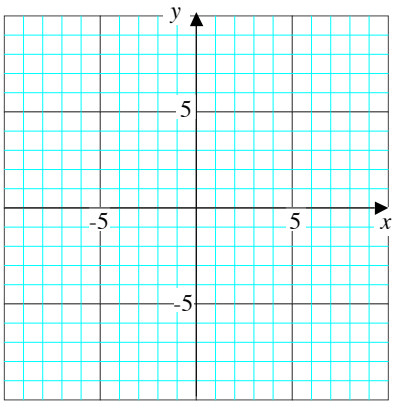
11.1 Absolute Value Equations and Inequalities

Example 1

1. Graph the function $f(x) = |x|$



x	$f(x) = \|x\|$
-8	
-6	
-4	
-2	
0	
2	
4	
6	
8	

2. Verify your result with a graphing calculator. Press `MATH/NUM/1:abs(` to get the absolute value

Absolute Value Property for Equations

For an expression E and a positive number k,

$$|E| = k \text{ is equivalent to } E = k \text{ or } E = -k$$

Example 2

Solve without a calculator. Then verify result by graphing.

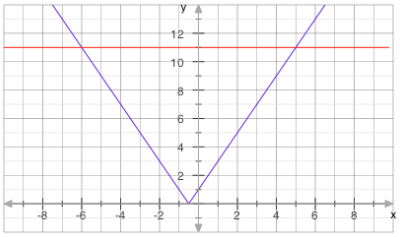
1. $|x| = 5$

2. $|x| = -6$

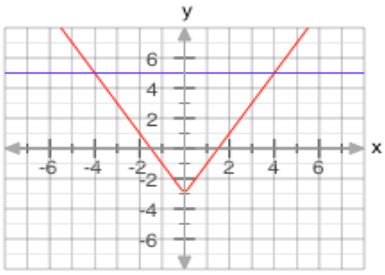
Example 3

Solve without a calculator. Then verify the result by graphing.

1. $|2x+1|=11$



2. $2|x|-3=5$



3. $|4p+12|=0$

4. $|2x-8|=-3$

5. $|6x-2|=|4x+5|$

Example 3

Solve by graphing $8-|x+3|=3|x+2|-6$

Example 5 Solving Absolute Value Inequalities

Graph the solution set. Write the solution set as an inequality and in interval notation.

1. $|x| \le 5$

2. $|x| > 5$

Absolute Value Property for Inequalities

For an expression E and positive number k.

1. $|E| < k$ is equivalent to $-k < E < k$
2. $|E| > k$ is equivalent to $E > k$ or $E < -k$

Absolute Value Property for Inequalities

For an expression E and positive number k.

1. $|E| < k$ is equivalent to $-k < E < k$
2. $|E| > k$ is equivalent to $E > k$ or $E < -k$

Example 6

Solve without a calculator. Describe the solution set as an inequality, in a graph and in interval notation. Verify with a graphing calculator.

1. $|2x - 3| \le 9$

2. $|3t + 4| > 12$

3. $7 - |x + 2| > 3$

Example 7

Solve without a calculator. Describe the solution set as an inequality, in a graph and in interval notation. Verify with a graphing calculator.

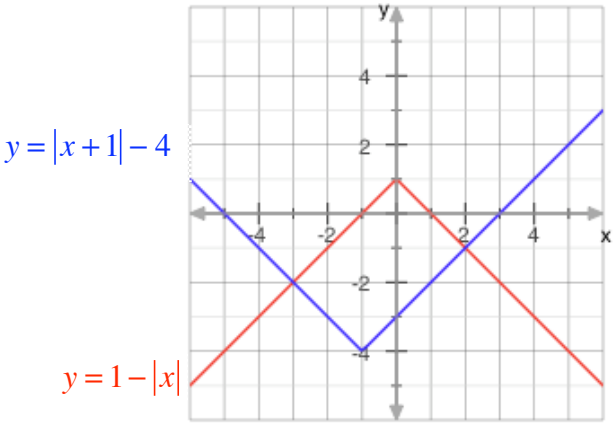
1. $|7x-10| \le -2$

2. $|5x-8| > -1$

Example 8

Use the graphs shown to solve the given equation/system.

