LESSON

5

EQUATIONS, INEQUALITIES, AND FUNCTIONS

Algebra Problem Solving

One strategy that can help you save time on the more complicated algebra problems is **guess-and-check.** Guess-and-check means selecting one of the answer choices and trying that value in the problem. If you guess correctly, you can move on to the next question. If not, guess again. Guess-and-check is a good strategy for problems involving quadratic equations and expressions.

Key Ideas

- Guess-and-check is a strategy for answering complicated multiple-choice problems.
- Choose an answer from the options and try the value in the problem. If it works, you have found the correct answer.

Example 1: Which of the following is a solution for the equation $2x^2 - 12 = 2x$?

A. 4
B. 3
C. 0
D. −1

To solve the problem, you would have to rewrite the equation so that the quadratic expression equals zero, factor the expression, and solve.

Instead, substitute each answer choice into the equation.

Option (A): $2x^2 - 12 = 2x$
$2(4)^2 - 12 = 2(4)$
$20 \neq 8$

Option (B): $2x^2 - 12 = 2x$
$2(3)^2 - 12 = 2(3)$
$6 = 6$

Option (B) 3 makes the equation true.

Guess-and-check can also save time when writing an equation seems difficult.

GED® TEST TIP

Use your judgment. Do not use guess-and-check if you can quickly see how to solve the problem. Trying each answer choice may take longer than simply solving the problem.

Example 2: Terry is ten years older than his brother Tomas. Twenty years ago, Terry was twice as old as Tomas. How old is Terry now?

A. 25
B. 30
C. 40
D. 45

Instead of writing an equation, try each age in the answer choices for Terry.

A. If Terry is 25 now, Tomas is 15. Twenty years ago, Tomas would not have been born.
B. If Terry is 30 now, Tomas is 20. Twenty years ago, Tomas would have been 0 years old, and Terry would have been 10.
C. If Terry is 40 now, Tomas is 30. Twenty years ago, Tomas would have been 10, and Terry would have been 20, which is twice as old as 10.

Therefore, **option (C) 40** is correct.

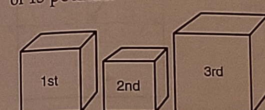
PRACTICE 5

A. Use guess-and-check to solve the following problems.

1. A number divided by 2 is equal to 12 less than the original number. What is the number?
   A. 12
   B. 20
   C. 24
   D. 28

2. For a fund-raiser, Sandra raised three times as much money as Barbara, and Barbara raised $50 more than Matt. Together they raised $950. How much money did Barbara raise?
   A. $150
   B. $175
   C. $200
   D. $325

3. The three packages below weigh a total of 15 pounds.



   The first package weighs twice as much as the second package. The third package weighs three times as much as the second package. How many pounds does the first package weigh?
   A. 2
   B. 4
   C. 5
   D. $6\frac{1}{2}$

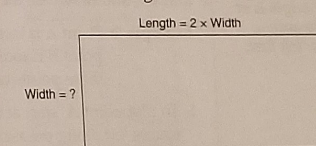
4. Hannah scored a total of 170 points on two math tests. The score of the first test was 6 points lower than the score of the second test. How many points did Hannah score on the first test?
   A. 76
   B. 82
   C. 88
   D. 90

5. Nelson is twice as old as Maria. Six years ago, Nelson was five times as old as Maria. How old was Nelson six years ago?
   A. 5
   B. 10
   C. 15
   D. 20

6. Which of the following is a solution for the quadratic equation $2x^2 + x - 15 = 0$?
   A. −3
   B. −1
   C. 2
   D. 3

7. An amusement park sells adults' and children's passes. An adult's pass is $25, and a child's pass is $15. A group spent $440 on 20 passes. How many children's passes did the group purchase?
   A. 5
   B. 6
   C. 9
   D. 14

8. The rectangular garden below is twice as long as it is wide. If the total distance around the garden is 120 feet, what is the width of the garden in feet?



   A. 15
   B. 20
   C. 30
   D. 40

Answers and explanations begin on page 677.

