# 5.7 Exercise Set

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***Concept Reinforcement*** *Classify each binomial as either a sum of cubes, a difference of cubes, a difference of squares, or none of these.*

1. $x^3 - 1$ Difference of cubes
2. $8 + t^3$ Sum of cubes
3. $9x^4 - 25$ Difference of squares
4. $9x^2 + 25$ None of these
5. $1000t^3 + 1$ Sum of cubes
6. $x^3y^3 - 27z^3$ Difference of cubes
7. $25x^2 + 8x$ None of these
8. $100y^8 - 25x^4$ Difference of squares
9. $s^{12} - t^{15}$ Difference of cubes
10. $14x^3 - 2x$ None of these

*Factor completely.*

11. $x^3 + 64$ $(x + 4)(x^2 - 4x + 16)$
12. $t^3 + 27$ $(t + 3)(t^2 - 3t + 9)$
13. $z^3 - 1$ $(z - 1)(z^2 + z + 1)$
14. $x^3 - 8$ $(x - 2)(x^2 + 2x + 4)$
15. $t^3 - 1000$ $(t - 10)(t^2 + 10t + 100)$
16. $m^3 - 125$ $(m - 5)(m^2 + 5m + 25)$
17. $27x^3 + 1$ $(3x + 1)(9x^2 - 3x + 1)$
18. $8a^3 + 1$ $(2a + 1)(4a^2 - 2a + 1)$
19. $64 - 125x^3$ $(4 - 5x)(16 + 20x + 25x^2)$
20. $27 - 8t^3$ $(3 - 2t)(9 + 6t + 4t^2)$
21. $8y^3 + 64$ $8(y + 2)(y^2 - 2y + 4)$
22. $8a^3 + 1000$ $8(a + 5)(a^2 - 5a + 25)$
23. $x^3 - y^3$ ⊡
24. $y^3 - z^3$ ⊡
25. $a^3 + \frac{1}{8}$ ⊡
26. $x^3 + \frac{1}{27}$ ⊡
27. $8t^3 - 8$ $8(t - 1)(t^2 + t + 1)$
28. $2y^3 - 128$ $2(y - 4)(y^2 + 4y + 16)$
29. $y^3 - \frac{1}{1000}$ ⊡
30. $x^3 - \frac{1}{125}$ $\left(x - \frac{1}{5}\right)\left(x^2 + \frac{1}{5}x + \frac{1}{25}\right)$
31. $ab^3 + 125a$ $a(b + 5)(b^2 - 5b + 25)$
32. $rs^3 + 64r$ $r(s + 4)(s^2 - 4s + 16)$
33. $5x^3 - 40z^3$ $5(x - 2z)(x^2 + 2xz + 4z^2)$
34. $2y^3 - 54z^3$ $2(y - 3z)(y^2 + 3yz + 9z^2)$
35. $x^3 + 0.001$ $(x + 0.1)(x^2 - 0.1x + 0.01)$
36. $y^3 + 0.125$ $(y + 0.5)(y^2 - 0.5y + 0.25)$
37. $64x^6 - 8t^6$ $8(2x^2 - t^2)(4x^4 + 2x^2t^2 + t^4)$
38. $125c^6 - 8d^6$ ⊡
39. $2y^4 - 128y$ $2y(y - 4)(y^2 + 4y + 16)$
40. $3z^5 - 3z^2$ $3z^2(z - 1)(z^2 + z + 1)$
41. $z^6 - 1$ ⊡
42. $t^6 + 1$ $(t^2 + 1)(t^4 - t^2 + 1)$
43. $t^6 + 64y^6$ ⊡
44. $p^6 - w^6$ ⊡
45. $x^{12} - y^3z^{12}$ ⊡
46. $a^9 + b^{12}c^{15}$ ⊡

*Solve.*

47. $x^3 + 1 = 0$ $-1$
48. $t^3 - 8 = 0$ $2$
49. $8x^3 = 27$ $\frac{3}{2}$
50. $64x^3 + 27 = 0$ $-\frac{3}{4}$
51. $2t^3 - 2000 = 0$ $10$
52. $375 = 24x^3$ $\frac{5}{2}$

TW 53. How could you use factoring to convince someone that $x^3 + y^3 \neq (x + y)^3$?

