

1.7 Linear Inequalities in One Variable

In Exercises 1–6, write an inequality that represents the interval, and state whether the interval is bounded or unbounded.

2. $(2, 10]$



Properties of Inequalities

Let a , b , c , and d be real numbers.

1. Transitive Property

$$a < b \text{ and } b < c \implies a < c$$

2. Addition of Inequalities

$$a < b \text{ and } c < d \implies a + c < b + d$$

3. Addition of a Constant

$$a < b \implies a + c < b + c$$

4. Multiplication by a Constant

$$\text{For } c > 0, a < b \implies ac < bc$$

$$\text{For } c < 0, a < b \implies ac > bc$$

$$\text{For } c > 0, a \leq b \implies ac \leq bc$$

$$\text{For } c < 0, a \leq b \implies ac \geq bc$$

Solving an Absolute Value Inequality

Let x be a variable or an algebraic expression and let a be a real number such that $a \geq 0$.

1. The solutions of $|x| < a$ are all values of x that lie between $-a$ and a .

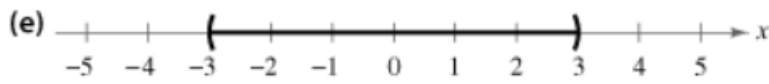
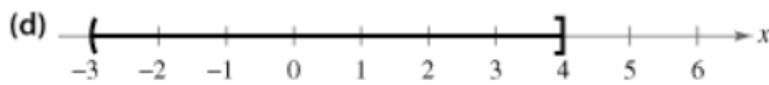
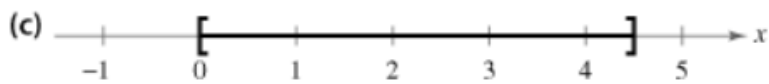
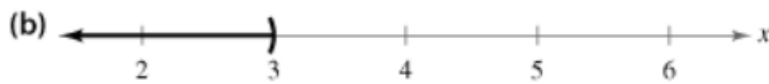
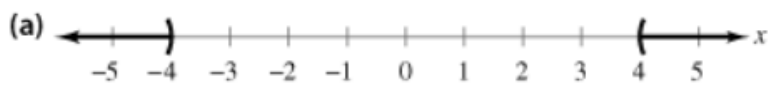
$$|x| < a \quad \text{if and only if} \quad -a < x < a.$$

2. The solutions of $|x| > a$ are all values of x that are less than $-a$ or greater than a .

$$|x| > a \quad \text{if and only if} \quad x < -a \quad \text{or} \quad x > a.$$

These rules are also valid if $<$ is replaced by \leq and $>$ is replaced by \geq .

In Exercises 7–12, match the inequality with its graph. [The graphs are labeled (a), (b), (c), (d), (e), and (f).]



8. $x \geq 5$

10. $0 \leq x \leq \frac{9}{2}$

12. $|x| > 4$

In Exercises 13–18, determine whether each value of x is a solution of the inequality.

18. $|2x - 3| < 15$

(a) $x = -6$

(b) $x = 0$

(c) $x = 12$

(d) $x = 7$

In Exercises 19–44, solve the inequality and sketch the solution on the real number line. (Some equalities have no solutions.)

30. $4(x + 1) < 2x + 3$

$$44. \quad 4.5 > \frac{1.5x + 6}{2} > 10.5$$

In Exercises 45–60, solve the inequality and sketch the solution on the real number line. (Some inequalities have no solution.)

$$54. |1 - 2x| < 5$$

58. $|x + 14| + 3 > 17$

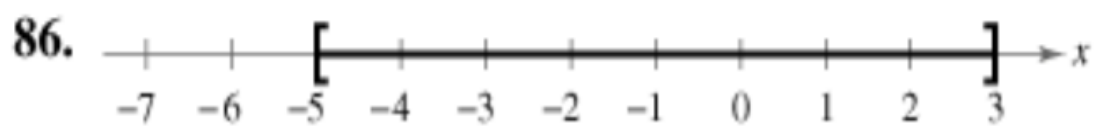
Graphical Analysis In Exercises 61–68, use a graphing utility to graph the inequality and identify the solution set.

$$66. |2x + 9| > 13$$

Graphical Analysis In Exercises 69–74, use a graphing utility to graph the equation. Use the graph to approximate the values of x that satisfy each inequality.

74. $y = \left| \frac{1}{2}x + 1 \right|$ (a) $y \leq 4$ (b) $y \geq 1$

In Exercises 83–90, use absolute value notation to define the interval (or pair of intervals) on the real number line.



104. Accuracy of Measurement You buy six T-bone steaks that cost \$3.98 per pound. The weight that is listed on the package is 5.72 pounds. The scale that weighed the package is accurate to within $\frac{1}{2}$ ounce. How much might you have been undercharged or overcharged?