LESSON

3

EQUATIONS, INEQUALITIES, AND FUNCTIONS

Inequalities

Key Ideas

- Use $<$, $>$, $\leq$, and $\geq$ to show the relationship between two unequal expressions.
- The symbol always points to the smaller expression.
- Use inverse operations to solve inequalities. Reverse the inequality sign if you multiply or divide by a negative number.

An **inequality** is a mathematical statement that connects two unequal expressions. The inequality symbols and their meanings are as follows:

$>$ greater than $\quad$ $\geq$ greater than or equal to

$<$ less than $\quad$ $\leq$ less than or equal to

An inequality is solved much as is an equation. Use inverse operations to isolate the variable.

Example 1: Solve for x in the inequality $3x+2<8$.

1. Subtract 2 from both sides. $\quad 3x+2<8$, $\quad 3x<6$
2. Divide both sides by 3. $\quad x<2$

The solution $x<2$ states that any number less than 2 makes the inequality true. Check by substituting 1 (a number less than 2) for $x: 3(1)+2<8$, which simplifies to $5<8$, a true statement.

There is one important difference between solving equalities and inequalities. Whenever you multiply or divide both sides of an inequality by a negative number, you must reverse the inequality symbol.

Example 2: Solve for n in the inequality $-2n-5\geq 3$.

1. Add 5 to both sides to remove -5 from the left side of the equation. $\quad -2n-5+5\geq 3+5$, $\quad -2n\geq 8$
2. Divide both sides by -2 and *reverse the inequality symbol.* $\quad \frac{-2n}{-2}\geq\frac{8}{-2}$, $\quad n\leq -4$

GED® TEST TIP

Avoid the most common mistake with inequalities: reversing the symbol accidentally. Always check your work by substituting any number that fits the solution into the original inequality.

Check your work by substituting a number that is less than or equal to -4 into the original inequality. Here -5 is used for n. Since $5\geq 3$ is a true statement, the answer is correct.

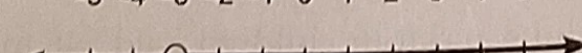
$$-2n-5\geq 3$$
$$-2(-5)-5\geq 3$$
$$5\geq 3$$

When an inequality contains a variable, there are usually several numbers that make the inequality true. For that reason, we often graph the solution. In the examples below, a closed dot means that the number is included in the solution set. An open dot means the number is not included.

Examples: $x<2$

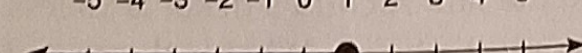
-5 -4 -3 -2 -1 0 1 2 3 4 5

$x>-3$



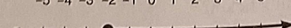
-5 -4 -3 -2 -1 0 1 2 3 4 5

$x\leq 1$



-5 -4 -3 -2 -1 0 1 2 3 4 5

$x\geq -2$



-5 -4 -3 -2 -1 0 1 2 3 4 5

A **compound inequality** combines two inequalities. To solve a compound inequality, separate the inequalities and solve both. Then combine the solutions.

Example 3: Solve $3x+4<5x<16+x$.

1. Write two inequalities and solve each separately. $\quad 3x+4<5x$, $4<2x$, $2<x$ $\quad$ $5x<16+x$, $4x<16$, $x<4$
2. Write the result as a compound inequality. $2<x<4$

In other words, any quantity that is greater than 2 *and* less than 4 will make the compound inequality true.

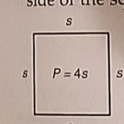
PRACTICE 3

A. **Solve.**

1. $3x-7>5$
2. $13<2x-1$
3. $4+2x\leq -2$
4. $\frac{4+x}{5}\leq 8$
5. $2(x+3)<4$
6. $3+9x\geq 4(x+7)$
7. $-4(x+2)<24$
8. $-2x+9<1$
9. $\frac{x-2}{3}>2x+11$
10. $6x<5x+2$
11. $x+6\leq 8x-15$
12. $5x+14>2+7x$
13. $13x-7>25-3x$
14. $x-6<2(x+2)$
15. $-5+3x\geq 4(3x-8)$
16. $36>4(x-12)$
17. $6\leq 3(x+3)$
18. $\frac{4x}{3}>8x-20$
19. $x-2<\frac{2x+6}{4}$
20. $x\geq 4x-9$
21. $30\geq 5(x+4)\geq 10$
22. $-7x>-2(x+15)<10$
23. $3<5x-27<53$
24. $22\leq 6x-2\leq 4x+16$

