Section 4.3
Graphing Inequalities with Two Variables

Because an inequality does not represent one exact answer \((a > -3)\), but a definite set of many answers, when we try to plot an inequality with two variables, the solution is a region containing many points.

**Example**: Graph the inequality \(y > x + 4\)

First we plot the boundary line by recognizing that the slope of the line is 1 (coefficient of \(x\)) and the \(y\)-intercept is 4 (See graph to the right).

Now we set the region using only the direction given by \(y\). According to the example, \((y >)\) \(y\) is “greater”, thus the solution area is above the line.

**Example**: Graph the inequality \(x \geq 1\)

Graphed in two dimensions, an inequality with only one variable is either vertical (\(x\) only) or horizontal (\(y\) only). In this case it is vertical passing through \(x \geq 1\).

Notice that in the two examples shown above, the line for “greater than” (\(>\)) is graphed dashed and the line for “greater than or equal to” (\(\geq\)) is graphed solid. Solid indicates that points ON the line are solutions.

**Example**: Graph the inequality \(y < -3\)

Graphed in two dimensions, an inequality with only one variable is either vertical (\(x\) only) or horizontal (\(y\) only). In this case it is horizontal passing through \(y < -3\).

Because the \(y\) in the inequality indicates “less than”, the solution area is found below the dashed (\(<\)) line.
Example: Graph the inequality \( y < \frac{1}{2}x + 2 \)

Because the inequality is already in \( y \)-intercept form, we can read the \( y \)-intercept as 2 and the slope as \( -\frac{1}{2} \).

Example: Graph the inequality \( 3x + 2y \leq 6 \)

Because the inequality is not in \( y \)-intercept form, we first turn it into \( y \)-intercept by solving for \( y \).

\[
3x - 3x + 2y \leq -3x + 6 \\
2y \leq -3x + 6 \\
\frac{2y}{2} \leq -\frac{3}{2}x + \frac{6}{2} \\
y \leq -\frac{3}{2}x + 3
\]

The \( y \)-intercept is 3 and the slope is \( -\frac{3}{2} \).

Because the inequality is \( y \leq \) (“less than or equal to”), the area is under the line and the line is solid.

Practice:
Graph the inequalities.

1. \( y > x + 5 \)
2. \( y \geq -3x + 1 \)
3. \( y < x - 2 \)
4. \( \frac{3}{4}x + \frac{2}{3}y \leq 6 \)
5. \( 3x - y > 7 \)
6. \( y - 2x < 5 \)
7. \( 4 \geq 2x - 6y \)
8. \( 2y \leq x - 3 \)
9. \( \frac{1}{2}x + y \leq 8 \)
10. \( 8 > y - 2x \)
11. \( x + y \geq 5 \)
12. \( y \leq \frac{3}{4}x - 4 \)
13. \( 4 \leq \frac{1}{4}x + y \)
14. \( 3x - 4y < 6 \)
15. \( y > 2 \)
16. \( 5y + x < 4 \)
17. \( 2y - x \geq 9 \)
18. \( x \leq -1 \)
19. \( 14 \geq 2y - 2x \)
20. \( x + y > 4 \)
21. \( y \leq \frac{3}{4}x - 4 \)
22. \( 5 > \frac{1}{2}x - y \)
23. \( 3x - 2y < 6 \)
24. \( y \leq 7 \)
25. \( 6y + x > 2 \)
26. \( 3y - x \geq 5 \)
27. \( x < -7 \)
Write the inequality represented in the graph.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.