

§4-1**LINEAR INEQUALITIES****Definition**

Linear inequalities in one variable are inequalities which can be written in one of the following forms: $ax + b > 0$
 $ax + b < 0$
 $ax + b \geq 0$
 $ax + b \leq 0$ where a and b are real numbers.

Properties**The Addition Properties of Inequalities**

If $a > b$ and c is a real number then $a + c > b + c$.

If $a < b$ and c is a real number then $a + c < b + c$.

Properties**The Multiplication Properties of Inequalities**

If $a > b$ and c is a positive real number then $ac > bc$.

If $a < b$ and c is a positive real number then $ac < bc$.

If $a > b$ and c is a negative real number then $ac < bc$.

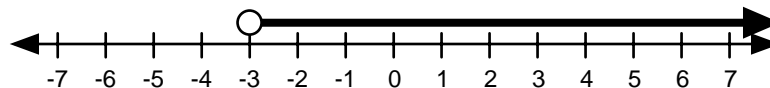
If $a < b$ and c is a negative real number then $ac > bc$.

Example 1

Solve the inequality, $5x + 15 > 0$.

Solution

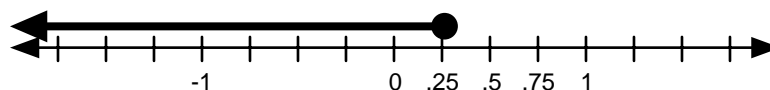
$$\begin{aligned} 5x + 15 &> 0 \\ 5x + 15 - 15 &> 0 - 15 \\ 5x &> -15 \\ \frac{5x}{5} &> \frac{-15}{5} \\ x &> -3 \end{aligned}$$

**Example 2**

Solve the inequality, $4x + 5 \leq 6$.

Solution

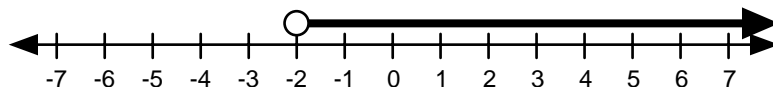
$$\begin{aligned} 4x + 5 &\leq 6 \\ 4x + 5 - 6 &\leq 6 - 6 \\ 4x &\leq 1 \\ \frac{4x}{4} &\leq \frac{1}{4} \\ x &\leq \frac{1}{4} \end{aligned}$$



Example 3 Solve the inequality, $-2x - 4 < 0$.

Solution

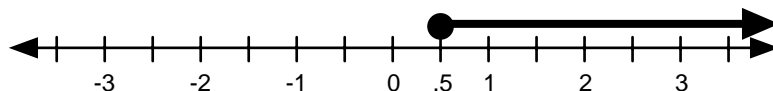
$$\begin{aligned} -2x - 4 &< 0 \\ -2x - 4 + 4 &< 0 + 4 \\ -2x &< 4 \\ \frac{-2x}{-2} &> \frac{4}{-2} \\ x &> -2 \end{aligned}$$



Example 4 Solve the inequality, $-16x + 7 \leq 2x - 2$.

Solution

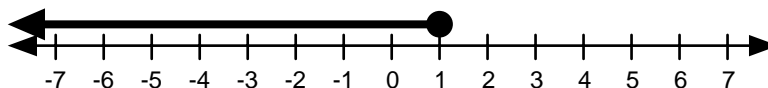
$$\begin{aligned} -16x + 7 &\leq 2x - 2 \\ -16x + 7 - 7 &\leq 2x - 2 - 7 \\ -16x &\leq 2x - 9 \\ -16x - 2x &\leq 2x - 9 - 2x \\ -18x &\leq -9 \\ \frac{-18x}{-18} &\geq \frac{-9}{-18} \\ x &\geq \frac{1}{2} \end{aligned}$$



Example 5 Solve the inequality, $(x - 3)^2 \geq x^2 + 3$.

Solution

$$\begin{aligned} (x - 3)^2 &\geq x^2 + 3 \\ x^2 - 6x + 9 &\geq x^2 + 3 \\ x^2 - 6x + 9 - x^2 &\geq x^2 + 3 - x^2 \\ -6x + 9 &\geq 3 \\ -6x + 9 - 9 &\geq 3 - 9 \\ -6x &\geq -6 \\ \frac{-6x}{-6} &\leq \frac{-6}{-6} \\ x &\leq 1 \end{aligned}$$



Solve each linear inequality and graph the solution on a number line.

