

# 8

# CHAPTER REVIEW

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- Multi-Language Glossary
- Vocabulary practice

## REVIEW KEY VOCABULARY

- monomial
- degree of a monomial
- polynomial
- degree of a polynomial
- leading coefficient
- binomial
- trinomial
- roots
- vertical motion model
- perfect square trinomial
- factor by grouping
- factor completely

### VOCABULARY EXERCISES

1. Copy and complete: The greatest degree of the terms in a polynomial is called the   ?  .
2. **WRITING** Is  $2x^{-1}$  a monomial? *Explain* why or why not.
3. **WRITING** What does it mean for a polynomial to be factored completely? Give an example of a polynomial that has been factored completely.

In Exercises 4–6, match the polynomial with its classification.

- |              |             |                  |
|--------------|-------------|------------------|
| 4. $5x - 22$ | 5. $-11x^3$ | 6. $x^2 + x + 1$ |
| A. Monomial  | B. Binomial | C. Trinomial     |

## REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of this chapter.

### 8.1 Add and Subtract Polynomials

#### EXAMPLE

Find the difference  $(3x^2 + 2) - (4x^2 - x - 9)$ .

Use a vertical format.

$$\begin{array}{r} 3x^2 \quad + 2 \\ - (4x^2 - x - 9) \\ \hline \end{array} \quad \longrightarrow \quad \begin{array}{r} 3x^2 \quad + 2 \\ + (-4x^2 + x + 9) \\ \hline -x^2 + x + 11 \end{array}$$

#### EXERCISES

Find the sum or difference.

- |   |   |
|---|---|
| 7. $(9x + 6x^3 - 8x^2) + (-5x^3 + 6x)$  | 8. $(7a^3 - 4a^2 - 2a + 1) + (a^3 - 1)$   |
| 9. $(11y^5 + 3y^2 - 4) + (y^2 - y + 1)$ | 10. $(3n^2 - 4n + 1) - (8n^2 - 4n + 17)$  |
| 11. $(2s^3 + 8) - (-3s^3 + 7s - 5)$     | 12. $(-k^2 + 7k + 5) - (2k^4 - 3k^3 - 6)$ |

**EXAMPLES 3 and 4**  
for Exs. 7–12

## 8.2 Multiply Polynomials

### EXAMPLE

Find the product.

a.  $(x^2 + 4x - 5)(2x - 1)$

b.  $(5y + 6)(y - 3)$

### Solution

a. Use a horizontal format.

$$(x^2 + 4x - 5)(2x - 1)$$

$$= x^2(2x - 1) + 4x(2x - 1) - 5(2x - 1) \quad \text{Write product.}$$

$$= 2x^3 - x^2 + 8x^2 - 4x - 10x + 5 \quad \text{Distributive property}$$

$$= 2x^3 + 7x^2 - 14x + 5 \quad \text{Combine like terms.}$$

b. Use a vertical format.

**STEP 1** Multiply by  $-3$ .

$$\begin{array}{r} 5y + 6 \\ \times \quad y - 3 \\ \hline -15y - 18 \end{array}$$

**STEP 2** Multiply by  $y$ .

$$\begin{array}{r} 5y + 6 \\ \times \quad y - 3 \\ \hline -15y - 18 \\ 5y^2 + 6y \end{array}$$

**STEP 3** Add products.

$$\begin{array}{r} 5y + 6 \\ \times \quad y - 3 \\ \hline -15y - 18 \\ 5y^2 + 6y \\ \hline 5y^2 - 9y - 18 \end{array}$$

### EXERCISES

Find the product.

13.  $(x^2 - 2x + 1)(x - 3)$

14.  $(y^2 + 5y + 4)(3y + 2)$

15.  $(x - 4)(x + 2)$

16.  $(5b^2 - b - 7)(b + 6)$

17.  $(z + 8)(z - 11)$

18.  $(2a - 1)(a - 3)$

19.  $(6n + 7)(3n + 1)$

20.  $(4n - 5)(7n - 3)$

21.  $(3x - 2)(x + 4)$

**EXAMPLES**  
1, 2, 3, and 4  
for Exs. 13–21

## 8.3 Find Special Products of Polynomials

### EXAMPLE

Find the product  $(3x + 2)(3x - 2)$ .

$$(3x + 2)(3x - 2) = (3x)^2 - 2^2 \quad \text{Sum and difference pattern}$$

$$= 9x^2 - 4 \quad \text{Simplify.}$$

### EXERCISES

Find the product.

