7.7 Start Thinking

Consider the expression $x^2 - 16$. Rewrite the expression as the difference of two squares. The factored form of the expression is $(x + 4)(x - 4)$. Explain why the factored form of this expression is correct.

The expression $x^2 + 2x + 1$ can be factored as $(x + 1)^2$. Rewrite the factored expression as the product of two identical binomials. Use this knowledge to factor the expression $x^2 + 8x + 16$.

7.7 Warm Up

Simplify.

1. $(y - 5)^2$

2. $(x + 1)^2$

3. $(3x - 7)^2$

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

5. $(4x - 9y)^2$

6. $(2x - 7)^2$

7.7 Cumulative Review Warm Up

Solve by substitution.

1. $2x + 3y = 7$
$x = 2$

2. $y = x + 2$
$x = 6 - y$

3. $y = 4 + x$
$y = -3x + 8$

4. $x + y = 2$
$x = y + 2$

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7.7 Practice A

In Exercises 1–3, factor the polynomial.

1. $x^2 - 36$ **2.** $49 - 4t^2$ **3.** $1 - 25y^2$

In Exercises 4–6, use a special product pattern to evaluate the expression.

4. $11^2 - 8^2$ **5.** $17^2 - 15^2$ **6.** $65^2 - 62^2$

In Exercises 7–9, factor the polynomial.

7. $k^2 + 14k + 49$ **8.** $m^2 - 18m + 81$ **9.** $x^2 + 34x + 289$

10. The area (in square centimeters) of a square thank-you card can be represented by $x^2 + 6x + 9$.

a. Write an expression that represents the side length of the card.

b. What is the perimeter of the card when $x = 4$?

In Exercises 11–14, solve the equation.

11. $v^2 - 25 = 0$ **12.** $p^2 + 8p + 16 = 0$

13. $q^2 - 14q + 49 = 0$ **14.** $16x^2 = 25$

In Exercises 15–17, factor the polynomial.

15. $5x^2 - 20$ **16.** $4x^2 - 24x + 36$ **17.** $9x^2 + 90x + 225$

18. While standing on a roof, you drop a hammer. The function $y = 16 - 16t^2$ represents the height y (in feet) of the hammer t seconds after it is dropped. After how many seconds does the hammer land on the ground?

19. Tell whether the polynomial can be factored. If not, change the constant term so that the polynomial is a perfect square trinomial.

a. $p^2 + 12p + 33$ **b.** $x^2 - 16x + 61$

20. A square picture frame has side length x inches. The square opening for a picture within the frame has side length 3 inches.

a. Write a polynomial that represents the area of the picture frame, not including the picture.

b. The area in part (a) is 55 square inches. What is the side length of the picture frame? Explain your reasoning.

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7.7 Practice B

In Exercises 1–3, factor the polynomial.

1. $100 - 49x^2$ **2.** $121s^2 - 25t^2$ **3.** $x^2 - 144y^2$

In Exercises 4–6, use a special product pattern to evaluate the expression.

4. $86^2 - 84^2$ **5.** $44^2 - 39^2$ **6.** $28^2 - 27^2$

In Exercises 7–9, factor the polynomial.

7. $z^2 + 26z + 169$ **8.** $16x^2 - 40x + 25$ **9.** $81a^2 + 36a + 4$

10. The area (in square inches) of a square table can be represented by $25x^2 + 40x + 16$.

a. Write an expression that represents the side length of the table.

b. Will a square table cloth with side length 60 inches cover the table when $x = 12$?

In Exercises 11–14, solve the equation.

11. $100x^2 = 81$ **12.** $w^2 + 24w + 144 = 0$

13. $s^2 + 81 = 18s$ **14.** $y^2 - \frac{1}{3}y = -\frac{1}{36}$

In Exercises 15–17, factor the polynomial.

15. $8y^2 - 72$ **16.** $7p^2 + 56p + 112$ **17.** $48t^2 - 72t + 27$

18. The function $y = -16t^2 + 24t$ represents the height y (in feet) of a tennis ball bouncing straight up from the ground t seconds after it bounces. After how many seconds does the tennis ball return to the ground?

19. Tell whether the polynomial can be factored. If not, change the constant term so that the polynomial is a perfect square trinomial.

a. $q^2 + \frac{1}{2}q + \frac{1}{3}$ **b.** $4x^2 + 28x + 47$

20. A square picture frame has side length x inches. The square opening for a picture within the frame has side length 6 inches.

a. Write a polynomial that represents the area of the picture frame, not including the picture.

b. The area in part (a) is 64 square inches. What is the side length of the picture frame? Explain your reasoning.

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7.7 Enrichment and Extension

The Binomial Theorem

In algebra, the *binomial theorem* can be used to expand the binomial $(a + b)^n$. The formula and triangle are attributed to the mathematician *Blaise Pascal*, and the triangle shown below is commonly known as *Pascal's Triangle*. The formula uses the coefficients from the nth row of the triangle, along with decreasing and increasing powers of the two variables.

0th row 1
1st row 1 1
2nd row 1 2 1
3rd row 1 3 3 1
4th row 1 4 6 4 1
5th row 1 5 10 10 5 1

Example: Expand $(x + 2y)^4$ by using the binomial theorem.

$$(x + 2y)^4 = x^4y^0 + 4x^3 \bullet 2y + 6x^2 \bullet 2^2y^2 + 4x \bullet 2^3y^3 + x^0 \bullet 2^4y^4$$
$$= x^4 + 8x^3y + 24x^2y^2 + 32xy^3 + 16y^4$$

In Exercises 1–6, expand the binomial.

1. $(x - y)^5$

2. $(a + 2b)^3$

3. $(x + 4y)^4$

4. $(a - 3c)^5$

5. $(a - b)^6$

6. $(x^2 + 3)^4$

In Exercises 7 and 8, find the term described.

7. 4th term of $(5y + x)^4$

8. 3rd term of $(a^2 - 2)^9$

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7.7 Puzzle Time

When Do You Put The Cart Before The Horse?

Write the letter of each answer in the box containing the exercise number.

Factor the polynomial.

1. $x^2 - 36$

2. $81 - 25x^2$

3. $x^2 + 14x + 49$

4. $4x^2 - 44x + 121$

5. $64x^2 - 9y^2$

6. $100x^2 - 20x + 1$

7. $3x^2 - 3$

8. $-x^2 + 144$

9. $4x^2 - 16x + 16$

10. $-18x^2 + 60x - 50$

Solve the equation.

11. $x^2 - 64 = 0$

12. $49 - 4x^2 = 0$

13. $x^2 = 8x - 16$

14. $36x^2 = -12x - 1$

15. You drop a penny while taking change out of your pocket. The function $y = 49 - 9t^2$ represents the height y (in feet) of the penny t seconds after it falls from your pocket. How many seconds does it take for the penny to land on the ground?

Answers

H. $-2(3x - 5)^2$

T. $(9 + 5x)(9 - 5x)$

N. $3(x + 1)(x - 1)$

C. $(2x - 11)^2$

E. $(8x + 3y)(8x - 3y)$

R. $4(x - 2)^2$

A. $(x - 6)(x + 6)$

N. $(10x - 1)^2$

T. $-(x + 12)(x - 12)$

I. $(x + 7)^2$ **Y.** 4

D. $\frac{7}{3}$ **I.** $-8, 8$

O. $-\frac{7}{2}, \frac{7}{2}$ **I.** $-\frac{1}{6}$

14	7		2	10	5		15	11	4	8	3	12	6	1	9	13