



Examples

Linear Inequalities in Two Variables

Based on power point presentations by Pearson Education, Inc.
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Learning Objectives

1. Recognize linear inequalities in two variables.
2. Graph linear inequalities in two variables by hand.

Example 1: Graph a Linear Inequality in Two Variables (1 of 5)

Graph the linear inequality $y > 2x$ by hand.

Step 1 – Replace the inequality sign with an equal sign.

$y = 2x$ This is a linear equation in two variables.

Step 2 – Find and graph the boundary line which is the graph of the equation from Step 1.

Using $y = 2x$, we will utilize the intercept method to graph it.

Coordinates of the point associated with the x -intercept (when $y = 0$):

$$0 = 2x$$

$$x = 0$$

The coordinates of the point associated with the x -intercept are $(0, 0)$.

Example 1: Graph a Linear Inequality in Two Variables (2 of 5)

Step 2 continued:

Coordinates of the point associated with the y -intercept (when $x = 0$):

$$y = 2(0)$$

$$y = 0$$

The coordinates of the point associated with the y -intercept are $(0, 0)$.

We find that the intercept method did not result in two data points ... and without two data points we cannot graph a line. Let's use the Point-by-Point Plotting Method to find the coordinates of two other points.

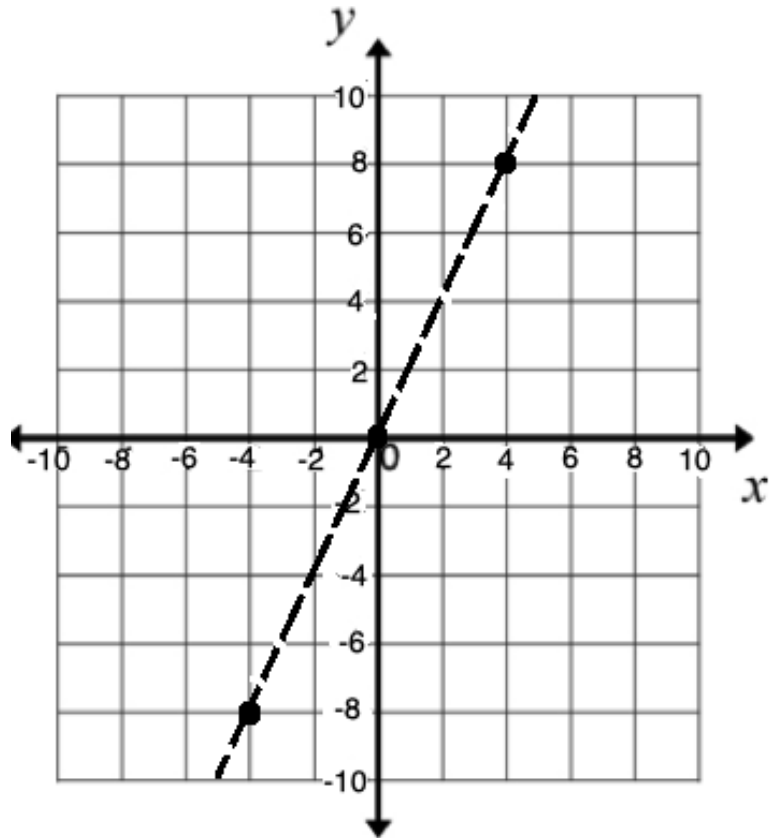
Let's use $x = 4$, then $y = 2(4)$ and $y = 8$. The coordinates of the additional point are $(4, 8)$.

Let's also use $x = -4$, then $y = 2(-4)$ and $y = -8$. The coordinates of the second point are $(-4, -8)$.

Example 1: Graph a Linear Inequality in Two Variables (3 of 5)

Step 2 continued:

Following is the graph of the linear equation $y = 2x$. This is the boundary line of the graph of $y > 2x$.



Example 1: Graph a Linear Inequality in Two Variables (4 of 5)

Step 3 – Find the portion of the coordinate plane to be included in the graph.

- Choose a “test point” to produce a “True” or “False” statement in the inequality.

