**State whether each sentence is *true* or *false*. If *false*, replace the underlined term to make a true sentence.**

1. The coefficient of the first term of a polynomial in standard form is called the <u>leading coefficient</u>.

*ANSWER:*
true

2. Polynomials that cannot be factored are called <u>polynomials in one variable</u>.

*ANSWER:*
false; prime polynomials

3. A <u>prime polynomial</u> has a degree that is one less than the original polynomial.

*ANSWER:*
false; depressed polynomial

4. A point on the graph of a function where no other nearby point has a greater $y$-coordinate is called a <u>relative maximum</u>.

*ANSWER:*
true

5. A <u>polynomial function</u> is a continuous function that can be described by a polynomial equation in one variable.

*ANSWER:*
true

6. To <u>simplify</u> an expression containing powers means to rewrite the expression without parentheses or negative exponents.

*ANSWER:*
true

7. <u>Synthetic division</u> is a shortcut method for dividing a polynomial by a binomial.

*ANSWER:*
true;

8. The relative maximum and relative minimum of a function are often referred to as <u>end behavior</u>.

*ANSWER:*
false; turning points

9. When a polynomial is divided by one of its binomial factors, the quotient is called a <u>depressed polynomial</u>.

*ANSWER:*
true

10. $(x^3)^2 + 3x^3 - 8 = 0$ is a <u>power function</u>.

*ANSWER:*
false; written in quadratic form

**Simplify. Assume that no variable equals 0.**

11. $\dfrac{14x^4 y}{2x^3 y^5}$

*ANSWER:*
$\dfrac{7x}{y^4}$

12. $3t(tn - 5)$

*ANSWER:*
$3t^2 n - 15t$

13. $(4r^2 + 3r - 1) - (3r^2 - 5r + 4)$

*ANSWER:*
$r^2 + 8r - 5$

14. $(x^4)^3$

*ANSWER:*
$x^{12}$

15. $(m + p)(m^2 - 2mp + p^2)$

*ANSWER:*
$m^3 - m^2 p - mp^2 + p^3$

16. $3b(2b - 1) + 2b(b + 3)$

*ANSWER:*
$8b^2 + 3b$

**Simplify.**

17. $\dfrac{12x^4y^5 + 8x^3y^7 - 16x^2y^6}{4xy^5}$

    *ANSWER:*

    $3x^3 + 2x^2y^2 - 4xy$

18. $(6y^3 + 13y^2 - 10y - 24) \div (y + 2)$

    *ANSWER:*

    $6y^2 + y - 12$

19. $(a^4 + 5a^3 + 2a^2 - 6a + 4)(a + 2)^{-1}$

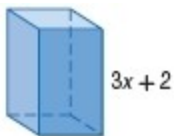    *ANSWER:*

    $a^3 + 3a^2 - 4a + 2$

**Simplify.**

20. $(4a^6 - 5a^4 + 3a^2 - a) \div (2a + 1)$

    *ANSWER:*

    $2a^5 - a^4 - 2a^3 + a^2 + a - 1 + \dfrac{1}{2a+1}$

21. **GEOMETRY** The volume of the rectangular prism is $3x^3 + 11x^2 - 114x - 80$ cubic units. What is the area of the base?

    

    *ANSWER:*

    $x^2 + 3x - 40$ units$^2$

**State the degree and leading coefficient of each polynomial in one variable. If it is not a polynomial in one variable, explain why.**

22. $5x^6 - 3x^4 + x^3 - 9x^2 + 1$

    *ANSWER:*

    degree: 6; leading coefficient: 5

23. $6xy^2 - xy + y^2$

    *ANSWER:*

    This is not a polynomial in one variable. It has two variables, $x$ and $y$.

24. $12x^3 - 5x^4 + 6x^8 - 3x - 3$

    *ANSWER:*

    degree: 8; leading coefficient: 6

**Find $p\,(-2)$ and $p\,(x + h)$ for each function.**

25. $p\,(x) = x^2 + 2x - 3$

    *ANSWER:*

    $p(-2) = -3; p\,(x + h) = x^2 + 2xh + h^2 + 2x + 2h - 3$

26. $p\,(x) = 3x^2 - x$

    *ANSWER:*

    $p(-2) = 14; p\,(x + h) = 3x^2 + 6xh + 3h^2 - x - h$

27. $p\,(x) = 3 - 5x^2 + x^3$

    *ANSWER:*

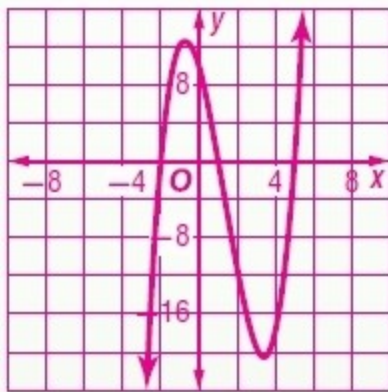    $p(-2) = -25; p\,(x + h) = 3 - 5x^2 - 10xh - 5h^2 + x^3 + 3hx^2 + 3h^2x + h^3$