B. **Choose the one best answer to each question.**

25. The perimeter of a square can be found using the formula $P=4s$, where s is one side of the square.

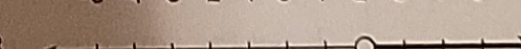


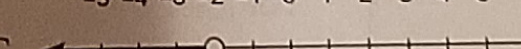
The perimeter of a square is less than or equal to 64 inches. Which of the following represents the possible measures of the side of the square in inches?

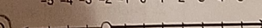
A. $s\leq 16$
B. $s\geq 16$
C. $s\geq 8$
D. $s\leq 64$

26. Three added to the product of -4 and a number (x) is less than 5 added to the product of -3 and the number. Which of the following is a graph of the solution set of x?

A. 
-5 -4 -3 -2 -1 0 1 2 3 4 5

B. 
-5 -4 -3 -2 -1 0 1 2 3 4 5

C. 
-5 -4 -3 -2 -1 0 1 2 3 4 5

D. 
-5 -4 -3 -2 -1 0 1 2 3 4 5

Answers and explanations begin on page 677.

LESSON

1

EQUATIONS, INEQUALITIES, AND FUNCTIONS

Equations

Writing and Solving One-Step Equations

An **equation** is a mathematical statement that two expressions are equal.

Examples: $3+5=4\times 2$ $\quad 10-1=3^2$ $\quad 5(3+4)=35$

An equation can contain one or more variables. Solving an equation means finding a value for the variable that will make the equation true.

Examples: $4+x=11$ $\quad 3x=24$ $\quad x-5=-2$

$x=7$ $\quad x=8$ $\quad x=3$

The basic strategy in solving an equation is to isolate the variable on one side of the equation. You can do this by performing **inverse**, or opposite, operations. However, you must always follow one basic rule: whatever you do to one side of the equation, you must also do to the other side.

Example 1: Solve $x-23=45$.

On the left side of the equation, the number 23 is subtracted from x. The inverse of subtraction is addition. Add 23 to both sides of the equation.

$$x-23=45$$
$$x-23+23=45+23$$
$$x=68$$

To check your work, replace the variable with your solution and simplify.
When $x=68$, the equation is true.

$$\text{Check: } x-23=45$$
$$68-23=45$$
$$45=45$$

The following examples use the inverse operations of multiplication and division.

Example 2: Solve $\frac{x}{2}=17$.

The variable x is divided by 2. Since multiplication is the inverse of division, you must multiply each side of the equation by 2.

$$\frac{x}{2}=17$$
$$2\left(\frac{x}{2}\right)=2(17)$$
$$x=34$$

When $x=34$, the equation is true.

$$\text{Check: } \frac{34}{2}=17$$
$$17=17$$

Example 3: Solve $5x=75$.

Since the variable x is multiplied by 5, divide both sides of the equation by 5.

$$5x=75$$
$$\frac{5x}{5}=\frac{75}{5}$$
$$x=15$$

When $x=15$, the equation is true.

$$\text{Check: } 5(15)=75$$
$$75=75$$

Key Ideas

- An equation states that two expressions are equal.
- To solve an equation, isolate the variable by applying inverse operations to both sides of the equation.
- Check your work by substituting your solution for the variable in the original equation and simplifying.

GED® TEST TIP

If you are unsure about a multiple-choice algebra problem, substitute each of the answer choices for the variable in the equation. You may be able to do this quickly using your calculator.