We will use the point created by the ordered pair (4, 2) since it does not lie on the boundary line. See graph on previous slide.

We will then substitute the coordinates of the test point into the inequality $y > 2x$.

$$2 \stackrel{?}{>} 2(4)$$

$$2 \stackrel{?}{>} 8 \quad \text{This is “False” since 2 is not greater than 8.}$$

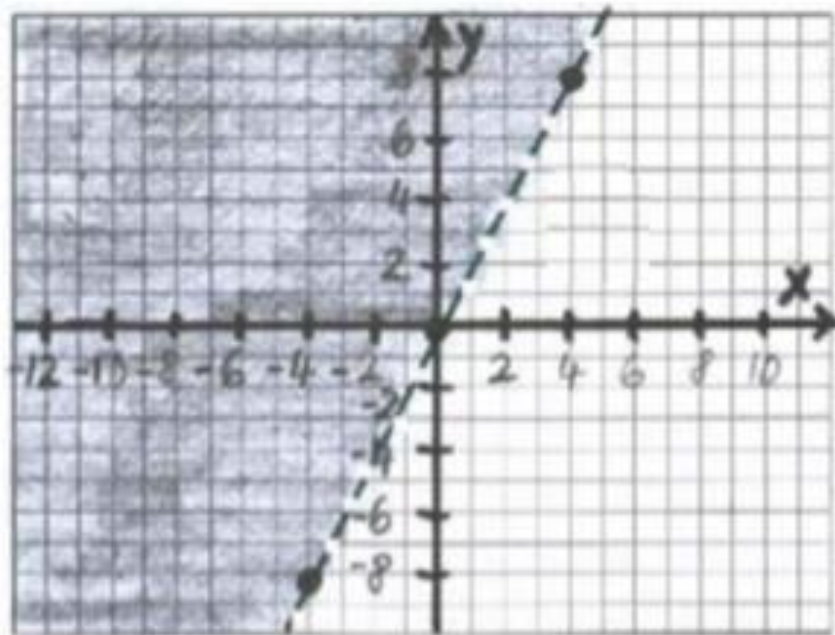
Example 1: Graph a Linear Inequality in Two Variables (5 of 5)

Step 3 continued:

- b. Shade the appropriate side of the boundary line.

Since the inequality is “false” given the test point $(4, 2)$, we shade the side of the boundary line that DOES NOT contain the test point.

This is the graph of $y > 2x$.



Example 2: Graph a Linear Inequality in Two Variables (1 of 5)

Graph the linear inequality $3y \geq -9x$ by hand.

Step 1 – Replace the inequality sign with an equal sign.

$3y = -9x$ This is a linear equation in two variables.

Step 2 – Find and graph the boundary line which is the graph of the equation from Step 1.

Using $3y = -9x$, we will utilize the intercept method to graph it.

Coordinates of the point associated with the x -intercept (when $y = 0$):

$$3(0) = -9x$$

$$x = 0$$

The coordinates of the point associated with the x -intercept are $(0, 0)$.

Example 2: Graph a Linear Inequality in Two Variables (2 of 5)

Step 2 continued:

Coordinates of the point associated with the y -intercept (when $x = 0$):

$$3y = -9(0)$$

$$y = 0$$

The coordinates of the point associated with the y -intercept are $(0, 0)$.

We find that the intercept method did not result in two data points ... and without two data points we cannot graph a line. Let's use the Point-by-Point Plotting Method to find the coordinates of two other points.

