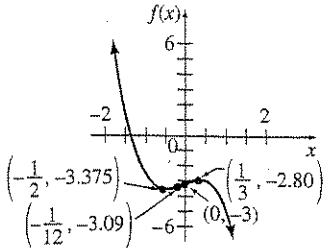
Concept Check (page 358)

1. True **2.** False **3.** False **4.** False **5.** True **6.** False **7.** True **8.** False **9.** False **10.** False
11. False **12.** True **13.** False

Chapter 5 Review Exercises (page 359)

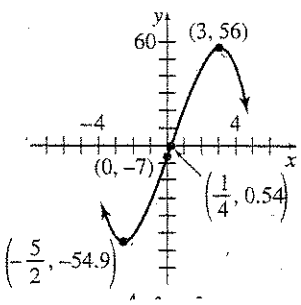
5. Increasing on $(-9/2, \infty)$; decreasing on $(-\infty, -9/2)$ **6.** Increasing on $(-\infty, 7/4)$; decreasing on $(7/4, \infty)$ **7.** Increasing on $(-5/3, 3)$; decreasing on $(-\infty, -5/3)$ and $(3, \infty)$ **8.** Increasing on $(-\infty, -2)$ and $(2/3, \infty)$; decreasing on $(-2, 2/3)$
9. Never decreasing; increasing on $(-\infty, 3)$ and $(3, \infty)$ **10.** Never increasing; decreasing on $(-\infty, -7/2)$ and $(-7/2, \infty)$
11. Decreasing on $(-\infty, -1)$ and $(0, 1)$; increasing on $(-1, 0)$ and $(1, \infty)$ **12.** Increasing on $(-\infty, 1/4)$; decreasing on $(1/4, \infty)$ **13.** Relative maximum of -4 at 2 **14.** Relative minimum of -5 at 3 **15.** Relative minimum of -7 at 2 **16.** Relative maximum of $-14/3$ at $1/3$ **17.** Relative maximum of 101 at -3; relative minimum of -24 at 2 **18.** Relative maximum of 25 at -2; relative minimum of -2 at 1 **19.** Relative maximum at $(-0.618, 0.206)$; relative minimum at $(1.618, 13.203)$ **20.** Relative maximum at $(\sqrt{e}/3, 0.83)$ or $(0.55, 0.83)$ **21.** $f''(x) = 36x^2 - 10$; 26; 314 **22.** $f''(x) = 54x + 2/x^3$; 56; $-4376/27$
23. $f''(x) = 180(3x - 6)^{-3}$ or $180/(3x - 6)^3$; $-20/3$; $-4/75$ **24.** $f''(x) = 112/(4x + 5)^3$; $112/729$; $-16/49$
25. $f''(t) = (t^2 + 1)^{-3/2}$ or $1/(t^2 + 1)^{3/2}$; $1/2^{3/2} \approx 0.354$; $1/10^{3/2} \approx 0.032$ **26.** $f''(t) = 5/(5 - t^2)^{3/2}$; $5/8$; does not exist

27.

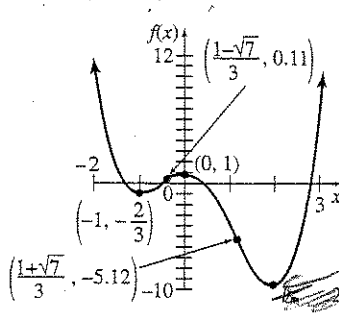


$f(x) = -2x^3 - \frac{1}{2}x^2 + x - 3$

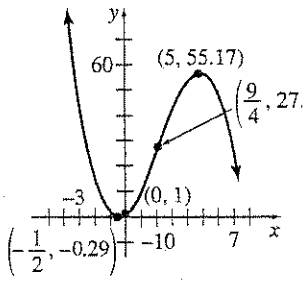
28.



29.

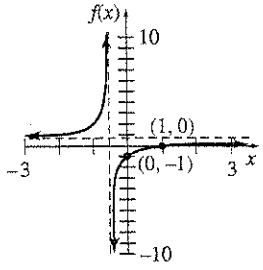


30.



