Use synthetic division in each of the following. See Examples 1 and 2.

1. $\dfrac{x^2 + 6x - 7}{x - 1}$

2. $\dfrac{x^2 - 2x - 15}{x + 3}$

3. $\dfrac{3a^2 + 10a + 11}{a + 2}$

4. $\dfrac{4y^2 - 5y - 20}{y - 3}$

5. $(p^2 - 3p + 5) \div (p + 1)$

6. $(z^2 + 4z - 6) \div (z - 5)$

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

8. $\dfrac{5p^3 - 6p^2 + 3p + 14}{p + 1}$

9. $(6x^5 - 2x^3 - 4x^2 + 3x - 2) \div (x - 2)$

10. $(y^5 - 4y^4 + 3y^2 - 5y + 4) \div (y - 3)$

11. $(-4r^6 - 3r^5 - 3r^4 + 5r^3 - 6r^2 + 3r + 3) \div (r - 1)$

12. $(m^6 + 2m^4 - 5m + 11) \div (m - 2)$

13. $\dfrac{y^3 - 1}{y + 1}$

14. $\dfrac{m^3 - 8}{m + 2}$

15. $\dfrac{p^4 + 16}{p + 4}$

16. $\dfrac{z^4 + 81}{z + 3}$

17. $\dfrac{.2m^3 - .28m^2 + .49m - .36}{m - .9}$

18. $\dfrac{.3a^3 + .02a^2 + .06a + .04}{a + .4}$

Use the remainder theorem to find P(k). See Example 3.

19. $k = 2$; $P(x) = x^3 - 4x^2 + 8x - 1$

20. $k = -1$; $P(y) = 2y^3 + y^2 - y + 5$

21. $k = -4$; $P(r) = -r^3 + 8r^2 - 3r - 2$

22. $k = 3$; $P(z) = z^3 + 5z^2 - 7z + 1$

23. $k = 3$; $P(y) = 2y^3 - 4y^2 + 5y - 33$

24. $k = 2$; $P(x) = x^3 - 3x^2 + 4x - 4$

25. $k = -2$; $P(x) = x^4 - 3x^3 + 5x^2 - 2x + 5$

26. $k = -1$; $P(t) = -t^4 + t^3 - 5t^2 + 3t - 4$

Use synthetic division to tell whether or not -2 is a solution of each of the following equations. See Example 4.

27. $x^3 - 2x^2 - 2x + 12 = 0$

28. $x^5 + 2x^4 - 3x^3 + 8x = 0$

29. $3a^3 + 2a^2 - 2a + 11 = 0$

30. $3z^3 + 10z^2 + 3z - 9 = 0$

31. $4x^5 + 3x^4 + .2x^3 + 9x^2 - 29x + 2 = 0$

32. $9k^5 + 15k^4 + 7k^2 - 2k + 6 = 0$

33. $-7w^6 + 15w^5 - w^4 + 16w^3 - 4w + 4 = 0$

34. $y^6 - 5y^5 + 2y^3 + 8y^2 + 10y + 28 = 0$

35. $.8x^4 + 2x^3 + x^2 + .2x - .4 = 0$

36. $.7z^4 + 1.6z^3 + .9z^2 + 1.2z + .4 = 0$

Use synthetic division in Exercises 37–42 to decide whether the given number is a solution for the given equation. If it is, factor the polynomial on the left of the equals sign. See Example 4.

37. $2x^3 - x^2 - 13x + 24 = 0$; $x = -3$

38. $5p^3 + 22p^2 + p - 28 = 0$; $p = -4$

39. $7z^3 - z^2 + 5z - 3 = 0$; $z = 3$

40. $2r^3 + 4r^2 - r - 5 = 0$; $r = -1$

41. $2y^4 - 5y^3 + 11y^2 - 14y + 3 = 0$; $y = 3/2$

42. $6m^4 + m^3 - 4m^2 + 13m - 4 = 0$; $m = 1/3$

43. Divide $2x^3 + 5x^2 + 7x - 5$ by $2x - 1$. (*Hint:* Divide by $x - 1/2$, then divide that result by 2.)

44. Divide $6x^3 - 11x^2 + 2x + 8$ by $3x + 2$.

Use synthetic division to show that the given number is a solution of the given equation. Factor the polynomial in the equation completely, then give all other solutions of the equation.

45. $k = -2$; $x^3 + x^2 - 3x - 2 = 0$

46. $k = 1$; $2x^3 + 2x^2 - 3x - 1 = 0$

47. $k = 4$; $x^3 - x^2 - 11x - 4 = 0$

48. $k = -2$; $x^3 - 3x^2 - 13x - 6 = 0$

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1. $x + 7$ **3.** $3a + 4 + 3/(a + 2)$ **5.** $p - 4 + 9/(p + 1)$ **7.** $4a^2 + a + 3 + 4/(a - 1)$ **9.** $6x^4 + 12x^3 + 22x^2 + 40x + 83 + 164/(x - 2)$ **11.** $-4r^5 - 7r^4 - 10r^3 - 5r^2 - 11r - 8 + (-5)/(r - 1)$ **13.** $y^2 - y + 1 + (-2)/(y + 1)$ **15.** $p^3 - 4p^2 + 16p - 64 + 272/(p + 4)$ **17.** $.2m^2 - .1m + .4$ **19.** 7 **21.** 202 **23.** 0 **25.** 69 **27.** Yes **29.** No **31.** Yes **33.** No **35.** Yes **37.** -3 is a solution; factor as $(x + 3)(2x^2 - 7x + 8)$ **39.** Not a solution **41.** 3/2 is a solution; factor as $(y - 3/2)(2y^3 - 2y^2 + 8y - 2)$ or $(2y - 3)(y^3 - y^2 + 4y - 1)$ **43.** $x^2 + 3x + 5$ **45.** $(x + 2)(x^2 - x - 1) = 0$; -2 is the only rational solution **47.** $(x - 4)(x^2 + 3x + 1) = 0$; 4 is the only rational solution **49.** $\{3\}$ **51.** $\{3\}$ **53.** $\{1, 3\}$ **55.** $\{-2/3, 1/2\}$