

3.3 Linear Inequalities

Basic Concepts Symbolic Solutions Numerical and Graphical Solutions An Application

Key Terms

Use the vocabulary terms listed below to complete the statements in exercises 1-8.

$f(x) = ax + b$	equivalent	set-builder
$ax + b = 0$	solve	break-even point
	solution set	linear inequality

1. A(n) _____ in one variable is an inequality that can be written in the form $ax + b > 0$, where $a \neq 0$. (The symbol $>$ may be replaced with \geq , $<$, or \leq .)
2. A linear function is given by _____.
3. A linear equation is given by _____.
4. To _____ an inequality means to find all values for a variable that make the statement true.
5. The set of all solutions to an inequality is called the _____.
6. Often, the solutions to an inequality are written in _____ notation.
7. Two inequalities are _____ if they have the same solution set.
8. The _____ occurs when revenue equals cost.

Exercises 9-11: Let a , b , and c be real numbers. Fill in the blank with the proper inequality symbol, $<$ or $>$.

9. If $a > b$, then $a + c$ _____ $b + c$.

10. If $c > 0$ and $a > b$, then ac _____ bc .

11. If $c < 0$ and $a > b$, then ac _____ bc .

Symbolic Solutions

Exercises 1-12: Solve each inequality. Write the solution set in set-builder notation.

1. $x + 2 < 7$ 1. _____

2. $z - 3 > -1$ 2. _____

3. $2 - 3x \leq 11$ 3. _____

4. $-4 + 2x \leq 5$ 4. _____

5. $\frac{1}{2}(x - 6) - (3 - x) < -1$ 5. _____

6. $-(7 + z) + 2(z - 3) \geq 4$ 6. _____

7. $2x + 4 > 3x - 5$

7. _____

8. $2(t - 18) \leq 4t - 16$

8. _____

9. $\frac{4}{3}(z - 6) < \frac{1}{3}(z + 2) - 4$

9. _____

10. $\frac{2x - 4}{3} \geq \frac{x - 2}{4} + 3x$

10. _____

11. $-\frac{2}{3}x + 2(3 + x) > \frac{x + 1}{6}$

11. _____

12. $-0.2(x - 5) - x \geq 0.4$

12. _____

Numerical and Graphical Solutions

Exercises 13-15: Use the table to find the solution set for each equation or inequality. Write the solution set in set-builder notation.

x	-1	0	1	2	3	4	5
$\frac{3}{2}x - 3$	$-\frac{9}{2}$	-3	$-\frac{3}{2}$	0	$\frac{3}{2}$	3	$\frac{9}{2}$

13. $\frac{3}{2}x - 3 = 0$

13. _____

14. $\frac{3}{2}x - 3 < 0$

14. _____

15. $\frac{3}{2}x - 3 \geq 0$

15. _____

Exercises 16-18: Use the table to find the solution set for each equation or inequality. Write the solution set in set-builder notation.

x	-3	-2	-1	0	1	2	3
$-3x + 3$	12	9	6	3	0	-3	-6

16. $-3x + 3 = 0$

16. _____

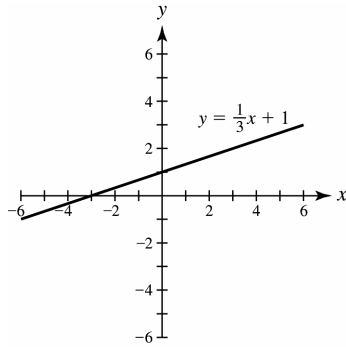
17. $-3x + 3 \leq 0$

17. _____

18. $-3x + 3 > 0$

18. _____

Exercises 19-21: Use the figure to find the solution set to each equation or inequality. Write the solution set in set-builder notation.



19. $\frac{1}{3}x + 1 = 0$

19. _____

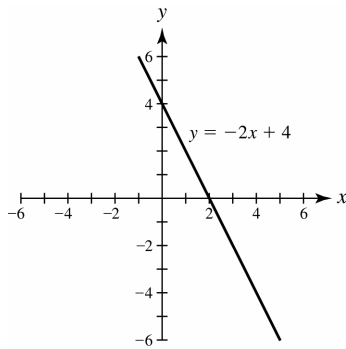
20. $\frac{1}{3}x + 1 \leq 0$

20. _____

21. $\frac{1}{3}x + 1 > 0$

21. _____

Exercises 22-24: Use the figure to find the solution set to each equation or inequality. Write the solution set in set-builder notation.



22. $-2x + 4 = 0$

22. _____

23. $-2x + 4 < 0$

23. _____

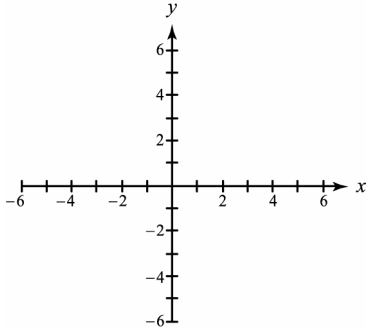
24. $-2x + 4 \geq 0$

24. _____

Exercises 25-28: Solve the inequality graphically. Write the solution set in set-builder notation.

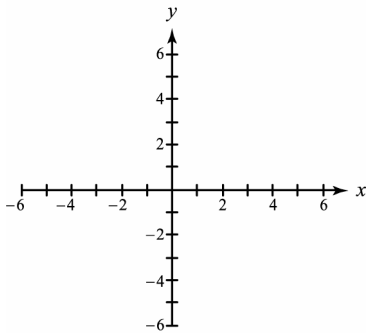
25. $3 - x > 0$

25. _____



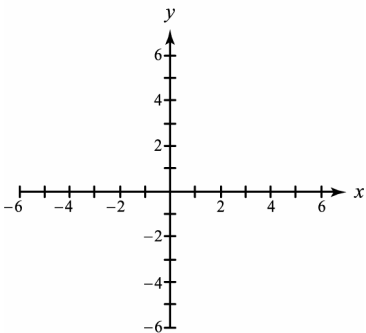
26. $-2x + 5 \leq -3$

26. _____



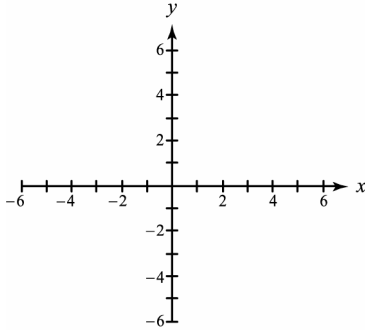
27. $3(x-1) - 2 > 10$

27. _____



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

28. _____



An Application

29. A student scores 79, 82, and 73 on three 100-point exams. If the final exam is worth 200 points, find the range of final exam scores S that gives the student an overall percentage of 80% or higher.

29. _____

30. Body Mass Index, BMI, gives a recommended relationship between a person's height H (in inches) and weight W (in pounds) and is given by $\text{BMI} = \frac{705W}{H^2}$. If a person is 68 inches tall, approximate the range of weights W that results in a BMI between 19 and 25, inclusively.

30. _____