Problems for Section 2.1

1. Use the graph in Figure 2.7 to decide if each of the following quantities is positive, negative or approximately zero. Illustrate your answers graphically.

   (a) The average rate of change of $f(x)$ between $x = 3$ and $x = 7$.

   (b) The instantaneous rate of change of $f(x)$ at $x = 3$.
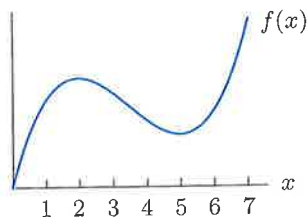

Figure 2.7

5. The distance (in feet) of an object from a point is given by $s(t) = t^2$, where time t is in seconds.

   (a) What is the average velocity of the object between $t = 3$ and $t = 5$?

   (b) By using smaller and smaller intervals around 3, estimate the instantaneous velocity at time $t = 3$.

11. (a) The function f is given in Figure 2.13. At which of the labeled points is $f'(x)$ positive? Negative? Zero?

    (b) At which labeled point is f' largest? At which labeled point is f' most negative?
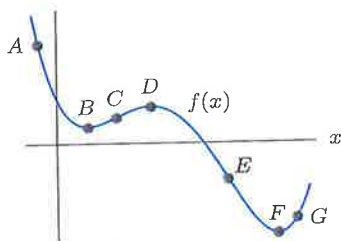

Figure 2.13

15. (a) Graph $f(x) = x^2$ and $g(x) = x^2 + 3$ on the same axes. What can you say about the slopes of the tangent lines to the two graphs at the point $x = 0$? $x = 1$? $x = 2$? $x = a$, where a is any value?

    (b) Explain why adding a constant to any function will not change the value of the derivative at any point.

Problems for Section 1.7

33. Find the future value in 15 years of a $20,000 payment today, if the interest rate is 3.8% per year compounded continuously.

35. Find the present value of a $20,000 payment to be made in 10 years. Assume an interest rate of 3.2% per year compounded continuously.

37. A person is to be paid $2000 for work done over a year. Three payment options are being considered. Option 1 is to pay the $2000 in full now. Option 2 is to pay $1000 now and $1000 in a year. Option 3 is to pay the full $2000 in a year. Assume an annual interest rate of 5% a year, compounded continuously.

    (a) Without doing any calculations, which option is the best option financially for the worker? Explain.

    (b) Find the future value, in one year's time, of all three options.

    (c) Find the present value of all three options.

Problems for Section 2.2

Sketch the graphs of the derivatives of the functions shown in Problems 11–18. Be sure your sketches are consistent with the important features of the graphs of the original functions.

11.

13.

15.

17.
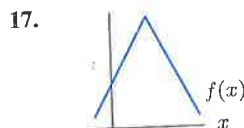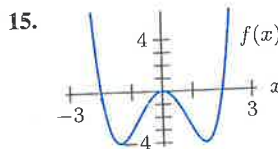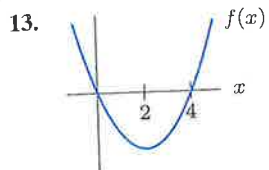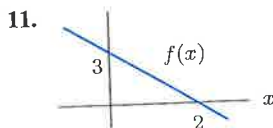
For 11-17

OK to look at answer if stuck

31.

Solutions

Section 1.9

1. $y = 5x^{1/2}$
3. Not a power function.
5. $y = 9x^{10}$
7. Not a power function
9. $y = 8x^{-1}$
11. Not a power function

Section 2.1

1. (a) Positive
   (b) Negative
3. (a) (i) 6.3 m/sec
       (ii) 6.03 m/sec
       (iii) 6.003 m/sec
   (b) 6 m/sec
5. (a) 8 ft/sec
   (b) 6 ft/sec
7. (a) 63 cubic millimeters
   (b) 10.5 cubic millimeters/month
   (c) 44.4 cubic millimeters/month
9. $f'(2) \approx 40.268$
11. (a) Positive at C and G
        Negative at A and E. Zero at B, D, and F
    (b) Largest at G
        Most negative at A
13. $f'(d) = 0$, $f'(b) = 0.5$, $f'(c) = 2$, $f'(a) = -0.5$, $f'(e) = -2$
15. (a) The slopes of the two tangent lines at $x = a$ are equal for all a
    (b) A vertical shift does not change the slope
17. $P'(0) = 10$
19. (a) $g(2) = 5$
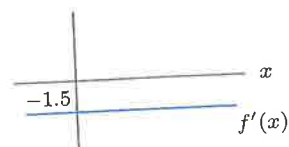   (b) $g'(2) = -0.4$
21. (a) $f(4)$
    (b) $f(2) - f(1)$

Section 1.7

33. $35,365.34
35. $14,522.98
37. (a) Option 1
    (b) $2102.54, $2051.27, $2000
    (c) $2000, $1951.23, $1902.46
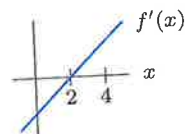
Section 2.2

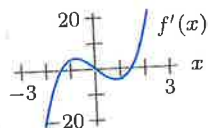11.

13.

15.

17.