**Complete each of the following.**
**a. Graph each function by making a table of values.**
**b. Determine the consecutive integer values of $x$ between which each real zero is located.**
**c. Estimate the $x$-coordinates at which the relative maxima and minima occur.**
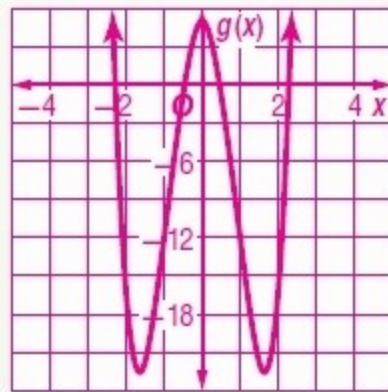
28. $h(x) = x^3 - 4x^2 - 7x + 10$

*ANSWER:*

**a.**



**b.** The zeros are at −2, 1, and 5.
**c.** rel. max: $x \approx -0.69$; rel. min: $x \approx 3.36$

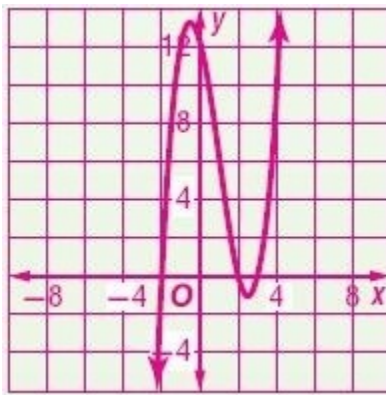29. $g(x) = 4x^4 - 21x^2 + 5$

*ANSWER:*

**a.**



**b.** between −3 and −2, between −1 and 0, between 0 and 1, between 2 and 3
**c.** rel. max: $x \approx 0$; rel. min: $x \approx 1.62$ and $x \approx -1.62$

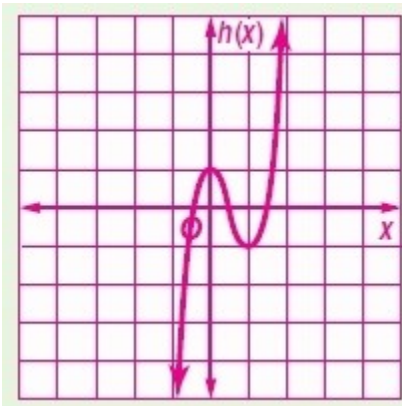30. $f(x) = x^3 - 3x^2 - 4x + 12$

*ANSWER:*

**a.**



**b.** zeros at −2, 2, and 3
**c.** rel. max: $x \approx -0.53$; rel. max: $x \approx 2.53$
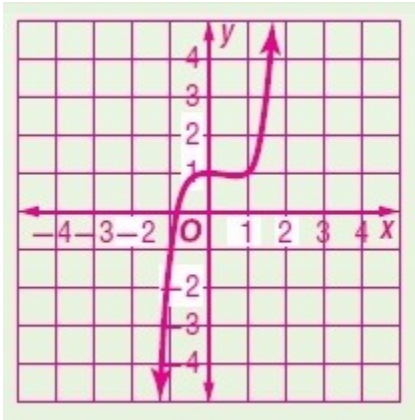
31. $h(x) = 4x^3 - 6x^2 + 1$

*ANSWER:*

**a.**



**b.** between −1 and 0, between 0 and 1, and between 1 and 2
**c.** rel. max: $x \approx 0$; rel. min: $x \approx 1$

32. $p(x) = x^5 - x^4 + 1$

    *ANSWER:*

    **a.**

    

    **b.** between $-1$ and $0$
    **c.** rel. max: $x = 0$; rel. min: $x \approx 0.80$

33. **BUSINESS** Milo tracked the monthly profits for his sports store business for the first six months of the year. They can be modeled by using the following six points: (1, 675), (2, 950), (3, 550), (4, 250), (5, 600), and (6, 400). How many turning points would the graph of a polynomial function through these points have? Describe them.

