

Chapter 3

Summary and Vocabulary

- ▶ **Constant-increase** and **constant-decrease situations** can be described by algebraic expressions of the form $ax + b$ (where x is changing) and equations of the form $ax + b = c$. Since the points (x, y) that satisfy the equation $y = ax + b$ lie on a line, we call the expressions *linear expressions* and the equations *linear equations*.
- ▶ There are many ways to solve an equation of the form $ax + b = c$. A **table of values** of the expression $ax + b$ may give a value that equals c . A **graph** of $y = ax + b$ may reach the value c at a point whose x -coordinate can be determined. For example, to solve $3x - 46 = 17$, you can make a table of values of $3x - 46$ for various values of x and check if 17 appears as a value of y . You can graph $y = 3x - 46$ and check if it crosses the line $y = 17$. Graphs and tables may be created by hand, but they are easily produced with the aid of technology.
- ▶ Tables and graphs can picture how a quantity is changing, but they are not reliable methods for finding an exact solution to a linear equation. A sure method is to use the **Addition and Multiplication Properties of Equality** to change the given equation into a simpler equation. For example, to solve $3x - 46 = 17$, you might add 46 to each side, resulting in $3x = 63$. Then multiply each side by $\frac{1}{3}$, resulting in $x = 21$. The solution 21 checks in the original equation.
- ▶ **Linear inequalities** can be solved by finding equivalent inequalities in much the same way that equivalent equations can be found to solve linear equations. For example, $-3x - 46 < 17$ is solved by adding 46 to each side and then dividing each side by -3 to get $x > 21$. Notice that when multiplying or dividing by a negative number, the inequality sign is reversed.
- ▶ To remove fractions from an equation, you can find a common multiple of the denominators and then multiply each side by that multiple.

Theorems and Properties

Multiplication Property of Inequality
(Parts 1 and 2) (p. 157)

Addition Property of Inequality
(p. 162)

Vocabulary

3-1

constant-increase situation
collinear
constant-decrease situation

3-2

solution to an equation

3-3

equivalent equations

3-6

inequality
boundary point
interval
endpoint

Chapter

3

Self-Test

Take this test as you would take a test in class. You will need a calculator. Then use the Selected Answers section in the back of the book to check your work.

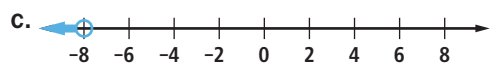
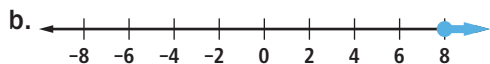
In 1–3, solve and check the equation.

- $4t - 5 = 13$
- $5(2 + t) = -10$
- $101 = 13f - 2(4 + 3f)$

In 4–6, solve the inequality.

- $3(x - 4) \geq 12$
- $5x + 14 < -26$
- $26 - 2x > 10$

7. Match the solutions to Questions 4–6 with the graphs below.



- Solve $\frac{n}{4} - \frac{n}{8} = 3$ by clearing fractions.
- A school held a fund-raising raffle that had three winners and one grand-prize winner. The value of the grand prize was twice the value of the other prizes combined. Together the prizes had a value of \$3,500. What was the value of the grand prize?
- Write down the steps you should take to solve the equation $-15 = -2x + 7$ for x . Solve the equation and check your answer.
- In 11–13, use the following situation. Allison has \$350 in her checking account and she withdraws \$20 each month to pay for her school lunch ticket. After m months she has $t = 350 - 20m$ dollars in the account.
 - Make a table of values for the relationship.
 - Make a graph from the table.
 - When will Allison have \$190?
- Make a table to solve the inequality $30 < 2x - 6$.
- Which commands would you enter on a CAS to find solutions to the inequality $5 - 3x > 17$? What are the solutions?
- Toni is collecting leaves for a school science project. She needs to have 37 different types of leaves for the project. Toni already has 9 leaves and she plans on collecting 7 more each weekend. When will Toni have enough leaves to complete her project?
- In 2006, the United States Postal Service charged \$0.39 for the first ounce and \$0.24 for each additional ounce for first-class mail.
 - Write an equation for the price P of a first class letter that weighs w ounces.
 - Use your equation from Part a to find the weight of a package that costs \$3.27 to ship.

Chapter 3

Chapter Review

SKILLS Procedures used to find answers

OBJECTIVE A Solve and check linear equations of the form $ax + b = c$.

(Lessons 3-4, 3-5)

In 1-12, solve and check the equation.

- $4t + 3 = 15$
- $5x + -3x + 6 = 12$
- $(4 + n) + -10 = -4 + 5$
- $-470 + 2r = 1,100$
- $0.9y + 11.2 + 1.7y = 131.2$
- $5(s + 4) = 85$
- $4,000W - 8,000 = 12,000$
- $21 = 2x + 3(2 + x)$
- $\frac{2}{3}z + 14 = 4$
- $16 = \frac{3}{4}x + 22$
- $3(w + 4) - 4(2w - 2) = 7$
- $\frac{n}{5} - \frac{2n}{11} = 6$

OBJECTIVE B Solve and check linear inequalities of the form $ax + b < c$.