22.  $(x + 11)^2$

23.  $(6y + 1)^2$

24.  $(2x - y)^2$

25.  $(4a - 3)^2$

26.  $(k + 7)(k - 7)$

27.  $(3s + 5)(3s - 5)$

**EXAMPLES**  
1 and 2  
for Exs. 22–27

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## CHAPTER REVIEW

## 8.4 Solve Polynomial Equations in Factored Form

## EXAMPLE

Solve  $6x^2 + 42x = 0$ .

$$6x^2 + 42x = 0 \quad \text{Write original equation.}$$

$$6x(x + 7) = 0 \quad \text{Factor left side.}$$

$$6x = 0 \quad \text{or} \quad x + 7 = 0 \quad \text{Zero-product property}$$

$$x = 0 \quad \text{or} \quad x = -7 \quad \text{Solve for } x.$$

▶ The solutions of the equation are 0 and  $-7$ .

## EXERCISES

Solve the equation.

28.  $2a^2 + 26a = 0$

29.  $3t^2 - 33t = 0$

30.  $8x^2 - 4x = 0$

31.  $m^2 = 9m$

32.  $5y^2 = -50y$

33.  $21h^2 = 7h$

## EXAMPLES

3 and 4

for Exs. 28–33

8.5 Factor  $x^2 + bx + c$ 

## EXAMPLE

Factor  $x^2 + 2x - 63$ .Find two factors of  $-63$  whose sum is 2. One factor will be positive, and the other will be negative. Make an organized list of factors.

Factors of $-63$	Sum of factors	
1, $-63$	$1 + (-63) = -62$	×
$-1$ , 63	$-1 + 63 = 62$	×
3, $-21$	$3 + (-21) = -18$	×
$-3$ , 21	$-3 + 21 = 18$	×
9, $-7$	$9 + (-7) = 2$	← Correct sum
$-9$ , 7	$-9 + 7 = -2$	×

▶  $x^2 + 2x - 63 = (x + 9)(x - 7)$ 

## EXERCISES

Factor the trinomial.

34.  $n^2 + 15n + 26$

35.  $s^2 + 10s - 11$

36.  $b^2 - 5b - 14$

37.  $a^2 + 5a - 84$

38.  $t^2 - 24t + 135$

39.  $x^2 + 4x - 32$

40.  $p^2 + 9p + 14$

41.  $c^2 + 8c + 15$

42.  $y^2 - 10y + 21$

## EXAMPLES

1, 2 and 3

for Exs. 34–42

## 8.6 Factor $ax^2 + bx + c$

### EXAMPLE

**THROWN BALL** You throw a ball up into the air. At 4 feet above the ground, the ball leaves your hand with an initial vertical velocity of 30 feet per second.

- Write an equation that gives the height (in feet) of the ball as a function of the time (in seconds) since it left your hand.
- After how many seconds does the ball land on the ground?

### Solution

- Use the vertical motion model  $h = -16t^2 + vt + s$  to write an equation for the height  $h$  (in feet) of the ball as a function of the time  $t$  (in seconds). In this case,  $v = 30$  and  $s = 4$ .

$$h = -16t^2 + vt + s \quad \text{Vertical motion model}$$

$$h = -16t^2 + 30t + 4 \quad \text{Substitute 30 for } v \text{ and 4 for } s.$$

- When the ball lands on the ground, its height is 0 feet. Substitute 0 for  $h$  and solve the equation for  $t$ .

$$0 = -16t^2 + 30t + 4 \quad \text{Substitute 0 for } h.$$

$$0 = -2(8t^2 - 15t - 2) \quad \text{Factor out } -2.$$

$$0 = -2(8t + 1)(t - 2) \quad \text{Factor the trinomial. Find factors of 8 and } -2 \text{ that produce a middle term with a coefficient of } -15.$$

$$8t + 1 = 0 \quad \text{or} \quad t - 2 = 0 \quad \text{Zero-product property}$$

$$t = -\frac{1}{8} \quad \text{or} \quad t = 2 \quad \text{Solve for } t.$$

The solutions of the equation are  $-\frac{1}{8}$  and 2. A negative solution does not make sense in this situation, so disregard  $-\frac{1}{8}$ .

