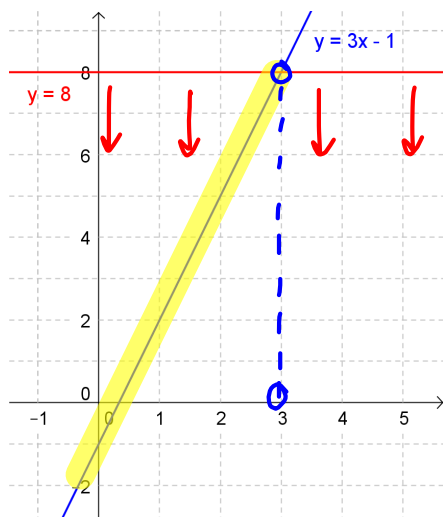


Solving Linear Inequalities

To solve an inequality, find all values that satisfy the inequality.

Consider:  $3x - 1 < 8$

The simplest way to visualize the solution is to graph and compare the LS and RS:



Where is the line  $y = 3x - 1$  less than the line  $y = 8$ ?

$$x < 3$$

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We have also solved such inequalities by:

- (1) solving the corresponding equation, then
- (2) testing values around the solution(s).

(1) Solve  $3x - 1 = 8$

$$\begin{aligned} 3x &= 9 \\ x &= 3 \end{aligned}$$

$$\begin{array}{cc} 3x - 1 < 8 \\ \text{LS} & \text{RS} \end{array}$$

(2) Test  $x < \frac{3}{\checkmark}$  and  $x > \frac{3}{x}$

test 2

$$\begin{aligned} \text{LS} &= 3(2) - 1 & \text{RS} &= 8 \\ &= 5 & & \\ & & \text{LS} &< \text{RS} \checkmark \end{aligned}$$

test 4

$$\begin{aligned} \text{LS} &= 3(4) - 1 \\ &= 11 \end{aligned}$$

$$\text{LS} < \text{RS} \times$$

$$\therefore x < 3$$

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$$3x - 1 < 8$$

$$(1) \text{ Solve } 3x - 1 = 8$$

$$3x = 9$$

$$x = 3$$

$$(2) \text{ Test } x < 3: 3(2) - 1 = 5, \text{ pass}$$

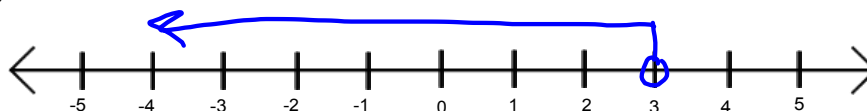
$$\text{Test } x > 3: 3(4) - 1 = 11, \text{ fail}$$

The solution can be represented as:

$$(a) \text{ set notation: } \{x \in \mathbb{R} | x < 3\}$$

$$(b) \text{ interval notation: } x \in (-\infty, 3)$$

(c) a number line:



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### Algebraic Operations on Inequalities

What are the effects of adding, subtracting, multiplying, and dividing on a very simple inequality?

Start with  $4 < 8$ , which is obviously true.

✓ add positive: $4 + 2 = 6$ $LS = 4 + 2 = 6$ $RS = 8 + 2 = 10$ $LS < RS$ ✓	✓ multiply by positive: $4 \times 3 = 12$ $LS = 12$ $RS = 8 \times 3 = 24$ $LS < RS$ ✓
✓ add negative: $4 + (-3) = 1$ $LS = 1$ $RS = 8 + (-3) = 5$ $LS < RS$ ✓	✗ multiply by negative: $4 \times (-4) = -16$ $LS = -16$ $RS = 8 \times (-4) = -32$ $LS < RS$ ✗
✓ subtract positive: $4 - 2 = 2$	✓ divide by positive: $4 \div 2 = 2$ $LS = 2$ $RS = 8 \div 2 = 4$ $2 < 4$ ✓
✓ subtract negative: $4 - (-4) = 8$	✗ divide by negative: $4 \div (-4) = -1$ $LS = -1$ $RS = 8 \div (-4) = -2$ $-1 > -2$ ✓

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## Solving Inequalities Algebraically:

We can use the same basic operations (add, subtract, multiply, divide) that we would with a regular equation.

**Note:** When multiplying or dividing by a negative value, the direction of the inequality must be switched.

Ex. Solve

(a)  $2x - 3 > 5$

$$2x > 8$$

$$x > 4$$

(b)  $\frac{-1}{3}(x + 4) \leq -7$   $[-3]$

$$(1)(x + 4) \geq 21$$

$$x + 4 \geq 21$$

$$x \geq 17$$

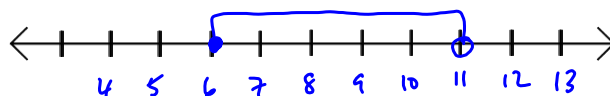
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For a double-inequality, perform each operation on all parts simultaneously.

Ex. Solve  $10 \leq 3(2x - 5) - (3x - 7) < 25$ .

Express your solution using:

- (a) set notation,
- (b) interval notation,
- (c) a number line.



$$10 \leq 6x - 15 - 3x + 7 < 25$$

$$10 \leq 3x - 8 < 25$$

$$18 \leq 3x < 33$$

$$6 \leq x < 11 \quad (a) \{x \in \mathbb{R} \mid 6 \leq x < 11\}$$

$$\{x \in \mathbb{R} \mid x \geq 6, x < 11\}$$

$$(b) x \in [6, 11)$$

↑ includes 6      ↑ does not include 11

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Assigned Work:

p.213 # 5bdf, 6be, 7bdf, 8, 9, 11, 15, 19

Oct 1-10:21 AM