(Lessons 3-7, 3-8)

In 13-16, solve and check the inequality.

- $2x + 11 < 199$
- $-3 + d + 6 < 4$
- $-28 \leq 18 - 3y - 7$
- $4 < -16t + 7t + 5$

PROPERTIES The principles behind the mathematics

OBJECTIVE C Apply the Addition and Multiplication Properties of Equality and Inequality. (Lessons 3-3, 3-6, 3-8)

SKILLS
PROPERTIES
USES
REPRESENTATIONS

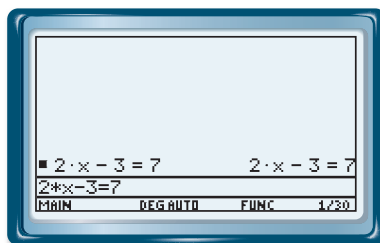
In 17 and 18, explain what has been done to both sides of the first equation to get the second equation.

17. If $17d - 17 = 22$, then $17d = 39$.

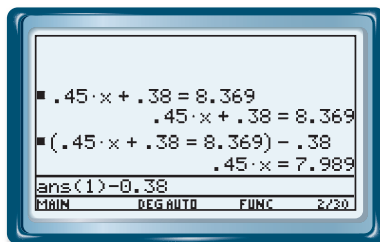
18. If $\frac{11}{12}b = \frac{2}{3}$, then $11b = 8$.

In 19 and 20, write a command you would enter in a CAS to complete the next step in solving the equation. Then predict the output of the CAS.

19.



20.



21. Given the inequality $-x \geq 4$, Desiree writes $x \leq -4$ as the next step. Is she correct? Why or why not?

22. To solve $5y + 38 < 50$, Kaya subtracts 38 from both sides. What inequality should she get?

USES Applications of mathematics in real-world situations

OBJECTIVE D Use linear equations and inequalities of the form $ax + b = c$ or $ax + b < c$ to solve real-world problems. (Lessons 3-2, 3-4, 3-5, 3-7, 3-8)

23. If the temperature is -12°C , by how much must it increase to become hotter than 14°C ?
24. Monica has \$250 in the bank and has a job that pays her \$9 per hour. She deposits all the money she earns into a savings account. How long will it take her to save a total of \$439?
25. Bo Constrictor earns \$7.80 per hour at the zoo. He also receives weekly a \$25 meal allowance, \$15 for transportation, and \$7.50 for dry cleaning. Last week he was paid a total of \$297.10. How many hours did he work last week?
26. A \$98,100 estate is to be split among four children and a grandchild after \$5,000 in estate expenses are paid. Each child gets the same amount and the grandchild gets half that amount. How much will each receive?
27. Saudi Arabia has about one-fourth of the world's oil reserves. The rest of the Middle East has approximately two-fifths of the world's oil reserves. Together they have about 660 billion barrels. How many barrels are estimated to be in the world's oil reserve?
28. A small cup is 2 inches high. When stacked, each cup adds $\frac{3}{32}$ inch to the height of the stack. How many cups are in a stack that is $5\frac{3}{8}$ inches high?
29. A tree now has a trunk with a radius of 12 centimeters. The radius is increasing by 0.5 centimeter per year. Its radius y after x years is described by $y = 12 + 0.5x$.
- Make a table of values for this relationship.
 - Use the table to draw a graph.
 - How many years will it take for the tree trunk to reach a radius of 15 centimeters?
 - What will the radius be in 8 years?
30. In the summer of 2005, the Chicago area had its worst drought on record. On July 3, the level of the Fox River was 6.1 feet and dropping 0.2 foot per week. Let y be the level of the river after x weeks.
- Suppose the river continues to drop at the same rate. Write an equation for y in terms of x .
 - Make a table of values for this relationship.
 - Use the table to draw a graph.
31. Darnell has \$55 in the bank and is adding \$20 every week. Let b be his balance after w weeks.
- Write an equation for b in terms of w .
 - Make a table of values for this relationship.
 - Make a graph from the table.
 - When will he have \$175 in the bank? Explain how you found your answer.

REPRESENTATIONS Pictures, graphs, or objects that illustrate concepts

OBJECTIVE E Solve problems involving equations of the form $y = ax + b$ using tables or graphs. (Lessons 3-1, 3-2)

OBJECTIVE F Graph all the solutions to a linear inequality. (Lessons 3-6, 3-7)

In 32–35, graph all solutions to each inequality on a number line.

32. $x \geq -4.3$

33. $d < 3\frac{1}{2}$

34. $2 < 5 - a$

35. $4m + 6 > -2$