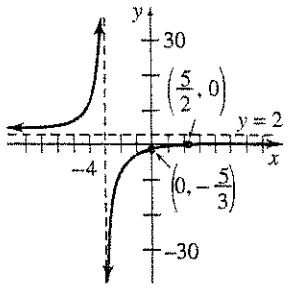
$f(x) = -\frac{2}{3}x^3 + \frac{9}{2}x^2 + 5x + 1$

31.



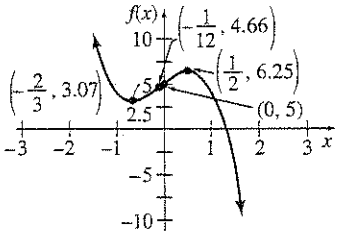
$f(x) = \frac{x - 1}{2x + 1}$

32.



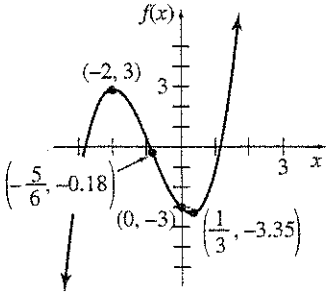
$f(x) = \frac{2x - 5}{x + 3}$

33.



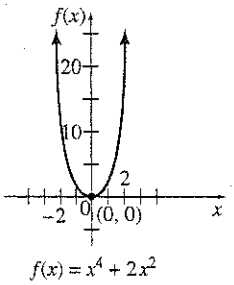
$f(x) = -4x^3 - x^2 + 4x + 5$

34.



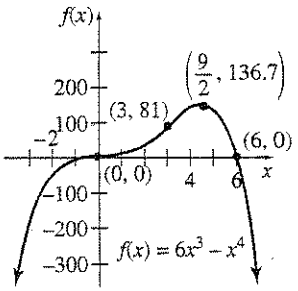
$f(x) = x^3 + \frac{5}{2}x^2 - 2x - 3$

35.



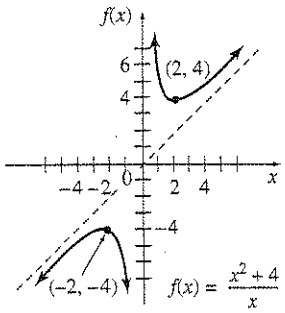
$f(x) = x^4 + 2x^2$

36.



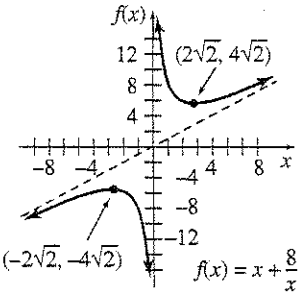
$f(x) = 6x^3 - x^4$

37.



$f(x) = \frac{x^2 + 4}{x}$

38.



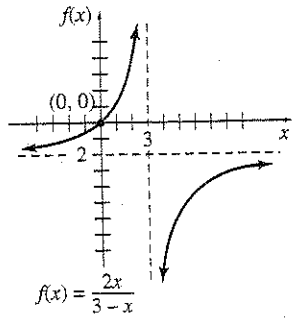
$f(x) = x + \frac{8}{x}$

39. f(x)

40. −4x f(x)

41. f(x)

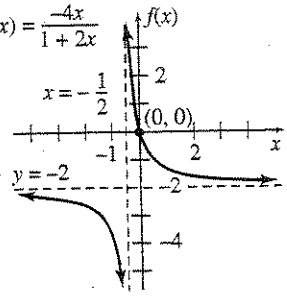
39.



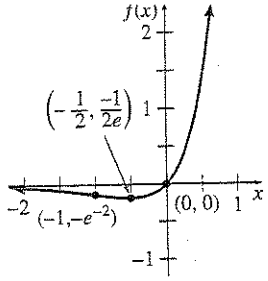
$f(x) = \dfrac{2x}{3-x}$

40.

$f(x) = \dfrac{-4x}{1+2x}$

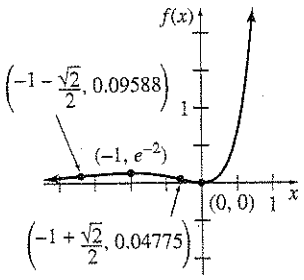


41.



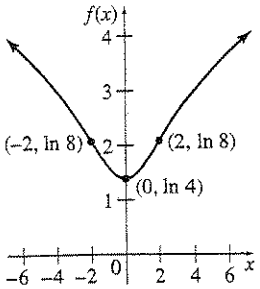
$f(x) = xe^{2x}$

42.



