In Exercises 1–8, factor the polynomial by grouping.
▶ *Example 1*

1. $x^3 + x^2 + 2x + 2$
2. $y^3 - 9y^2 + y - 9$
3. $3z^3 - 8 - 12z^2 + 2z$
4. $2s^3 + 27 + 18s + 3s^2$
5. $x^2 + xy + 8x + 8y$
6. $q^2 + q + 5pq + 5p$
7. $m^2 - 3n - 3m + mn$
8. $2a^2 - 12b + 8ab - 3a$
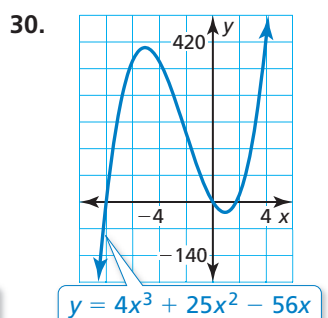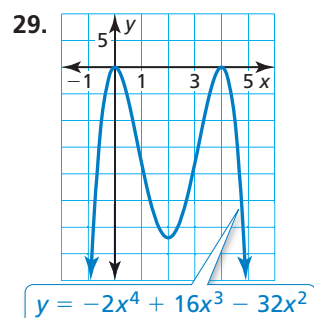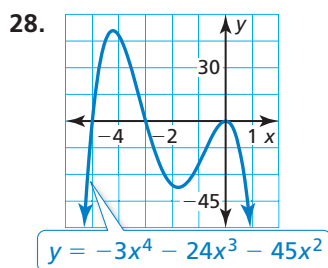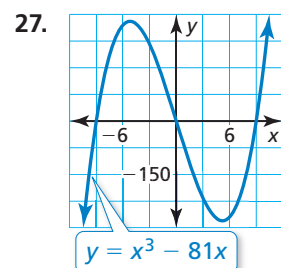
In Exercises 9–20, factor the polynomial completely.
▶ *Example 2*

9. $2x^3 - 2x$
10. $36a^4 - 4a^2$
11. $2c^2 - 7c + 19$
12. $m^2 - 5m - 35$
13. $6g^3 - 24g^2 + 24g$
14. $-15d^3 + 21d^2 - 6d$
15. $3r^5 + 3r^4 - 90r^3$
16. $5w^4 - 40w^3 + 80w^2$
17. $-4c^4 + 8c^3 - 28c^2$
18. $8t^2 + 8t - 72$
19. $b^3 - 5b^2 - 4b + 20$
20. $h^3 + 4h^2 - 25h - 100$

In Exercises 21–26, solve the equation. ▶ *Example 3*

21. $5n^3 - 30n^2 + 40n = 0$
22. $k^4 - 100k^2 = 0$
23. $x^3 + x^2 = 4x + 4$
24. $2t^5 + 2t^4 - 144t^3 = 0$
25. $147s - 3s^3 = 0$
26. $4y^3 - 7y^2 + 28 = 16y$

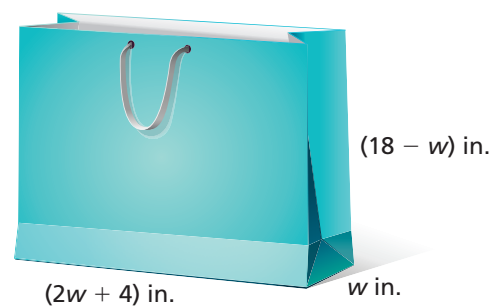**In Exercises 27–30, find the x-intercepts of the graph.**

27.

$y = x^3 - 81x$

28.

$y = -3x^4 - 24x^3 - 45x^2$

29.

$y = -2x^4 + 16x^3 - 32x^2$

30.

$y = 4x^3 + 25x^2 - 56x$

ERROR ANALYSIS In Exercises 31 and 32, describe and correct the error in factoring the polynomial completely.

31.

$$a^3 + 8a^2 - 6a - 48$$
$$= a^2(a + 8) + 6(a + 8)$$
$$= (a + 8)(a^2 + 6)$$

32.

$$x^3 - 6x^2 - 9x + 54$$
$$= x^2(x - 6) - 9(x - 6)$$
$$= (x - 6)(x^2 - 9)$$

33. **MODELING REAL LIFE** A birdhouse in the shape of a rectangular prism has a volume of 128 cubic inches. The width is w inches, the depth is 4 inches, and the height is 4 inches greater than the width. What are the dimensions of the birdhouse? ▶ *Example 4*

34. **MODELING REAL LIFE** A gift bag has width w and is in the shape of a rectangular prism. The volume of the gift bag is 1152 cubic inches. The height is greater than the width. What are the dimensions of the gift bag?

$(18 - w)$ in.
$(2w + 4)$ in.
w in.

In Exercises 35–38, factor the polynomial completely.

35. $x^3 + 2x^2y - x - 2y$
36. $8b^3 - 4b^2a - 18b + 9a$
37. $4s^2 - s + 12st - 3t$
38. $6m^3 - 12mn + m^2n - 2n^2$

39. **COLLEGE PREP** When $9h^3 - 25h - 27h^2 + 75$ is factored completely, which of the following is one of the factors? Select all that apply.

Ⓐ $9h^2 - 25$
Ⓑ $h - 3$
Ⓒ $3h - 5$
Ⓓ $3h + 5$