PRACTICE 1.1

A. Solve for the variable in each equation.

1. $7x=63$ $x=9$
2. $23+m=51$ $m=28$
3. $-13=y-12$ $-1=y$
4. $\frac{x}{4}=-16$ $x=-64$
5. $5a=625$ $x=125$
6. $y-17=-30$ $y=-13$
7. $x+6=33$ $x=27$
8. $4c=28$
9. $\frac{12}{x}=-3$ $x=-4$
10. $26=b+33$ $-7=b$
11. $93=3x$ $31=x$
12. $s+16=8$ $s=-8$
13. $36=\frac{x}{3}$ $108=x$
14. $t+14=53$ $t=39$
15. $\frac{x}{6}=8$ $x=48$
16. $16y=-48$ $y=-3$
17. $r-35=75$ $r=110$
18. $24=\frac{120}{x}$
19. $5y=-45$
20. $d+45=20$
21. $16=4x$
22. $-4x=24$
23. $19=h-7$
24. $\frac{t}{11}=6$
25. $m+24=14$
26. $5y=45$
27. $14-w=42$
28. $18=\frac{y}{4}$

B. Choose the one best answer to each question.

Questions 29 and 30 refer to the following table.

April Time Sheet Summary
Hours Worked per Week

Week	1	2	3	4
Kayla Sax	36	40	40	
Erin Grady		24	28	38

29. Kayla and Erin worked a total of 77 hours during Week 1. Let x = Erin's hours for Week 1. Which of the following equations could be used to solve for Erin's hours during Week 1?
    A. $x-36=77$
    B. $x+77=36$
    C. $x+36=77$
    D. $x-77=36$

30. Erin worked twice as many hours as Kayla did during Week 4. Let y = Kayla's hours for Week 4. Which of the following equations could be used to solve for Kayla's hours during Week 4?
    A. $\frac{y}{2}=38$
    B. $38y=2$
    C. $2y=38$
    D. $\frac{1}{2y}=38$

31. The quotient of a number divided by 4 is 32. What is the number?
    A. 8
    B. 28
    C. 128
    D. 512

32. The solution $x=-5$ makes which of the following equations true?
    A. $14-x=9$
    B. $\frac{x}{5}=1$
    C. $x+3=8$
    D. $12x=-60$

33. Mike had \$572.18 in his checking account. After writing a check, he had \$434.68. Which of the following equations could be used to find the amount of the check (c)?
    A. $\$572.18+c=\$434.68$
    B. $\$572.18-c=\$434.68$
    C. $\$572.18c=\$434.68$
    D. $\frac{\$572.18}{c}=\$434.68$

Answers and explanations begin on page 676.

Equation Word Problems

Key Ideas

- To solve a word problem, decide what quantity will be represented by x. Then write expressions for the other quantities in terms of x.
- Write and solve an equation. Answer the question asked in the problem.

Algebra problems describe how several numbers are related. One number is the unknown, which you will represent with a variable. Using the relationships described in the problem, you can write an equation and solve for the variable.

Example 1: There are twice as many women as men in a class on auto repair. If there are 24 students in the class, how many are women?

1. Express the numbers in the problem in terms of the same variable. Let x represent the number of men. Since there are twice as many women, let $2x$ represent the number of women.

2. Write and solve an equation. The total number of men and women is 24, so $x+2x=24$. Solve:

$$x+2x=24$$
$$3x=24$$
$$x=8$$

Since $x=8$, $2x=2(8)=16$. There are 8 men and **16 women** in the class.

Consecutive numbers are numbers that follow in counting order. For example, 1, 2, and 3 are consecutive numbers. The numbers 2, 4, and 6 are consecutive even numbers, and 1, 3, and 5 are consecutive odd numbers.

Example 2: The sum of three consecutive numbers is 105. What is the greatest of the three numbers?

1. Let x represent the first number and $x+1$ and $x+2$ represent the other numbers.

2. Write an equation and solve:

$$x+(x+1)+(x+2)=105$$
$$3x+3=105$$
$$3x=102$$
$$x=34$$

3. Find the answer. The variable x represents the first number in the sequence, so the three numbers are 34, 35, and 36. The problem asks for the greatest number, which is **36**.

GED® TEST TIP

When you find x, you may not be finished solving a problem. Always reread the question. As shown in Examples 1 and 2, you may need to use the value of x to calculate the solution in a multi-step problem.

You may need to use the difference between numbers to write equations.

Example 3: The ticket prices for a play are $12 for adults and $8 for children. One evening, the box office sold 200 tickets. If the total box office receipts were $2240, how many adult tickets were sold?