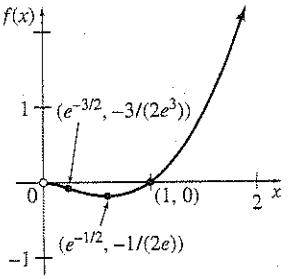
$f(x) = x^2e^{2x}$

43.



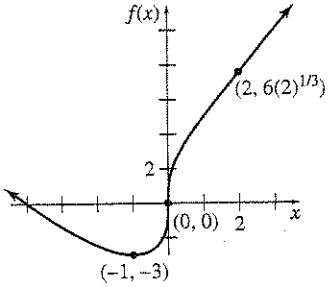
$f(x) = \ln(x^2 + 4)$

44.



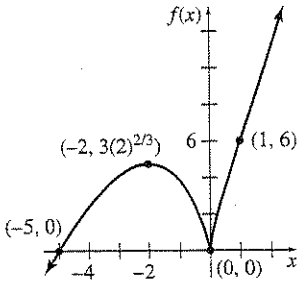
$f(x) = x^2 \ln x$

45.



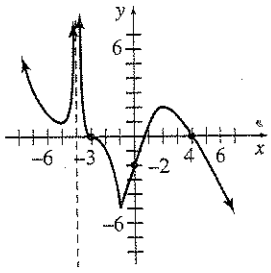
$f(x) = 4x^{1/3} + x^{4/3}$

46.



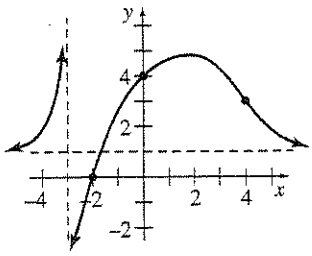
$f(x) = 5x^{2/3} + x^{5/3}$

47.



In Exercise 47, other answers are possible.

48. In Exercise 48, other answers are possible

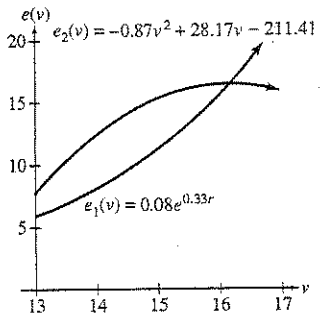


49. a. Both are negative.

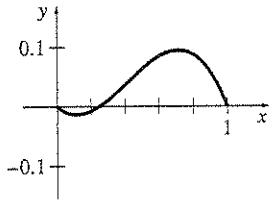
50. a. $P'(t) = 0$; $P''(t) < 0$

51. a. $P(q) = -q^3 + 7q^2 + 49x$ **b.** 7 brushes **c.** \$229 **d.** \$343 **e.** $q = 7/3$; between 2 and 3 brushes **52. a.** The first derivative has many critical numbers **b.** The curve is always decreasing except at frequent inflection points. **53. a.** Metabolic rate and life span are increasing and concave downward. Heartbeat is decreasing and concave upward.

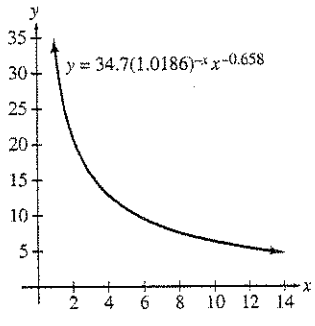
54.



55.



56.



57. a. 1486 ml per square meter; for males with 1.88 m^2 of surface area, the red cell volume increases approximately 1486 ml for each additional square meter of surface area. **b.** 1.57 m^2; 2593 ml (Hurley); 2484 ml (Pearson et al.) **c.** 1578 ml per m^2; for males with 1.57 m^2 of surface area, the red cell volume increases approximately 1578 ml for each additional square meter of surface area. **58. a.** 7.405 yr; the age at which the rate of learning to pass the test begins to slow down **59. a.** 2010, 380 million **b.** 2030 **c.** 325 million **60. a.** Between 1965 and 1967, at 1974, 1980, 1984, and at 1987 **b.** Concave upward; this means that the stockpile was increasing at an increasingly rapid rate. **61. a.** $v(t) = 512 - 32t$; $a(t) = -32$ **b.** 4096 ft **c.** After 32 sec; -512 ft per sec