

5.6 Graph Linear Inequalities in Two Variables

Essential Question How can you graph a linear inequality in two variables?

Core Vocabulary

linear inequality in two variables, p. 268
 solution of a linear inequality in two variables, p. 268
 graph of a linear inequality, p. 268
 half-planes, p. 268

Previous
 ordered pair

What You Will Learn

- ▶ Check solutions of linear inequalities.
- ▶ Graph linear inequalities in two variables.
- ▶ Use linear inequalities to solve real-life problems.

$$y = 2x + 4$$

Linear Inequalities

A **linear inequality in two variables**, x and y , can be written as

$$ax + by < c \quad ax + by \leq c \quad ax + by > c \quad ax + by \geq c$$

where a , b , and c are real numbers. A **solution of a linear inequality in two variables** is an ordered pair (x, y) that makes the inequality true.

$$x = 5$$

$$x < 5$$

$$0, 2, -16, \dots, \infty$$

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Example 1:

Tell whether the ordered pair is a solution of the inequality.

a. $2x + y < -3$; $(-1, 9)$

$$2(-1) + 9 < -3 ?$$

$$-2 + 9 < -3$$

$$7 < -3 \quad \times$$

not a sol.

b. $x - 3y \geq 8$; $(2, -2)$

$$2 - 3(-2) \geq 8 ?$$

$$2 + 6 \geq 8$$

$$8 \geq 8 \quad \checkmark$$

sol.

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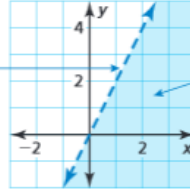
Graphing Linear Inequalities in Two Variables

The **graph of a linear inequality** in two variables shows all the solutions of the inequality in a coordinate plane.

READING

A **dashed boundary** line means that points on the line are **not solutions**. A solid boundary line means that points on the line are solutions.

All solutions of $y < 2x$ lie on one side of the boundary line $y = 2x$



The boundary line divides the coordinate plane into two **half-planes**. The **shaded** half-plane is the graph of $y < 2x$.

← ———→
 \leq $>$ dashed

\leq \geq
 solid

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Graph $y \leq 2$ in a coordinate plane. $y \leq \frac{1}{2}x - 2$

- 1) Solve the inequality for y (reverse arrow if $\# \div \text{neg}$)
- 2) Graph the related equation $y = 2$
- 3) Decide if boundary line is solid or dashed
 - * solid for $y \leq$ or $y \geq$ and dashed for $y <$ or $y >$
- 4) Decide which half-plane to shade for the solution
 - * for $y <$ shade below line and for $y >$ shade above

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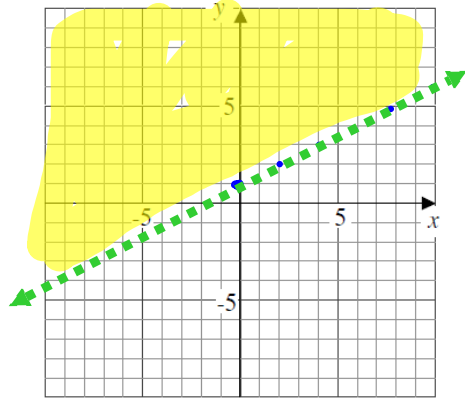
EXAMPLE 2:

Graph $-x + 2y > 2$ in a coordinate plane.

$$\begin{aligned} & \frac{-x + 2y > 2}{2} \\ & \frac{-x}{2} + \frac{2y}{2} > \frac{2}{2} \\ & y > \frac{1}{2}x + 1 \end{aligned}$$

$m = \frac{1}{2}$ $b = 1$

$(0,0)$
 $-0 + 2(0) > 2 ?$
 $0 > 2 \times$



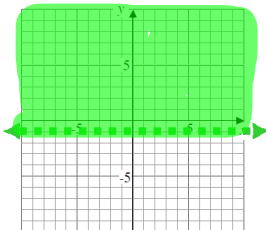
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Examples:

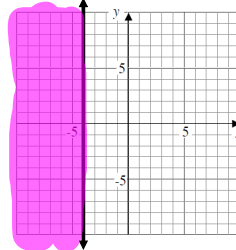
YOUR TURN:

Graph the inequality in a coordinate plane.

5. $y > -1$

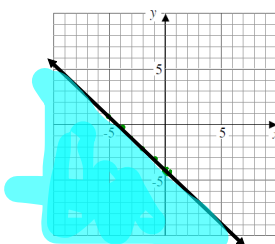


6. $x \leq -4$



7. $x + y \leq -4$

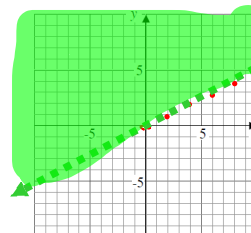
$y \leq -x - 4$



$(-4, 0)$
 $0 + 0 \leq -4$
 $\times 0 \leq -4$

8. $x - 2y < 0$

~~$-x - 2y < 0$~~
 $\frac{-x}{-2} \frac{-2y}{-2} < \frac{0}{-2}$
 $y > \frac{1}{2}x$



$(0, 1)$
 $0 - 2(1) < 0$
 $-2 < 0 \checkmark$

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Example 3:

You can spend at most \$10 on x grapes and y apples for a fruit salad. Grapes cost \$2.50 per pound, and apples cost \$1 per pound.

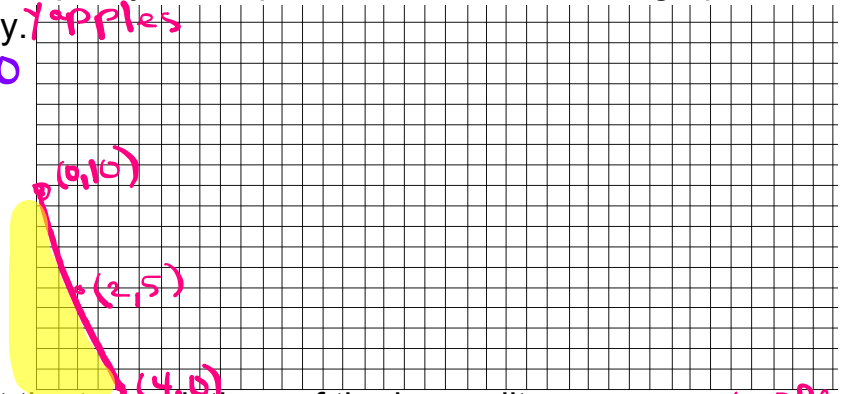
a) Write and graph an inequality that represents the amounts of grapes and apples you can buy.

$$2.50x + 1y \leq 10$$

$$y = -2.50x + 10$$

$$\downarrow 2.5$$

$$\rightarrow 1 = \frac{5}{2}$$



b) Identify and interpret the two solutions of the inequality.

(0, 10) would be 0 grapes and 10 apples.

(2, 5) two lbs of grapes and 5 lbs of apples.

(4, 0) only four lbs of grapes.

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Homework Assignment 5.6 Worksheet