1. Let x represent the number of adult tickets. Since 200 tickets were sold, the number of children's tickets sold can be written as $200-x$.

2. Multiply each term by the cost for that type of ticket. Set the total equal to $2240, and solve for x.

$$12x+8(200-x)=2240$$
$$12x+1600-8x=2240$$
$$4x+1600=2240$$
$$4x=640$$
$$x=160$$

3. There were **160 adult tickets** sold.

PRACTICE 2

A. **Solve.**

1. Two houses are for sale on the same street. The second house has 1000 square feet less than twice the square feet of the first house. Together the houses have 4400 square feet. What is the square footage of the first house?
2. Julia has 24 coins in her pocket. The coins are either dimes or quarters. The total value of the coins is $4.50. How many coins are dimes? (*Hint:* The value of the dimes is $0.10x$, and the value of the quarters is $0.25(24-x)$.)
3. The Bulldogs won twice as many games as they lost. If they played a total of 36 games, how many did they win? (There were no tied games.)
4. The sum of four consecutive even numbers is 212. What is the third number? (*Hint:* Let $x=$ the first number, $x+2=$ the the second number, $x+4=$ the the third, and so on.)
5. A children's store is selling pants for $6 each and shirts for $4. Brenda bought 13 items and paid $62. How many shirts did she buy?
6. The sum of three consecutive numbers is 180. What is the least number in the series?
7. In a month Andrew spends twice as much on rent as he does on food for his family. Last month, he spent $1650 on rent and food. How much did he spend on rent?
8. George spends four times as much time helping customers as he does stocking shelves. Last week, he spent 35 hours on the two tasks. How many hours were spent helping customers?

B. **Choose the <u>one best answer</u> to each question.**

9. Sylvia scored 10 points better than Wiley on their science exam. Greg scored 6 points less than Wiley. Altogether, the students earned 226 points. How many points did Sylvia earn?
   A. 74
   B. 78
   C. 84
   D. 94
10. Two adults and four children paid $48 to get into the fair. A child's ticket is $6 less than an adult's ticket. What is the cost of an adult's ticket?
    A. $15
    B. $12
    C. $9
    D. $6
11. Jenny is four times as old as her niece Tina. In 12 years, Jenny will be only twice as old as Tina. The chart shows expressions for Tina and Jenny's ages now and in 12 years.

	Jenny's Age	Tina's Age
Now	$4x$	x
In 12 Years	$4x+12$	$x+12$

How old is Tina now?
    A. 4
    B. 6
    C. 8
    D. 12

Answers and explanations begin on page 676.

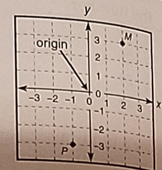
EQUATIONS, INEQUALITIES, AND FUNCTIONS

The Coordinate Plane

Key Ideas

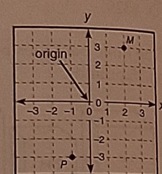
- A coordinate grid is formed by two intersecting axes, or number lines.
- The x-axis is horizontal, and the y-axis is vertical.
- The location of a point is shown by two numbers called an ordered pair: (x, y).

A **coordinate grid** is a way to locate points that lie in a **plane**, or flat surface. The grid is formed by two intersecting lines, an x-axis and a y-axis. The x-axis is actually a horizontal number line, and the y-axis is a vertical number line. The point at which the two axes intersect is called the **origin**.



Each point on the grid can be named using two numbers called an **ordered pair**. The first number is the distance from the origin along the x-axis. The second number is the distance from the origin along the y-axis. The numbers are written in parentheses and are separated by a comma: (x, y).

Example 1: Write the ordered pairs for points M and P.



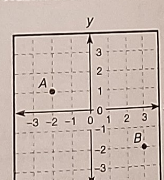
1. Point M lies 2 spaces to the right of the origin along the x-axis and 3 spaces above the origin along the y-axis. The coordinates are **(2, 3).**
2. Point P lies 1 space to the left along the x-axis and 3 spaces down along the y-axis. The coordinates are $(-1, -3)$.

GED® TEST TIP

If you are given a coordinate grid that is not labeled, remember that the origin is at (0,0). Starting at the origin, count either right or left first, then up or down.