TW 54. Is the following statement true or false and why? If $A^3$ and $B^3$ have a common factor, then $A$ and $B$ have a common factor.

## SKILL REVIEW

*To prepare for Section 5.8, review solving problems using the five-step strategy (Section 1.7).*

*Translate to an algebraic expression.* [1.7]

55. The square of the sum of two numbers ⊡
56. The sum of the squares of two numbers ⊡
57. The product of two consecutive integers ⊡

*Solve.* [1.7]

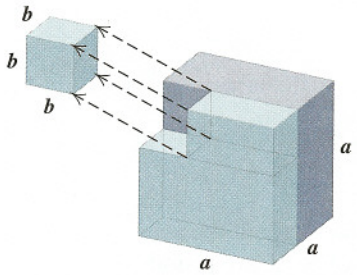
58. In 2009, shoppers spent $23.5 billion on gifts for Mother's Day and for Father's Day combined. They spent $4.7 billion more for Mother's Day than for Father's Day. How much did shoppers spend for each holiday? Mother's Day: $14.1 billion; Father's Day: $9.4 billion
Source: National Retail Federation

59. The first angle of a triangle is four times as large as the second. The measure of the third angle is 30° less than that of the second. How large are the angles? 140°, 35°, 5°
60. A rectangular table top is twice as long as it is wide. The perimeter of the table is 192 in. What are the dimensions of the table? Length: 64 in.; width: 32 in.

⊡ Answers to Exercises 23–26, 29, 38, 41, 43–46, and 55–57 are on p. IA-13.

## SYNTHESIS

TW **61.** Explain how the geometric model below can be used to verify the formula for factoring $a^3 - b^3$.




TW **62.** Explain how someone could construct a binomial that is both a difference of two cubes and a difference of two squares.

*Factor.*

**63.** $x^{6a} - y^{3b}$ ⊡

**64.** $2x^{3a} + 16y^{3b}$ ⊡

Aha! **65.** $(x + 5)^3 + (x - 5)^3$ ⊡

**66.** $\frac{1}{16}x^{3a} + \frac{1}{2}y^{6a}z^{9b}$ ⊡

⊡ Answers to Exercises 63–68 are on p. IA-13.

**67.** $5x^3y^6 - \frac{5}{8}$ ⊡

**68.** $x^3 - (x + y)^3$ ⊡

**69.** $x^{6a} - (x^{2a} + 1)^3$
$-(3x^{4a} + 3x^{2a} + 1)$

**70.** $(x^{2a} - 1)^3 - x^{6a}$
$-(3x^{4a} - 3x^{2a} + 1)$

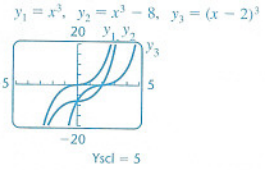
**71.** $t^4 - 8t^3 - t + 8$
$(t - 8)(t - 1)(t^2 + t + 1)$

**72.** If $P(x) = x^3$, use factoring to simplify
$P(a + h) - P(a)$. $h(3a^2 + 3ah + h^2)$

**73.** If $Q(x) = x^6$, use factoring to simplify
$Q(a + h) - Q(a)$.
$h(2a + h)(a^2 + ah + h^2)(3a^2 + 3ah + h^2)$

**74.** Using one viewing window, graph the following.

**a)** $f(x) = x^3$
**b)** $g(x) = x^3 - 8$
**c)** $h(x) = (x - 2)^3$




**Try Exercise Answers: Section 5.7**
**11.** $(x + 4)(x^2 - 4x + 16)$
**33.** $5(x - 2z)(x^2 + 2xz + 4z^2)$ **47.** $-1$

# Mid-Chapter Review

We can use the following guidelines to factor polynomials.

### To Factor a Polynomial

**A.** Always look for a common factor first. If there is one, factor out the largest common factor. Be sure to include it in your final answer.

**B.** Then look at the number of terms.

*Two terms*: Try factoring as a difference of squares first:

$$A^2 - B^2 = (A - B)(A + B).$$

Next, try factoring as a sum or a difference of cubes:

$$A^3 + B^3 = (A + B)(A^2 - AB + B^2)$$

and

$$A^3 - B^3 = (A - B)(A^2 + AB + B^2).$$