1. $1-|x|=3$



2. $|x+1|-4=0$

3. $|x+1|-4=1-|x|$

11.2 Linear Inequalities in Two Variables; Systems of Linear Inequalities

Examples of linear inequalities in two variables are

$$y < \frac{1}{2}x + 1 \qquad y \le \frac{3}{4}x - 1 \qquad -2x - 3y > 6 \qquad x \le 6$$

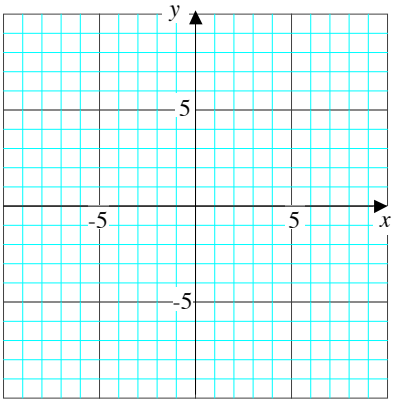
Steps to Graph Inequalities in Two Variables

1. Isolate y so that $y > mx + b$ (or $<, \le, \ge$).
2. Graph the equation $y = mx + b$ as either a solid or dashed line as follows.
   a. Graph a solid line if $\le$ or $\ge$ is in the inequality in step 1.
   b. Graph a dashed line if $<$ or $>$ is in the inequality in step 1.

3 Shade above or below the line as follows:
   a. Shade above the line if $>$ or $\ge$ is in the inequality from step 1.
   b. Shade below the line if $<$ or $\le$ is in the inequality from step 1.

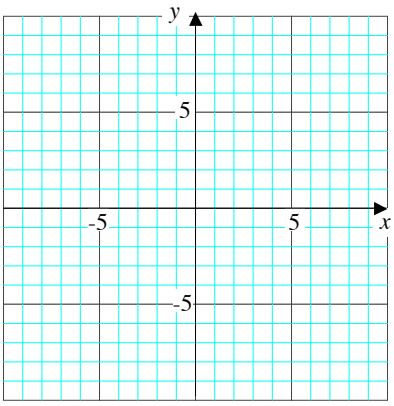
Example 1

Sketch the graph of $y < \frac{1}{2}x + 1$.



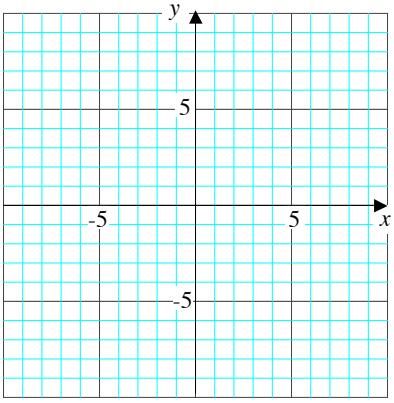
Example 2

Sketch the graph of $4y - 3x \leq -4$.



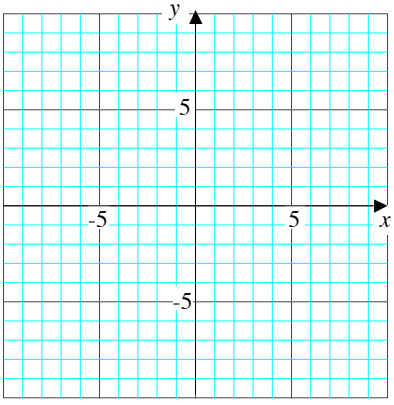
Example 3

Sketch the graph of $-2x - 3y > 6$.



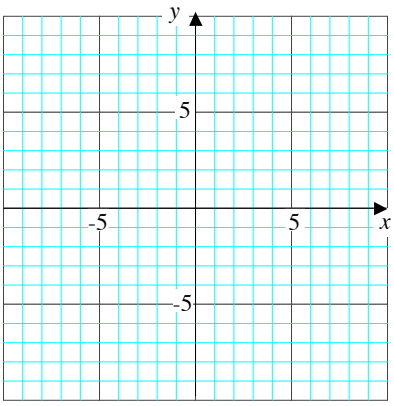
Example 4

Sketch the graph of $x > -3$.



Example 5

Sketch the graph of $y \le 6$.

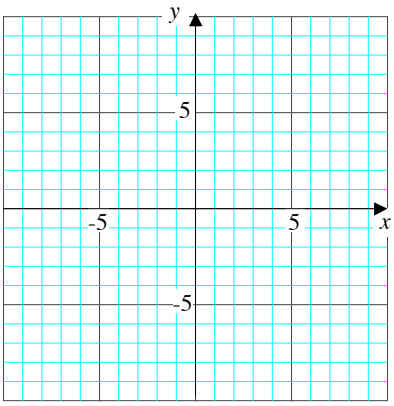


Example 6

Graph the solution set of the system the graph of

$$y \ge -2x + 1$$

$$y < \frac{1}{2}x - 3$$



Example 7

Graph the solution set of the system the graph of

$$y \ge 2x - 3$$

$$y \le -x + 5$$

$$x \ge 0$$

$$y \ge 0$$