To plot points on the grid, use the number lines located at the axes. Remember that right and up are the directions for positive numbers and left and down are the directions for negative numbers.

Example 2: Point A is located at $(-2, 1)$, and point B is located at $(3, -2)$. Plot these points on a coordinate grid.

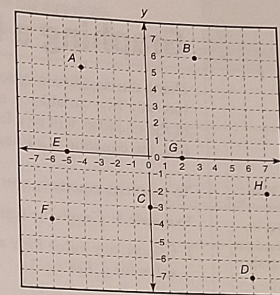


1. To plot point A, start at the origin. Count 2 spaces left along the x-axis. Count 1 space up along the y-axis.
2. To plot point B, start at the origin. Count 3 spaces right along the x-axis. Count 2 spaces down along the y-axis.

PRACTICE 6

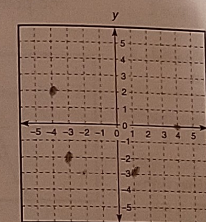
A. Write the ordered pair for each point.

1. Point A
2. Point B
3. Point C
4. Point D
5. Point E
6. Point F
7. Point G
8. Point H

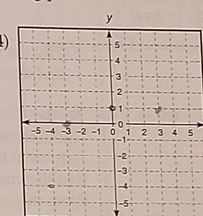


B. Plot the points on the coordinate grid.

9. Plot the following points:
   J at $(-3, -2)$
   K at $(4, 0)$
   L at $(1, -3)$
   M at $(-4, 2)$

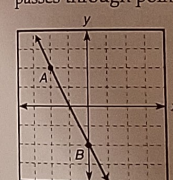


10. Plot the following points:
    N at $(0, -1)$
    O at $(-4, -4)$
    P at $(3, 1)$
    Q at $(-3, 0)$



C. Choose the one best answer to each question.

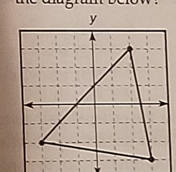
11. On the coordinate grid below, a line passes through points A and B.



Which of the following ordered pairs also lies on the line?

A. $(1, 0)$
B. $(1, -1)$
C. $(0, -1)$
D. $(-1, 0)$

12. Two of the corners of a triangle are located at $(3, -3)$ and $(2, 3)$. What is the location of the third corner as shown in the diagram below?



A. $(-3, -2)$
B. $(-3, 2)$
C. $(-2, -3)$
D. $(3, -2)$

Answers and explanations begin on page 678.

LESSON

4

EQUATIONS, INEQUALITIES, AND FUNCTIONS

Quadratic Equations

Key Ideas

- A quadratic equation can have two solutions.
- Set the quadratic equation equal to 0 and factor.
- Find the values for x that will make each factor equal 0.

A **quadratic equation** contains a squared variable, for example, $x^2 - 3x = 4$. One way to solve quadratic equations is by factoring. This is the simplest method and the one you should use on the GED® *Mathematical Reasoning Test*. When you factor an expression, you find the terms that divide evenly into the expression.

Example 1: Factor the expression $15x^2 + 9x$.

1. Look for a term that divides evenly into both $15x^2$ and $9x$. Both terms can be divided by $3x$. — $15x^2 \div 3x = 5x$; $9x \div 3x = 3$
2. Factor out $3x$. Write the terms as factors. — $15x^2 + 9x = 3x(5x + 3)$

Study Example 2 to learn how to multiply factors with more than one term.

Example 2: Multiply $\underbrace{(2x+3)}_{\text{(factor)}}\underbrace{(x-4)}_{\text{(factor)}}$.

four terms

1. Multiply each term in the first factor by each term in the second factor.

$$2x \cdot x = 2x^2$$
$$2x \cdot -4 = -8x$$
$$3 \cdot x = 3x$$
$$3 \cdot -4 = -12$$

2. Combine the results.

$$2x^2 + (-8x) + 3x + (-12) =$$
$$\mathbf{2x^2 - 5x - 12}$$

This method of multiplying factors is called the FOIL method. The letters in FOIL stand for First, Outer, Inner, and Last. Use the word FOIL to make sure you have performed all the necessary operations.