► The ball lands on the ground after 2 seconds.

### EXERCISES

Solve the equation.

43.  $7x^2 - 8x = -1$

44.  $4n^2 + 3 = 7n$


45.  $3s^2 + 4s + 4 = 8$

46.  $6z^2 + 13z = 5$

47.  $-4r^2 = 18r + 18$

48.  $9a^2 = 6a + 24$

49. **THROWN BALL** You throw a ball up into the air with an initial vertical velocity of 46 feet per second. The ball leaves your hand when it is 6 feet above the ground. After how many seconds does the ball land on the ground?

50.  **GEOMETRY** The length of a rectangle is 1 inch less than twice the width. The area of the rectangle is 21 square inches. What is the length of the rectangle?

**EXAMPLES**  
1, 2, 3, and 4  
for Exs. 43–50

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## CHAPTER REVIEW

## 8.7 Factor Special Products

## EXAMPLE

Factor the polynomial.

a.  $100x^2 - y^2$

b.  $4x^2 - 36x + 81$

## Solution

$$\begin{aligned} \text{a. } 100x^2 - y^2 &= (10x)^2 - y^2 \\ &= (10x + y)(10x - y) \end{aligned}$$

Write as  $a^2 - b^2$ .

Difference of two squares pattern

$$\begin{aligned} \text{b. } 4x^2 - 36x + 81 &= (2x)^2 - 2(2x \cdot 9) + 9^2 \\ &= (2x - 9)^2 \end{aligned}$$

Write as  $a^2 - 2ab + b^2$ .

Perfect square trinomial pattern

## EXERCISES

Factor the polynomial.

51.  $z^2 - 225$

52.  $a^2 - 16y^2$

53.  $12 - 48n^2$

54.  $x^2 + 20x + 100$

55.  $16p^2 - 8p + 1$

56.  $-2y^2 + 32y - 128$

57. **DROPPED OBJECT** You drop a penny from a height of 16 feet. After how many seconds does the penny land on the ground?

EXAMPLES  
1, 2, 3, 4, and 6  
for Exs. 51–57

## 8.8 Factor Polynomials Completely

## EXAMPLE

Factor the polynomial completely.

a.  $y^3 - 4y^2 + 8y - 32$

b.  $5x^3 - 40x^2 + 80x$

## Solution

$$\begin{aligned} \text{a. } y^3 - 4y^2 + 8y - 32 &= (y^3 - 4y^2) + (8y - 32) \\ &= y^2(y - 4) + 8(y - 4) \\ &= (y - 4)(y^2 + 8) \end{aligned}$$

Group terms.

Factor each group.

Distributive property

$$\begin{aligned} \text{b. } 5x^3 - 40x^2 + 80x &= 5x(x^2 - 8x + 16) \\ &= 5x(x - 4)^2 \end{aligned}$$

Factor out 5x.

Perfect square trinomial pattern

## EXERCISES

Factor the polynomial completely.

58.  $a^3 + 6a - 5a^2 - 30$

59.  $y^2 + 3y + yx + 3x$

60.  $x^3 - 11x^2 - x + 11$

61.  $5s^4 - 125s^2$

62.  $147n^5 - 3n^3$

63.  $2z^3 + 2z^2 - 60z$

64.  $x^3 + 5x^2 - x - 5$

65.  $2b^3 + 3b^2 - 8b - 12$

66.  $x^3 + x^2 - 6x - 6$

EXAMPLE 4  
for Exs. 58–66