Linear Inequalities in Two Variables

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What is a Linear Inequality in Two Variables?

It is an inequality which can be written in any one of the following forms:

$$Ax + By < C \qquad Ax + By \leq C$$
$$Ax + By > C \qquad Ax + By \geq C$$

where A, B, and C are any real numbers.

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9. $y \leq -6x - 4$ **YES**
10. $2x + y < 8$

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Convert each situation into an inequality model.

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$$m > c$$

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$$s > 2r + 1$$

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To be an honor student in school, a student must have a grade (g) of at least 90.	$g \geq 90$

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The yearly budget of Jose (J) is less than the yearly budget of Gian (G). $J < G$

What are the Solutions of a Linear Inequality?

The solution of an inequality in two variables are the ordered pairs of numbers that make the inequality true.

How to Determine Whether an Ordered Pair is a Solution to a Linear Inequality?

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1. Substitute the values for x and y.
2. Simplify the inequality.
3. Check whether the resulting inequality statement is true or false.

Example 1

Is $(1, 1)$ a solution to $y \geq 2x - 1$?

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Is $(1, 1)$ a solution to $y \geq 2x - 1$?

Let: $x = 1, \qquad y = 1$

$$y \geq 2x - 1$$

$$1 \geq 2(1) - 1$$

Example 1

Step 2: Simplify the inequality.

Is $(1, 1)$ a solution to $y \geq 2x - 1$?

Let: $x = 1, \quad y = 1$

$y \geq 2x - 1$

$1 \geq 2(1) - 1$ Substitution Property

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Step 2: Simplify the inequality.

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$1 \geq 2(1) - 1$ Substitution Property

$1 \geq 2 - 1$ Simplification

$1 \geq 1$

Example 1

Step 3: Check whether the resulting inequality statement is true or false.

Is $(1, 1)$ a solution to $y \geq 2x - 1$?

Let: $x = 1$, $y = 1$

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Is $(1, 1)$ a solution to $y \geq 2x - 1$?

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$y \geq 2x - 1$

$1 \geq 2(1) - 1$ Substitution Property

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$\therefore$ since the resulting inequality is true, $(1, 1)$ **is a solution** to $y \geq 2x - 1$.

Example 2

Is $(4, -1)$ a solution to $x + 3y \leq 8$?

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Let: $x = 4, \qquad y = -1$

$$x + 3y \leq 8$$

$$4 + 3(-1) \leq 8$$

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Step 2: Simplify the inequality.

Is $(4, -1)$ a solution to $x + 3y \leq 8$?

Let: $x = 4$, $y = -1$

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$\therefore$ since the resulting inequality is true, $(4, -1)$ **is a solution** to $x + 3y \leq 8$.

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Is $(0, 0)$ a solution to $y < 4x - 5$?

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Is $(0, 0)$ a solution to $y < 4x - 5$?

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$$y < 4x - 5$$

$$0 < 4(0) - 5$$

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$y < 4x - 5$

$0 < 4(0) - 5$ Substitution Property

$0 < 0 - 5$ Simplification

$0 < -5$

Example 3

Step 3: Check whether the resulting inequality statement is true or false.

Is $(0, 0)$ a solution to $y < 4x - 5$?

Let: $x = 0$, $y = 0$

$y < 4x - 5$

$0 < 4(0) - 5$ Substitution Property

$0 < 0 - 5$ Simplification

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Example 3

Is $(0, 0)$ a solution to $y < 4x - 5$?

Let: $x = 0$, $y = 0$

$y < 4x - 5$

$0 < 4(0) - 5$ Substitution Property

$0 < 0 - 5$ Simplification

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$\therefore$ since the resulting inequality is false, $(0, 0)$ **is not a solution** to $y < 4x - 5$.

Example 4

Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

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Step 1: Substitute the values for x and y.

Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

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Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

Let: $x = 4, \qquad y = \frac{1}{2}$

$$\frac{1}{2}x + y > 5$$

$$\frac{1}{2}(4) + \frac{1}{2} > 5$$

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Step 2: Simplify the inequality.

Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

Let: $x = 4, \qquad y = \frac{1}{2}$

$\frac{1}{2}x + y > 5$

$\frac{1}{2}(4) + \frac{1}{2} > 5$ Substitution Property

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$\frac{1}{2}x + y > 5$

$\frac{1}{2}(4) + \frac{1}{2} > 5$ Substitution Property

$2 + \frac{1}{2} > 5$

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Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

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$\frac{1}{2}(4) + \frac{1}{2} > 5$ Substitution Property

$2 + \frac{1}{2} > 5$ Simplification

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Step 3: Check whether the resulting inequality statement is true or false.

Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

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$\frac{1}{2}(4) + \frac{1}{2} > 5$ Substitution Property

$2 + \frac{1}{2} > 5$ Simplification

$2\frac{1}{2} > 5$ Simplification

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Is $\left(4, \frac{1}{2}\right)$ a solution to $\frac{1}{2}x + y > 5$?

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$\frac{1}{2}(4) + \frac{1}{2} > 5$ Substitution Property

$2 + \frac{1}{2} > 5$ Simplification

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$\therefore$ since the resulting inequality is false, $(4, \frac{1}{2})$ **is not a solution** to $\frac{1}{2}x + y > 5$.

Thank you for watching.