

Linear Inequalities

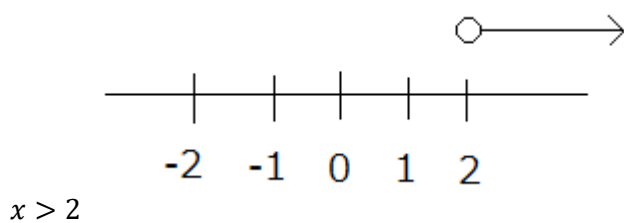
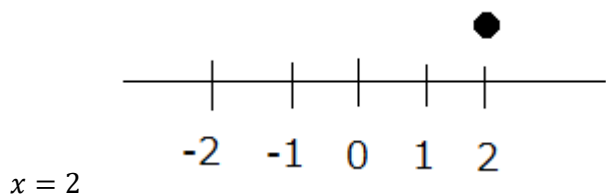
Contents

1. Why learn?	2
2. Examples	2
3. Properties.....	2
a. Addition and Subtraction	2
b. Multiplication and Division by POSITIVE number (Sign DOES NOT CHANGE)	2
c. Multiplication and Division by NEGATIVE number (Sign CHANGES).....	2
4. Exercise – Solve the inequalities.....	3
5. Solve 2 or more inequalities equation (use number lines to visualize)	3
6. Exercise – Solve 2 or more inequalities equation (use number lines to visualize)	3
7. Exercise – Solve quadratic inequalities (use number lines and draw graph to visualize).....	4

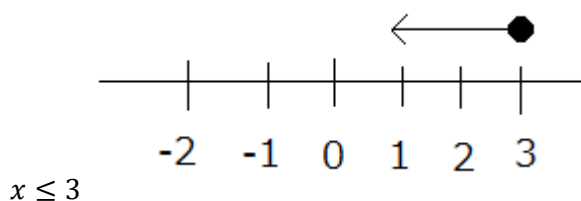
1. Why learn?

- Inequalities are used to represent a range of values
- Number of lines are used to illustrate and solve inequalities

2. Examples



2 is not included, $x = 3, x = 4 \dots$



3 is included, $x = 3, x = 2 \dots$

3. Properties

a. Addition and Subtraction

$$\text{if } x > y, \quad 5 > 3$$

$$x + b > y + b, \quad 5 + 2 > 3 + 2$$

$$x - b > y - b, \quad 5 - 2 > 3 - 2$$

b. Multiplication and Division by POSITIVE number (Sign DOES NOT CHANGE)

$$\text{if } x > y \text{ and } a > 0, \quad 7 > 4 \text{ and } 3 > 0$$

$$x \times a > y \times a, \quad 7 \times 3 > 4 \times 3$$

$$\frac{x}{a} > \frac{y}{a}, \quad \frac{7}{3} > \frac{4}{3}$$

c. Multiplication and Division by NEGATIVE number (Sign CHANGES)

$$\text{if } x > y \text{ and } a < 0, \quad 7 > 4 \text{ and } -2 < 0$$

$$x \times a < y \times a, \quad 7 \times -2 < 4 \times -2$$

$$\frac{x}{a} < \frac{y}{a}, \quad \frac{7}{-2} < \frac{4}{-2}$$

4. Exercise – Solve the inequalities

1	<p><i>Solve the inequality</i> $3x + 2 < 8$</p> $3x < 6$ $x < 2$
2	<p><i>Solve the inequality</i> $\frac{3x}{4} + 3 \leq x - 6$</p> $\frac{3x}{4} + 3 \leq x - 6$ $3x + 12 \leq 4x - 24$ $36 \leq x$
3	$\frac{x-2}{4} + \frac{2}{3} < \frac{x-4}{6}$ $3(x-2) + 8 < 2x - 8$ $3x - 6 + 8 < 2x - 8$ $3x + 2 < 2x - 8$ $x < -10$

5. Solve 2 or more inequalities equation (use number lines to visualize)

Case 1	$x > 1, \quad x > 3$ <i>ans: $x > 3$</i>
Case 2	$x < 1, \quad x < 3$ <i>ans: $x < 1$</i>
Case 3	$x > 1, \quad x < 3$ <i>ans: $1 < x < 3$</i>
Case 4	$x < 1, \quad x > 3$ <i>ans: no solution</i>

6. Exercise – Solve 2 or more inequalities equation (use number lines to visualize)

1	$3x + 4 > 13$ and $4x - 13 < 11$ $3x + 4 > 13, \quad 4x - 13 < 11$ $3x > 9, \quad 4x < 24$ $x > 3, \quad x < 6$ $3 < x < 6$
2	$\frac{1}{3}(x+7) < \frac{1}{6}(x+37) < x$ $\frac{1}{3}(x+7) < \frac{1}{6}(x+37), \quad \frac{1}{6}(x+37) < x$ $2x + 14 < x + 37, \quad x + 37 < 6x$ $x < 23, \quad 37 < 5x$ $x < 23, \quad \frac{37}{5} < x \rightarrow x > 7\frac{2}{5}$ $\frac{37}{5} < x < 23$

7. Exercise – Solve quadratic inequalities (use number lines and draw graph to visualize)

1	$(x - 1)(x - 5) < 0$ $x < 1, \quad x < 5$ $1 < x < 5$
2	$2x^2 < 5x + 3$ $2x^2 - 5x - 3 < 0$ $(2x + 1)(x - 3) < 0$ $x < -\frac{1}{2}, \quad x < 3$
3	$2x^2 < 5x + 3$ $2x^2 - 5x - 3 < 0$ $(2x + 1)(x - 3) < 0$ $x < -\frac{1}{2}, \quad x < 3$ $-\frac{1}{2} < x < 3$
4	$(2x + 1)(4 - x) \geq 4$ $8x - 2x^2 + 4 - x \geq 4$ $7x - 2x^2 \geq 0$ $x(7 - 2x) \geq 0$ $x \geq 0, \quad \frac{7}{2} \geq x$ $0 \leq x \leq \frac{7}{2}$
5	$-5 < x^2 - 5x + 1 < 15$ $-5 < x^2 - 5x + 1, \quad x^2 - 5x + 1 < 15$ $0 < x^2 - 5x + 6, \quad x^2 - 5x - 14 < 0$ $0 < (x - 3)(x - 2), \quad (x - 7)(x + 2) < 0$ $3 < x, \quad 2 < x, \quad x < 7, \quad x < -2$ $3 < x, \quad 2 > x, \quad x < 7, \quad x > -2$ $-2 < x < 2, \quad 3 < x < 7$