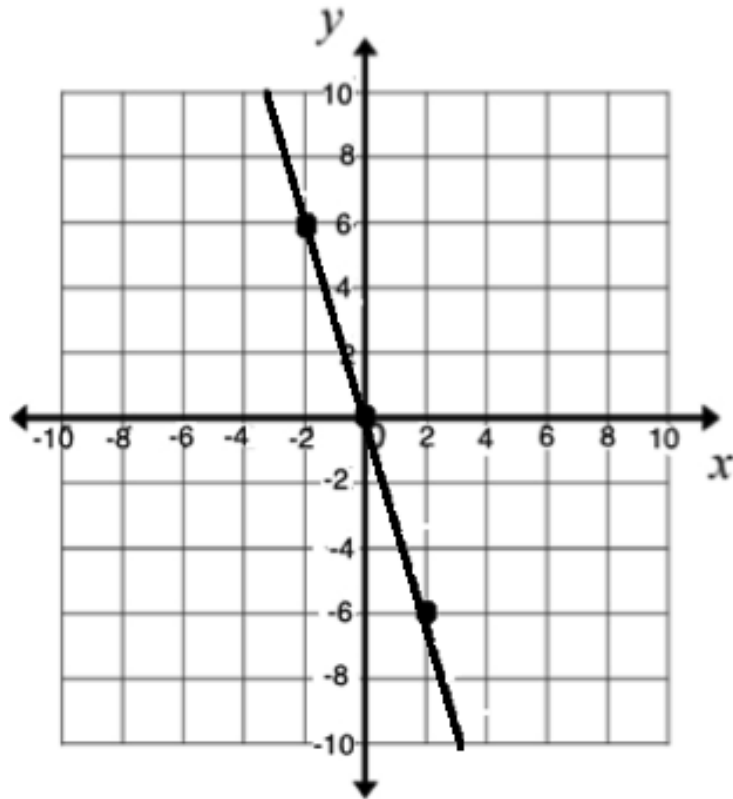
Let's use $x = 2$, then $3y = -9(2)$ and $y = -6$. The coordinates of the additional point are $(2, -6)$.

Let's also use $x = -2$, then $3y = -9(-2)$ and $y = 6$. The coordinates of the second point are $(-2, 6)$.

Example 2: Graph a Linear Inequality in Two Variables (3 of 5)

Step 2 continued:

Following is the graph of $3y = -9x$. This is the boundary line of the graph of $3y \geq -9x$.



Example 2: Graph a Linear Inequality in Two Variables (4 of 5)

Step 3 – Find the portion of the coordinate plane to be included in the graph.

- Choose a “test point” to produce a “True” or “False” statement in the inequality.

We will use the point created by the ordered pair (4, 2) since it does not lie on the boundary line. See graph in previous slide.

We will then substitute the coordinates of the test point into the inequality $3y \geq -9x$.

$$3(2) \stackrel{?}{\geq} -9(4) ?$$

$$6 \stackrel{?}{\geq} -36 \quad \text{This is “True” since 6 is greater than } -36.$$

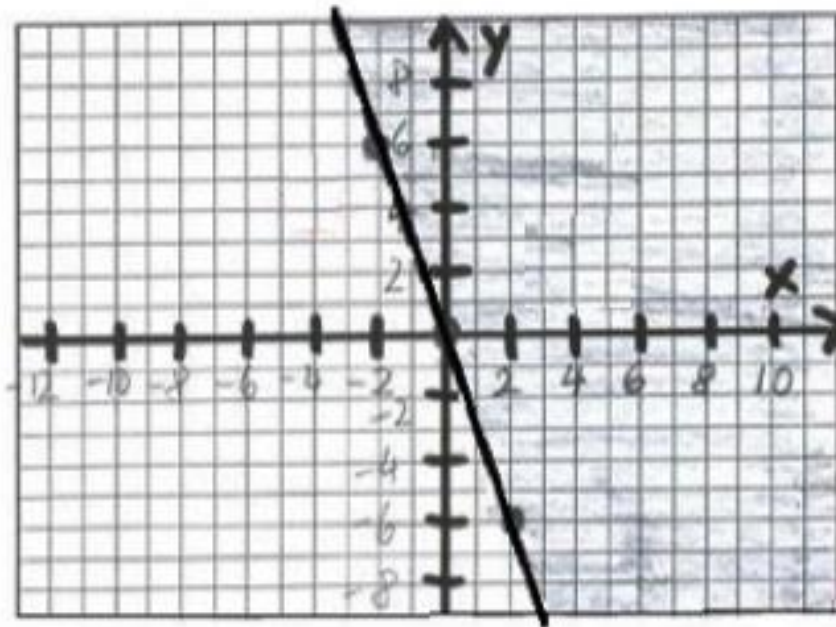
Example 2: Graph a Linear Inequality in Two Variables (5 of 5)

Step 3 continued:

- b. Shade the appropriate side of the boundary line.

