the inequality, if needed!) | | | |
| **Step 2** | Graph the **TYPE** of boundary line → | **DASHED** line (without equals) | > | < |
| **SOLID** line (with equals) | ≥ | ≤ |
| **Step 3** | Choose **DIRECTION** of shading → → | | shade **ABOVE**  (greater-than type) | shade **BELOW** (less-than type) |
| \*\* exception: for **vertical** lines () → | | shade **RIGHT** | shade **LEFT** |

* **EXAMPLE:** Graph the inequality

Use the graphing tool to graph the inequality. [6.2.11]

|  |  |
| --- | --- |
| * **Step 1.** To graph a linear inequality, you need to convert it to **SLOPE-INTERCEPT** form first. | The boundary line and shaded area describe the **solution.** |
| (Subtract 7*x*)  (Simplify) |
| Graph the boundary line:  *y*-intercept: slope:  The symbol used: (**greater**-than)   * **Step 2.** Type of line: **DASHED** (missing equals) * **Step 3.** Direction to shade: **ABOVE** |

Note: to verify this solution, we can use a **TEST POINT** that is **NOT** on the line. Often the origin **(0,0)** is best to use. If the origin is on the boundary line, then test some other point.

Test it with the inequality: (**FALSE**)

Since testing the origin is **FALSE**, that means that the (0,0) region will **NOT** be shaded – the other side will be.

**Big Idea!** Test point **TRUE** = shade it; Test point **FALSE** = don’t shade it

* **EXAMPLE:** Use the graphing tool to graph the given inequality.

|  |  |
| --- | --- |
| [6.2.7] | The boundary line and shaded area describe the **solution.** |
| * **Step 1.** Can’t get this into slope-intercept form because this is a **VERTICAL** line.   Graph the boundary line:  Vertical line passing through the ***x***-axis at 6 |
| The symbol used: **greater**-than or equal to   * **Step 2.** Type of line: **SOLID** (it has equals) * **Step 3.** Direction to shade: **RIGHT** |

Test point into : (**FALSE**) So, shaded region will **NOT** contain .

# **Solve a System of 2 Linear Inequalities Graphically**

* **EXAMPLE:** Graph the solution set to the system of inequalities.

Use the graph to identify one solution. Use the graphing tool to graph the system.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [6.2.23] | | | | Use small arrows on the **ends** of each line to show the direction of the shading.  The region with **TWO** arrows is the solution.  The boundary lines and shaded area describe the **solution.** |
| * **Step 1.** Convert each to **SLOPE-INTERCEPT** form: | | | |
|  | |  | |
|  | (subtract 2*x*) |  | (subtract *x*) |
|  | (simplify) |  | (simplify) |
|  | | | |
| Graph the boundary line: | | Graph the boundary line: | |
|  | |  | |
| *y*-intercept: | | *y*-intercept: | |
| slope: | | slope: | |
| The symbol used:  (**less**-than) | | The symbol used:  (**less**-than) | |
| * **Step 2.** Type of line:   **DASHED**  (no equals) | | * **Step 2.** Type of line:   **DASHED** (no equals) | |
| * **Step 3.** Direction to shade: **BELOW** | | * **Step 3.** Direction to shade:  **BELOW** | |

* **EXAMPLE:** Graph the system of inequalities. Which graph is the solution of the system?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | [6.2.17] | | **A.**    **B.**    **C.**    **D.** |
| * **Step 1.** Convert each to **SLOPE-INTERCEPT** form. | | | |
|  | |  | |
|  | (subtract *x*) |  | (subtract *x*) |
|  | (simplify) |  | (simplify) |
|  |  |  | (divide by –1) |
|  |  |  | **REVERSE it !!** |
| Graph the boundary line: | | Graph the boundary line: | |
|  | |  | |
| *y*-intercept: | | *y*-intercept: | |
| slope: | | slope: | |
| The symbol used:  (**less**-than or equal to) | | The symbol used:  (**greater**-than or equal to) | |
| * **Step 2.** Type of line:   **SOLID** (has equals) | | * **Step 2.** Type of line:   SOLID (has equals) | |
| * **Step 3.** Direction to shade: **BELOW** | | * **Step 3.** Direction to shade: **ABOVE** | |
| Use small **arrows** on the ends of each line to show direction of shading.  The region with TWO arrows is the **solution**.  The boundary line and shaded area describe the **solution**. Answer is **A**. | | | |