You factor a quadratic equation to solve it. A quadratic equation may have two solutions. Find values that make the factors equal to 0. Since a number multiplied by 0 is 0, each of the values is a solution.

GED® TEST TIP

Trial and error can help you factor quadratic equations. The more you practice, the better you will get at solving them.

Example 3: Solve $x^2 - 3x = 4$.

1. Set the equation equal to 0 by subtracting 4 from both sides.

$$x^2 - 3x = 4$$
$$x^2 - 3x - 4 = 0$$

2. Factor by trial and error. Think: What factors of the last term, -4, when added, will equal -3, the number part of the middle term?
$-4 \cdot 1 = -4$ and $-4 + 1 = -3$

$$(x \quad)(x \quad) = 0$$
$$(x+1)(x-4) = 0$$

3. If either one of the factors equals 0, then the product of the factors will be 0. Set each factor equal to 0 and solve for x.

$$x + 1 = 0$$
$$x = -1$$
$$x - 4 = 0$$
$$x = 4$$

The solutions to the quadratic equation are **−1 and 4**.

PRACTICE 4

A. Multiply.

1. $(x+4)(x+2)$
2. $(x-3)(x+5)$
3. $(x-1)(x+4)$
4. $(x-6)(x-3)$
5. $(x+8)(x-2)$
6. $(2x+1)(x-2)$
7. $(x-9)(x-5)$
8. $(x+1)(3x-2)$
9. $(x-2)(x+7)$
10. $(3x+8)(x+2)$
11. $(x-6)(x+5)$
12. $(x-10)(x-3)$
13. $(2x+1)(2x+2)$
14. $(x+9)(x-4)$
15. $(x-5)(x-5)$

B. Factor each expression.

16. $x^2 + 4x + 3$
17. $x^2 + 4x - 5$
18. $x^2 + 8x + 12$
19. $x^2 - x - 6$
20. $x^2 + 5x - 14$
21. $x^2 - x - 12$
22. $x^2 + 2x - 35$
23. $x^2 - 12x + 36$
24. $x^2 - 6x - 7$
25. $x^2 + 4x - 32$
26. $2x^2 + 5x - 3$
27. $2x^2 - 8x - 10$
28. $x^2 + 5x - 50$
29. $4x^2 + 4x - 3$
30. $x^2 + x - 56$

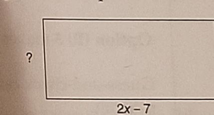
C. Choose the <u>one best answer</u> to each question.

31. What are two solutions for the equation $x^2 - x = 20$?
    A. −4 and 5
    B. 4 and −5
    C. −10 and 2
    D. −2 and 10

32. For which of the following equations is $x = -4$ a solution?
    A. $2x^2 - 8 = 0$
    B. $x^2 - 8x + 64 = 0$
    C. $x^2 - 2x - 15 = 0$
    D. $2x^2 + 2x - 24 = 0$

33. What is the only positive solution for the equation $2x^2 - 7x - 30 = 0$?
    A. 5
    B. 6
    C. 7
    D. 8

34. The area of a rectangle is found by multiplying the length by the width. In the rectangle below, the area of the rectangle is equal to the expression $2x^2 - 27x + 70$.



An expression equal to the length is shown on the diagram. Which of the following expressions is equal to the width of the rectangle?
    A. $x + 10$
    B. $x - 10$
    C. $2x + 10$
    D. $2x - 10$

Answers and explanations begin on page 677.

Solving Multi-Step Equations

Most equations require more than one operation in order to find a solution. Follow these basic steps:

- Simplify by combining like terms.
- Perform addition and subtraction steps.
- Perform multiplication and division steps.

Example 1: Solve $6x+5-2x=25$.

1. Combine like terms ($6x-2x=4x$). $\quad 6x+5-2x=25$; $\quad 4x+5=25$
2. Subtract 5 from both sides. $\quad 4x+5-5=25-5$; $\quad 4x=20$
3. Divide both sides by 4. $\quad \frac{4x}{4}=\frac{20}{4}$; $\quad x=5$
4. Check by substituting the solution for x in the original equation. $\quad 6(5)+5-2(5)=25$; $\quad 30+5-10=25$; $\quad 25=25$

In this example, the distributive property is used to simplify an expression. Notice that not every step is written out. As you gain experience, you can perform an operation on both sides of an equation mentally.