Since the inequality is “true” given the test point $(4, 2)$, we shade the side of the boundary line that contains the test point.

This is the graph of $3y \geq -9x$.



Example 3: Graph a Linear Inequality in Two Variables (1 of 2)

Graph the linear inequality $y \geq 0$ by hand.

Step 1 – Replace the inequality sign with an equal sign.

$y = 0$ This is the equation of a horizontal line!

Step 2 – Find and graph the boundary line which is the graph of the equation of a line from Step 1.

$y = 0$ is the equation of the x -axis. This is our boundary line.

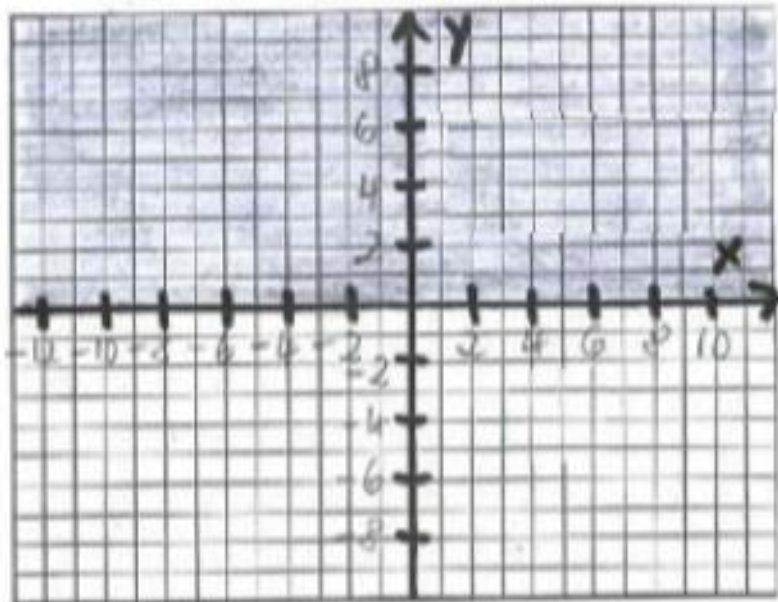
Since the inequality contains the “greater than or equal to” (\geq) symbol the x -axis is included in the graph.

Example 3: Graph a Linear Inequality in Two Variables (2 of 2)

Steps 3a & 3b – Choose a test point to produce a “True” or “False” statement then shade the appropriate side of the boundary line.

We use the test point $(2, 4)$ in $y \geq 0$ to get $4 \stackrel{?}{\geq} 0$. Don't worry about the x -coordinate. We don't need it! Of course, 4 is greater than 0, so the statement is “True”.

We shade the side of the boundary line that contains $(2, 4)$. See graph below.



Example 4: Graph a Linear Inequality in Two Variables (1 of 2)

Graph the linear inequality $x \leq 0$ by hand.

Step 1 – Replace the inequality sign with an equal sign.

$x = 0$ This is the equation of a vertical line!

Step 2 – Find and graph the boundary line which is the graph of the equation from Step 1.

$x = 0$ is the equation of the y -axis. This is our boundary line.

Since the inequality contains the “less than or equal to” (\leq) sign the y -axis is included in the graph.

Example 4: Graph a Linear Inequality in Two Variables (2 of 2)

Steps 3a & 3b – Choose a test point to produce a “True” or “False” statement then shade the appropriate side of the boundary line.

We use the “test point” (2, 3) in $x \leq 0$ to get $2 \stackrel{?}{\leq} 0$. Don’t worry about the y-coordinate. We don’t need it! Of course, 2 is NOT less than 0, so the statement is “False”.

We shade the side of the boundary line that DOES NOT contain (2, 3). See graph below.

