6.7 Exercise Set

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Concept Reinforcement *Classify each of the following statements as either true or false.*

1. If $x - 2$ is a factor of some polynomial $P(x)$, then $P(2) = 0$. True
2. If $p(3) = 0$ for some polynomial $p(x)$, then $x - 3$ is a factor of $p(x)$. True
3. If $P(-5) = 39$ and $P(x) = x^3 + 7x^2 + 3x + 4$, then

$$\begin{array}{r|rrrr} -5 & 1 & 7 & 3 & 4 \\ & & -5 & -10 & 35 \\ \hline & 1 & 2 & -7 & 39. \end{array}$$

True

4. In order for $f(x)/g(x)$ to exist, $g(x)$ must be 0. False
5. In order to use synthetic division, we must be sure that the divisor is of the form $x - a$. True
6. Synthetic division can be used in problems in which long division could not be used. False

Use synthetic division to divide.

7. $(x^3 - 4x^2 - 2x + 5) \div (x - 1)$ $x^2 - 3x - 5$
8. $(x^3 - 4x^2 + 5x - 6) \div (x - 3)$ $x^2 - x + 2$
9. $(a^2 + 8a + 11) \div (a + 3)$ $a + 5 + \dfrac{-4}{a + 3}$
10. $(a^2 + 8a + 11) \div (a + 5)$ $a + 3 + \dfrac{-4}{a + 5}$
11. $(2x^3 - x^2 - 7x + 14) \div (x + 2)$ $2x^2 - 5x + 3 + \dfrac{8}{x + 2}$
12. $(3x^3 - 10x^2 - 9x + 15) \div (x - 4)$ $3x^2 + 2x - 1 + \dfrac{11}{x - 4}$
13. $(a^3 - 10a + 12) \div (a - 2)$ $a^2 + 2a - 6$
14. $(a^3 - 14a + 15) \div (a - 3)$ $a^2 + 3a - 5$
15. $(3y^3 - 7y^2 - 20) \div (y - 3)$ $3y^2 + 2y + 6 + \dfrac{-2}{y - 3}$
16. $(2x^3 - 3x^2 + 8) \div (x + 2)$ $2x^2 - 7x + 14 + \dfrac{-20}{x + 2}$
17. $(x^5 - 32) \div (x - 2)$ $x^4 + 2x^3 + 4x^2 + 8x + 16$
18. $(y^5 - 1) \div (y - 1)$ $y^4 + y^3 + y^2 + y + 1$
19. $(3x^3 + 1 - x + 7x^2) \div \left(x + \frac{1}{3}\right)$ $3x^2 + 6x - 3 + \dfrac{2}{x + \frac{1}{3}}$
20. $(8x^3 - 1 + 7x - 6x^2) \div \left(x - \frac{1}{2}\right)$ $8x^2 - 2x + 6 + \dfrac{2}{x - \frac{1}{2}}$

Use synthetic division to find the indicated function value.

21. $f(x) = 5x^4 + 12x^3 + 28x + 9$; $f(-3)$ 6
22. $g(x) = 3x^4 - 25x^2 - 18$; $g(3)$ 0
23. $P(x) = 2x^4 - x^3 - 7x^2 + x + 2$; $P(-3)$ 125
24. $F(x) = 3x^4 + 8x^3 + 2x^2 - 7x - 4$; $F(-2)$ 2
25. $f(x) = x^4 - 6x^3 + 11x^2 - 17x + 20$; $f(4)$ 0
26. $p(x) = x^4 + 7x^3 + 11x^2 - 7x - 12$; $p(2)$ 90

TW 27. Why is it that we *add* when performing synthetic division, but *subtract* when performing long division?

TW 28. Explain how synthetic division could be useful when attempting to factor a polynomial.

SKILL REVIEW

To prepare for Section 6.8, review solving a formula for a variable (Section 1.6).

Solve. [1.6]

29. $ac = b$, for c ⊡
30. $x - wz = y$, for w ⊡
31. $pq - rq = st$, for q ⊡
32. $ab = d - cb$, for b ⊡
33. $ab - cd = 3b + d$, for b ⊡
34. $ab - cd = 3b + d$, for d ⊡

SYNTHESIS

TW 35. Let $Q(x)$ be a polynomial function with $p(x)$ a factor of $Q(x)$. If $p(3) = 0$, does it follow that $Q(3) = 0$? Why or why not? If $Q(3) = 0$, does it follow that $p(3) = 0$? Why or why not?

TW 36. What adjustments must be made if synthetic division is to be used to divide a polynomial by a binomial of the form $ax + b$, with $a > 1$?

37. To prove the remainder theorem, note that any polynomial $P(x)$ can be rewritten as $(x - r) \cdot Q(x) + R$, where $Q(x)$ is the quotient polynomial that arises when $P(x)$ is divided by $x - r$, and R is some constant (the remainder).
   a) How do we know that R must be a constant? ⊡
   b) Show that $P(r) = R$ (this says that $P(r)$ is the remainder when $P(x)$ is divided by $x - r$). ⊡

38. Let $f(x) = 6x^3 - 13x^2 - 79x + 140$. Find $f(4)$ and then solve the equation $f(x) = 0$. 0; $-\frac{7}{2}, \frac{5}{3}, 4$

39. Let $f(x) = 4x^3 + 16x^2 - 3x - 45$. Find $f(-3)$ and then solve the equation $f(x) = 0$. 0; $-3, -\frac{5}{2}, \frac{3}{2}$

⊡ Answers to Exercises 29–34 and 37 are on pp. IA-14 and IA-15.