1. $3x > 36$

2. $x + 14 < 64$

3. $x - 7 \geq 43$

4. $\frac{x}{4} \leq 8$

5. $3y - 2 < -14$

6. $-2x > 14$

7. $2r + 1 \leq 4r - 5$

8. $\frac{2x}{3} \geq 6$

9. $-2(x - 3) > 8$

10. $1 - 2t < 7$

11. $2(m - 5) \geq -9$

12. $\frac{x}{9} - 5 \leq 40$

13. $\frac{5x}{3} < 10$

14. $13x + 57 > 182$

15. $14 \leq 3x - 4$

16. $5(b - 3) \geq 7$

17. $\frac{x}{3} + 1 > 22$

18. $12x - 3 < 8x - 9$

19. $-3k \geq -2$

20. $2x + 1 \leq 5$

21. $\frac{7 - 2s}{3} < 2$

22. $6s + 8 > 8 - 5s$

23. $\frac{2 + 9x}{6} \leq 12$

24. $6s + 3 \geq 4s - 1$

25. $4 + 6(r + 2) > 9$

26. $7 - 2x < 1$

27. $\frac{3t}{2} - 10 \geq 6$

28. $0.3c + 1.5 \leq 0.8c$

29. $0.1(v - 8) < 10$

30. $\frac{3w}{2} - \frac{5}{6} > \frac{w}{3}$

31. $41.7x - 13.2 \leq 91.8$

32. $\frac{2}{3}t + 8 \geq \frac{5}{4}t$

33. $6(k + 10) > 5(k + 14)$

34. $3t - 7 < 8t + 5$

35. $1.83 \geq 7x - 4.19$

36. $r + \frac{1}{3} \leq \frac{2}{3}r + \frac{5}{6}$

37. $3s + 1 < 7s - 15$

38. $\frac{3y}{4} + 7 > 10$

39. $2 - 2(7 - 2x) \leq 3(3 - x)$

40. $8 - 9a \geq 9a - 8$

41. $\frac{3}{5}(2t - 4) > \frac{1}{5}t$

42. $4(1 - b) < 2(b + 14)$

43. $\frac{5x}{2} + 2 \geq 3x - 1$

44. $3a + 2 \leq \frac{a}{5} - 4$

45. $5 - x < \frac{2x}{3} - 6$

46. $\frac{x}{2} - \frac{2}{3} > \frac{1}{4}$

47. $\frac{2x}{3} - \frac{1}{2} \leq \frac{1}{4}$

48. $\frac{2x}{3} - 2 \geq \frac{1}{5}$

49. $3 + 2(x + 5) > x + 5(x + 1) + 1$

50. $3 - 5t < 18$

- | | | | |
|------------------------|--------------------------|------------------------------|----------------------------|
| 1. $x > 126$ | 2. $x < 50$ | 3. $x \geq 50$ | 4. $x \leq 32$ |
| 5. $y < -4$ | 6. $x < -7$ | 7. $r \geq 3$ | 8. $x \geq 9$ |
| 9. $x < -1$ | 10. $t > -3$ | 11. $m \geq \frac{1}{2}$ | 12. $x \leq 405$ |
| 13. $x < 6$ | 14. $x > \frac{125}{13}$ | 15. $x \geq 6$ | 16. $b \geq \frac{22}{5}$ |
| 17. $x > 63$ | 18. $x < -\frac{3}{2}$ | 19. $k \leq \frac{2}{3}$ | 20. $x \leq 2$ |
| 21. $x > \frac{1}{2}$ | 22. $s > 0$ | 23. $x \leq \frac{70}{9}$ | 24. $s \geq -2$ |
| 25. $r > -\frac{7}{6}$ | 26. $x > 3$ | 27. $t \geq \frac{32}{3}$ | 28. $c \geq 3$ |
| 29. $v < 9$ | 30. $w \geq \frac{5}{7}$ | 31. $x \leq \frac{350}{139}$ | 32. $t \leq \frac{96}{7}$ |
| 33. $k > 10$ | 34. $t > -\frac{12}{5}$ | 35. $x \leq -\frac{43}{50}$ | 36. $r \leq \frac{3}{2}$ |
| 37. $s > 4$ | 38. $y > 4$ | 39. $x \leq 3$ | 40. $a \leq \frac{9}{8}$ |
| 41. $t > \frac{12}{5}$ | 42. $b > -4$ | 43. $x \leq 6$ | 44. $a \leq -\frac{15}{7}$ |
| 45. $x > \frac{33}{5}$ | 46. $x > \frac{11}{6}$ | 47. $x \leq \frac{9}{8}$ | 48. $x \geq \frac{33}{10}$ |
| 49. $x < \frac{7}{4}$ | 50. $t > -3$ | | |