

Graphing Linear Inequalities in Two Variables

A solution to a linear inequality in two variables is any ordered pair that can be substituted for the variables in the inequality to make it true. When you graph a linear inequality, you graph a shaded region that includes all the points with ordered pairs that are solutions to the linear inequality. The shaded region has a boundary line with points that may or may not be part of the solution to the inequality.

Example

Graph the following linear inequality.

$$2x + 3y < 6$$

Step 1: Replace the inequality sign with an equal to sign and write the equation in slope-intercept form.

$$2x + 3y = 6$$

$$y = -\frac{2}{3}x + 2$$

Step 2: Plot at least three points of the resulting equation.

The equation from Step 1 is in slope-intercept form.

$$\text{slope: } -\frac{2}{3} \quad \text{y-intercept: } 2$$

Plot the y-intercept (0, 2). From there, since the slope is $-\frac{2}{3}$, go down 2, right 3 or up 2, left 3 to plot more points.

Step 3: Connect the points. Notice the sign in the original inequality to determine whether to use a solid or dashed line.

The boundary line connecting the points is dashed because the less than sign ($<$) is used in the original linear inequality. This means that the points on the boundary line are **not** part of the solution. When you substitute the coordinates from any point on the boundary line for the variables in the original linear inequality, the inequalities are false.

$2(0) + 3(2) < 6$	$2(3) + 3(0) < 6$	$2(-3) + 3(4) < 6$
$6 < 6$	$6 < 6$	$6 < 6$
false	false	false

The inequalities are all false, which verifies that the points on the boundary line are not part of the solution.

Step 4: **Select a test point.**

A **test point** is any point that is on either side of the boundary line. Use $(0, 0)$ if it's not on the boundary line. (Calculations are faster.)

Substitute the coordinates of the test point into the original inequality.

$$2x + 3y < 6$$

$$2(0) + 3(0) < 6$$

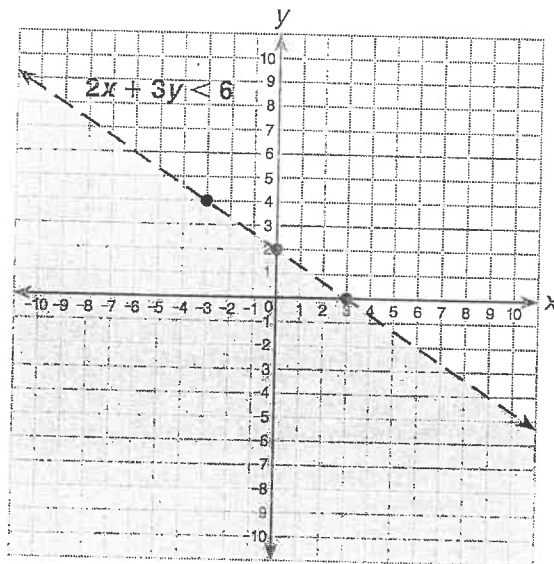
$$0 + 0 < 6$$

$$0 < 6 \text{ true}$$

Step 5: **Shade the side of the boundary line that satisfies the inequality.**

If the coordinates of the **test point** make the inequality **true**, shade the side of the boundary line where the test point is located.

If the coordinates of the **test point** make the inequality **false**, shade the side of the boundary line where the test point is **not** located.



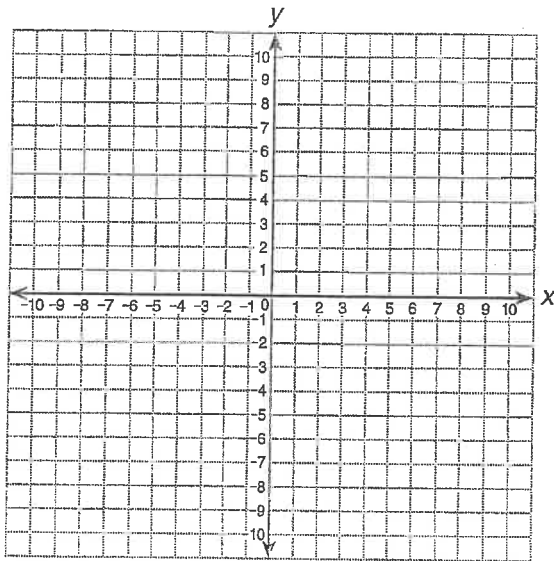
All solutions of the inequality lie in the shaded region of the coordinate plane and do not include the points on the boundary line.

TIP: Use a dashed line on the graph when you are given $>$ or $<$. Use a solid line when you are given \geq or \leq . (The points of the boundary line are part of the solution.)

Practice

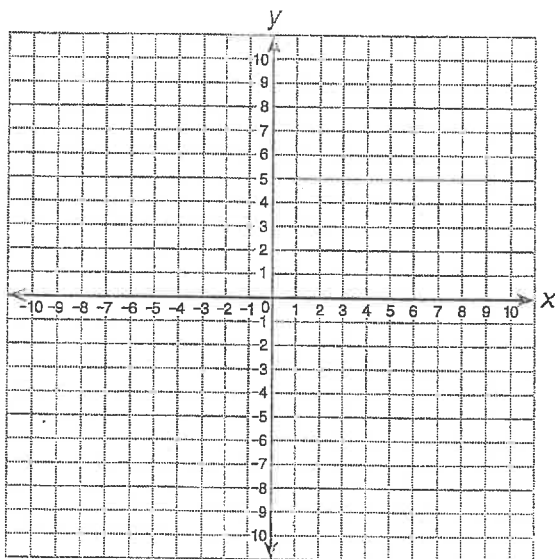
DIRECTIONS: For Numbers 1 through 4, graph the given linear inequality. Then write the ordered pairs of three points that are solutions to the inequality.

1 $2x + 3y < 12$



x	y

2 $x - y \geq 5$



x	y

DIRECTIONS: Read each question and choose the best answer.

- 1 What is the solution to the following inequality?

$$-\frac{5}{2}x + 11 \leq \frac{7}{2}x - 13$$

- A $x \geq 4$
 B $x \leq 4$
 C $x \geq -4$
 D $x \leq -4$

- 2 What is the solution to the following inequality?

$$4y + \frac{7}{4} \geq 1y + \frac{3}{4}$$

- A $y \leq \frac{1}{3}$
 B $y \geq \frac{1}{3}$
 C $y \leq -\frac{1}{3}$
 D $y \geq -\frac{1}{3}$

- 3 What is the solution to the following inequality?

$$-5z - 8 < -2.5$$

- A $z > 1.1$
 B $z < 1.1$
 C $z > -1.1$
 D $z < -1.1$

- 4 Which graph shows the solution to the inequality $y < -2x + 3$?

