When you factor out the GCF of a polynomial, sometimes the expression that remains is a perfect-square trinomial or the difference of two squares. You can then factor this expression further using the rules from this lesson.

Problem 5 Factoring Out a Common Factor

What is the factored form of $24g^2 - 6$?

Think
Is $24g^2 - 6$ a difference of two squares?
No. $24g^2$ and 6 are not perfect squares. To get a difference of squares, you must first factor out the GCF.

$24g^2 - 6 = 6(4g^2 - 1)$ Factor out the GCF, 6.

$= 6[(2g)^2 - 1^2]$ Write the difference as $a^2 - b^2$.

$= 6(2g + 1)(2g - 1)$ Use the rule for the difference of squares.

Got It? **5.** What is the factored form of each expression?

a. $12t^2 - 48$ **b.** $12x^2 + 12x + 3$

Lesson Check

Do you know HOW?

Factor each expression.

1. $y^2 - 16y + 64$
2. $9q^2 + 12q + 4$
3. $p^2 - 36$
4. The area of a square is $36w^2 + 60w + 25$. What is the side length of the square?

Do you UNDERSTAND? MATHEMATICAL PRACTICES

Identify the rule you would use to factor each expression.

5. $81r^2 - 90r + 25$
6. $k^2 + 12k + 36$
7. $9h^2 - 64$
8. **Reasoning** Explain how to determine whether a binomial is a difference of two squares.

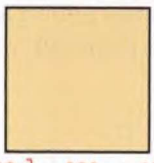
Practice and Problem-Solving Exercises MATHEMATICAL PRACTICES

A Practice

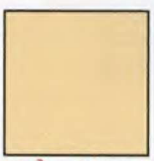
Factor each expression. See Problems 1 and 2.

9. $h^2 + 8h + 16$
10. $v^2 - 10v + 25$
11. $d^2 - 20d + 100$
12. $m^2 + 18m + 81$
13. $q^2 + 2q + 1$
14. $p^2 - 4p + 4$
15. $64x^2 + 112x + 49$
16. $4r^2 + 36r + 81$
17. $9n^2 - 42n + 49$
18. $36s^2 - 60s + 25$
19. $25z^2 + 40z + 16$
20. $49g^2 - 84g + 36$

The given expression represents the area. Find the side length of the square.

21. 
$100r^2 - 220r + 121$

22. 
$64r^2 - 144r + 81$

23. 
$25r^2 + 30r + 9$

Factor each expression. See Problems 3–5.

24. $w^2 - 144$ **25.** $a^2 - 49$ **26.** $y^2 - 121$

27. $t^2 - 25$ **28.** $k^2 - 64$ **29.** $m^2 - 225$

30. $4p^2 - 49$ **31.** $81r^2 - 1$ **32.** $36v^2 - 25$

33. $64q^2 - 81$ **34.** $16x^2 - 121$ **35.** $9n^2 - 400$

36. $2h^2 - 2$ **37.** $27w^2 - 12$ **38.** $80g^2 - 45$

B Apply

39. Rewrite the expression $x^4 - y^4$ so that it is a difference of squares. Then factor the expression completely.

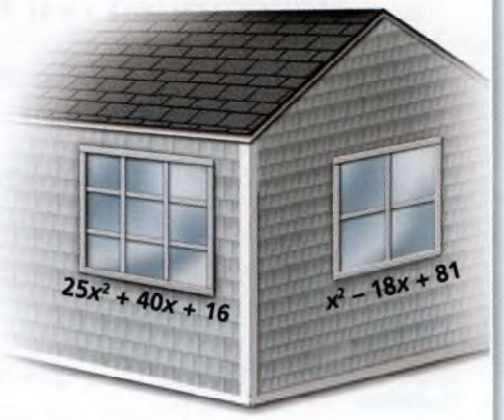
40. Error Analysis Describe and correct the error made in factoring.

$9x^2 - 49 = (9x + 7)(9x - 7)$

41. Writing Summarize the procedure for factoring a difference of two squares. Give at least two examples.

42. Think About a Plan Two square windows and their areas are shown at the right. What is an expression that represents the difference of the areas of the windows? Show two different ways to find the solution.

- How can you solve the problem without factoring?
- How can you use the factored forms of the areas to find the difference of the areas of the windows?



43. Interior Design A square rug has an area of $49x^2 - 56x + 16$. A second square rug has an area of $16x^2 + 24x + 9$. What is an expression that represents the difference of the areas of the rugs? Show two different ways to find the solution.

Mental Math **For Exercises 44–48, find a pair of factors for each number by using the difference of two squares.**

Sample

$117 = 121 - 4$ Write 117 as the difference of two squares.

$= 11^2 - 2^2$ Write each term as a square.

$= (11 + 2)(11 - 2)$ Use the rule for the difference of squares.

$= (13)(9)$ Simplify.

44. 143 **45.** 99 **46.** 224 **47.** 84 **48.** 91

49. a. Open-Ended Write an expression that is a perfect-square trinomial.
b. Explain how you know your trinomial is a perfect-square trinomial.

50. **a.** Factor $4x^2 - 100$ by removing the common monomial factor and then using the difference-of-squares rule to factor the remaining expression.

b. Factor $4x^2 - 100$ by using the difference-of-squares rule and removing the common monomial factors.

c. **Reasoning** Why can you factor $4x^2 - 100$ in two different ways?

d. Can you factor $3x^2 - 75$ in the two ways you factored $4x^2 - 100$ in parts (a) and (b)? Explain your answer.

Challenge **Factor each expression.**

51. $64r^6 - 144r^3 + 81$

52. $p^6 + 40p^3q + 400q^2$

53. $36m^4 + 84m^2 + 49$

54. $108n^6 - 147$

55. $x^{20} - 4x^{10}y^5 + 4y^{10}$

56. $256g^4 - 100h^6$

57. The binomial $16 - 81n^4$ can be factored twice using the difference-of-squares rule.

a. Factor $16 - 81n^4$ completely.

b. **Reasoning** What characteristics do 16 and $81n^4$ share that make this possible?

c. **Open-Ended** Write another binomial that can be factored twice using the difference of squares rule.

Standardized Test Prep

SAT/ACT

58. What is the factored form of $4x^2 - 20x + 25$?

(A) $(2x + 5)(2x - 5)$ (B) $(2x - 5)(2x - 5)$ (C) $(4x - 5)(4x - 5)$ (D) $(4x + 5)(4x - 5)$

59. Which equation has -2 as its solution?

(F) $x + 3 = 2x + 1$ (G) $x - 5 = 2x - 7$ (H) $2x + 5 = 5x + 11$ (I) $3x + 1 = x - 5$

60. Which equation illustrates the Commutative Property of Multiplication?

(A) $ab = ba$ (B) $a(bc) = (ab)c$ (C) $ab = ab$ (D) $a(b + c) = ab + ac$

Short Response

61. A film club sponsors a film fest at a local movie theater. Renting the theater costs \$190. The admission is \$2 per person.

a. Write an equation that relates the film club's total cost c and the number of people p who attend the film fest.

b. Graph the equation you wrote in part (a).

Mixed Review

Factor each expression. See Lesson 8-6.

62. $18x^2 + 9x - 14$

63. $8x^2 + 18x + 9$

64. $12x^2 - 41x + 35$

Get Ready! **To prepare for Lesson 8-8, do Exercises 65–67.**

Find the GCF of the terms of each polynomial. See Lesson 8-2.

65. $6t^2 + 12t - 4$

66. $9m^3 + 15m^2 - 21m$

67. $16h^4 - 12h^3 - 36h^2$