Example 2: Solve $-4(x-6)=2x$.

1. Use the distributive property to remove the grouping symbols. $\quad -4(x-6)=2x$; $\quad -4x+24=2x$
2. Add $4x$ to each side. $\quad 24=6x$
3. Divide each side by 6. $\quad 4=x$
4. Check. $\quad -4(4-6)=2(4)$; $\quad -4(-2)=8$; $\quad 8=8$

Some of the time you will be expected to write an equation from information given in the problem. The problem will describe two expressions that are equal. Write each expression in symbols and connect the expressions with the equal sign (=). In many problems, the word *is* indicates the = symbol.

Example 3: The product of a number and 6 is 44 more than twice the number. What is the number?

1. Write an equation. The word *is* represents the equal sign. $\quad 6x=44+2x$
2. Subtract $2x$ from both sides. $\quad 4x=44$
3. Divide both sides by 4. $\quad x=11$
4. Check. $\quad 6(11)=44+2(11)$; $\quad 66=44+22$; $\quad 66=66$

The number described in the problem is 11.

NOTE: Subtraction and division operations must be written in the order indicated by the words. "The difference between x and y" must be written $x-y$, not $y-x$. "The quotient of x and y" must be written $\frac{x}{y}$, not $\frac{y}{x}$.

PRACTICE 1.2

A. Solve for the variable in each equation.

1. $3x-20=130$ $\quad x=50$
2. $2y-8=-3y-18$ $\quad y=-2$
3. $6m=14m-16$
4. $2x+5+6x=-27$ $\quad x=-4$
5. $5y+3(y+2)=54$ $\quad 8y=48$ $\quad x=6$
6. $17-4z+2z=13$ $\quad z=2$
7. $6m-4=m+11$
8. $35=x+7+6x$
9. $5p-2=6p-9$
10. $50=3(s+16)-2(s-2)$ $\quad s=-2$
11. $\frac{5(2x-10)}{2}+14=19$
12. $3(3+r)=2r+4$ $\quad r=-5$
13. $5y=2y+22+y$
14. $38=5(2b-3)+3b+1$
15. $-5-x=2x-(4x+6)$
16. $\frac{3h}{2}=30$
17. $4(3+2x)+8=92$ $\quad 8x=72$ $\quad x=9$
18. $-5(3-z)=z+1$
19. $10-3b+3=-1+(b+2)$
20. $5n+8-n=6(n-1)$

B. Choose the <u>one best answer</u> to each question.

21. Three times a number increased by 9 is 15 less than six times the number. Let x = the unknown number. Which of the following equations could be used to find the value of x?
    A. $3(9x)=6(15x)$
    B. $3x(9)=6x-15x$
    C. $3x+9=15-6x$
    D. $3x+9=6x-15$

22. Dave has 500 baseball cards, which is as many as Eric and Travis have combined. Eric has three times as many cards as Travis has.

Dave	Eric	Travis
500	$3x$	x

From the information, you can write the equation $3x+x=500$. How many cards does Eric have? (*Hint:* Solve for x. Then find how many cards Eric has.)
    A. 150
    B. 250
    C. 350
    D. 375

23. The difference of four times a number and 7 is 15 plus the quotient of the number and 3. Which of the following equations could be used to find the value of x?
    A. $4x-7=\frac{x}{3}+15$
    B. $7-4x=\frac{x}{3}+15$
    C. $7-4x=\frac{3}{x}+15$
    D. $4x-7=\frac{3}{x}+1$

24. Kim earned x dollars at his part-time job on Friday. His wife earned $12 more than twice Kim's pay $(2x+12)$. Together, they earned $174. How much did Kim earn on Friday? (*Hint:* Use the equation $x+(2x+12)=\$174$)
    A. $54
    B. $87
    C. $108
    D. $120

Answers and explanations begin on page 676.