

Solving Linear Inequalities

linear inequality - a pair of algebraic expressions of degree 1 or less surrounding an inequality.

Some of these inequalities include:

- ≥ greater than or equal to
- > greater than
- ≤ less than or equal to
- < less than

Solving a linear inequality is done in much the same that a linear equation is solved with the inclusion of one extra rule:

When both sides of an inequality are multiplied or divided by a negative, the direction of the inequality must be changed.

$$\begin{array}{r} 5 > -3 \\ -5 < 3 \end{array} \qquad \begin{array}{r} \frac{2}{-2} < \frac{8}{-2} \\ -1 > -4 \end{array}$$

Example 1

Solve the following linear inequalities.

a) $4x + 4 < 20$

$$\begin{array}{l} 4x < 20 - 4 \\ 4x < 16 \\ \frac{4x}{4} < \frac{16}{4} \\ x < 4 \end{array}$$

b) $2(x + 5) \leq 4(x + 4)$

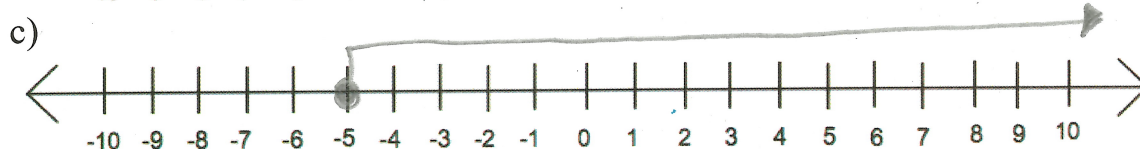
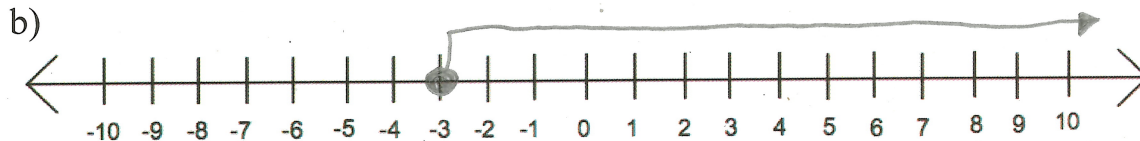
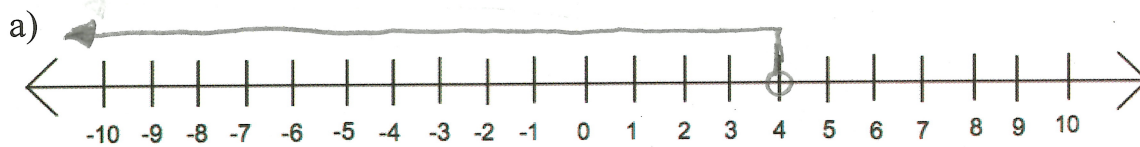
$$\begin{array}{l} 2x + 10 \leq 4x + 16 \\ 2x - 4x \leq 16 - 10 \\ -2x \leq 6 \\ \frac{-2x}{-2} \leq \frac{6}{-2} \\ x \geq -3 \end{array}$$

c) $6x - 1 \leq 9x + 14$

$$\begin{array}{l} 6x - 9x \leq 14 + 1 \\ -3x \leq 15 \\ \frac{-3x}{-3} \leq \frac{15}{-3} \\ x \geq -5 \end{array}$$

Example 2

Express your answers from Example 1 on a numberline.



$$2x - 5 \geq x - 1$$

$$2x - x \geq -1 + 5$$

$$x \geq 4$$

Linear inequalities can also be solved by graphing.

Example 3

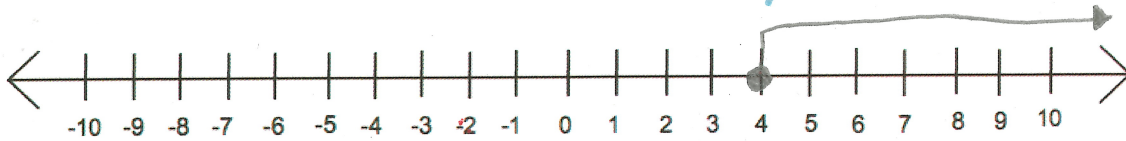
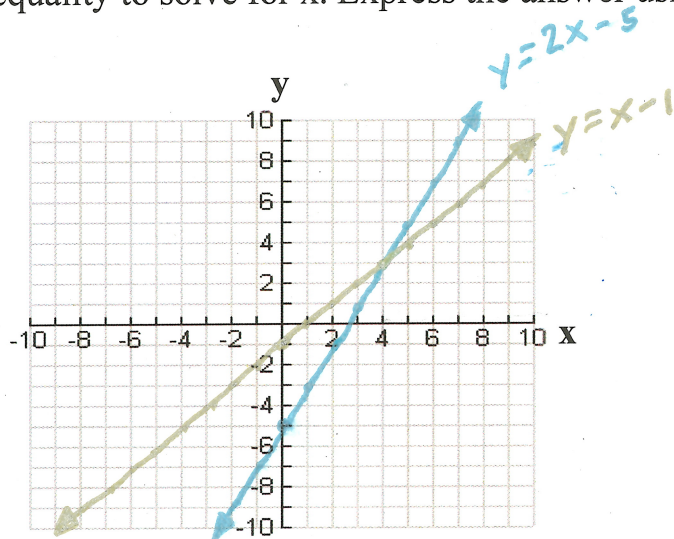
Create graphs for both sides of the inequality to solve for x . Express the answer using the numberline.

$$2x - 5 \geq x - 1$$

$y = 2x - 5$
 $m = 2$
 $b = -5$

$y = x - 1$
 $m = 1$
 $b = -1$

Solⁿ $x \geq 4$



Double inequalities are really a combination of two inequalities. They can be solved by determining where the two solutions overlap.

Example 4

Solve the double inequality.

$$30 \leq 3(2x + 4) - 2(x + 1) < 46$$

$$30 \leq 6x + 12 - 2x - 2 < 46$$

$$30 \leq 4x + 10 < 46$$

L.I.

$$30 \leq 4x + 10$$

$$-4x \leq 10 - 30$$

$$-4x \leq -20$$

$$\frac{-4x}{-4} \leq \frac{-20}{-4}$$

$$x \geq 5$$

R.I.

$$4x + 10 < 46$$

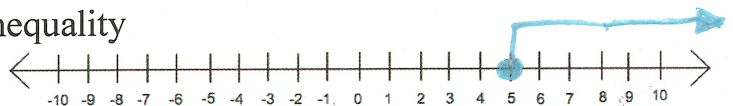
$$4x < 46 - 10$$

$$4x < 36$$

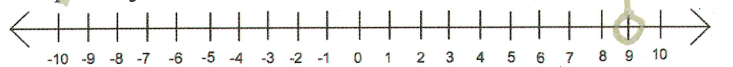
$$\frac{4x}{4} < \frac{36}{4}$$

$$x < 9$$

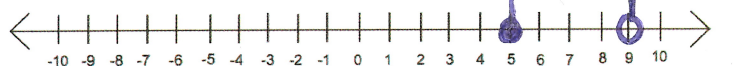
Left Inequality



Right Inequality



Final Solution



Final Solution

$$5 \leq x < 9$$

$$[5, 9)$$