    *ANSWER:*
    2 relative maxima and 1 relative minima

    **Factor completely. If the polynomial is not factorable, write *prime*.**

34. $a^4 - 16$

    *ANSWER:*
    $(a - 2)(a + 2)(a^2 + 4)$

35. $x^3 + 6y^3$

    *ANSWER:*
    prime

36. $54x^3y - 16y^4$

    *ANSWER:*
    $2y(3x - 2y)(9x^2 + 6xy + 4y^2)$

37. $6ay + 4by - 2cy + 3az + 2bz - cz$

    *ANSWER:*
    $(2y + z)(3a + 2b - c)$

**Solve each equation.**
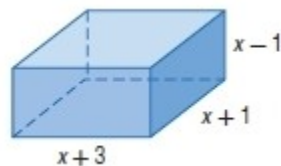
38. $x^3 + 2x^2 - 35x = 0$

    *ANSWER:*
    $-7, 0, 5$

39. $8x^4 - 10x^2 + 3 = 0$

    *ANSWER:*
    $\pm\dfrac{\sqrt{3}}{2}, \pm\dfrac{\sqrt{2}}{2}$

40. **GEOMETRY** The volume of the prism is 315 cubic inches. Find the value of $x$ and the length, height, and width.

    

    *ANSWER:*
    $x = 6$, length $= 9$ in., height $= 5$ in., width $= 7$ in.

    **Use synthetic substitution to find $f(-2)$ and $f(4)$ for each function.**

41. $f(x) = x^2 - 3$

    *ANSWER:*
    $f(-2) = 1; f(4) = 13$

42. $f(x) = x^2 - 5x + 4$

    *ANSWER:*
    $f(-2) = 18; f(4) = 0$

43. $f(x) = x^3 + 4x^2 - 3x + 2$

    *ANSWER:*
    $f(-2) = 16; f(4) = 118$

44. $f(x) = 2x^4 - 3x^3 + 1$

    *ANSWER:*
    $f(-2) = 57; f(4) = 321$

**Study Guide and Review - Chapter 5**

**Given a polynomial and one of its factors, find the remaining factors of the polynomial.**

45. $3x^3 + 20x^2 + 23x - 10; x + 5$

*ANSWER:*

$x + 2$ and $3x - 1$

46. $2x^3 + 11x^2 + 17x + 5; 2x + 5$

*ANSWER:*

2 and $x^2 + 3x + 1$

47. $x^3 + 2x^2 - 23x - 60; x - 5$

*ANSWER:*

$x + 3, x + 4$

**State the possible number of positive real zeros, negative real zeros, and imaginary zeros of each function.**

48. $f(x) = -2x^3 + 11x^2 - 3x + 2$

*ANSWER:*

positive real zeros: 3 or 1
negative real zeros: 0
imaginary zeros: 2 or 0

49. $f(x) = -4x^4 - 2x^3 - 12x^2 - x - 23$

*ANSWER:*

positive real zeros: 0
negative real zeros: 4, 2, or 0
imaginary zeros: 4, 2, or 0

50. $f(x) = x^6 - 5x^3 + x^2 + x - 6$

*ANSWER:*

positive real zeros: 3 or 1
negative real zeros: 1
imaginary zeros: 4 or 2

51. $f(x) = -2x^5 + 4x^4 + x^2 - 3$

*ANSWER:*

positive real zeros: 2 or 0
negative real zeros: 1
imaginary zeros: 4 or 2

52. $f(x) = -2x^6 + 4x^4 + x^2 - 3x - 3$

*ANSWER:*

positive real zeros: 2 or 0
negative real zeros: 2 or 0
imaginary zeros: 6, 4, or 2

**Find all of the zeros of each function.**

53. $f(x) = x^3 + 4x^2 + 3x - 2$

*ANSWER:*

$-2, -1 \pm \sqrt{2}$

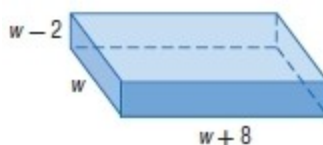54. $f(x) = 4x^3 + 4x^2 - x - 1$

*ANSWER:*

$-1, -\dfrac{1}{2}, \dfrac{1}{2}$

55. $f(x) = x^3 + 2x^2 + 4x + 8$

*ANSWER:*

$-2, \pm 2i$

56. **STORAGE** Melissa is building a storage box that is shaped like a rectangular prism. It will have a volume of 96 cubic feet. Using the diagram below, find the dimensions of the box.



*ANSWER:*
width = 4 ft,
length = 12 ft,
height = 2 ft