Homework #10
Math 211

Problems for Section 3.1

For Problems 1–36, find the derivative. Assume a, b, c, k are constants.

1. $y = 5$

3. $y = x^{12}$

5. $y = x^{4/3}$

7. $y = 3t^4 - 2t^2$

9. $f(x) = \dfrac{1}{x^4}$

11. $y = x^2 + 5x + 9$

13. $y = 3x^2 + 7x - 9$

15. $y = 4.2q^2 - 0.5q + 11.27$

17. $g(t) = \dfrac{1}{t^5}$

19. $y = \dfrac{1}{r^{7/2}}$

21. $h(\theta) = \dfrac{1}{\sqrt[3]{\theta}}$

23. $y = 3t^5 - 5\sqrt{t} + \dfrac{7}{t}$

25. $y = 3t^2 + \dfrac{12}{\sqrt{t}} - \dfrac{1}{t^2}$

27. $y = \sqrt{x}(x + 1)$

29. $f(x) = kx^2$

31. $Q = aP^2 + bP^3$

33. $P = a + b\sqrt{t}$

35. $w = 3ab^2q$

Problems for Section 3.1

41. The height of a sand dune (in centimeters) is represented by $f(t) = 700 - 3t^2$, where t is measured in years since 2005. Find $f(5)$ and $f'(5)$. Using units, explain what each means in terms of the sand dune.

43. The quantity, Q, in tons, of material at a municipal waste site is a function of the number of years since 2000, with

$$Q = f(t) = 3t^2 + 100.$$

Find $f(10)$, $f'(10)$, and the relative rate of change f'/f at $t = 10$. Interpret your answers in terms of waste.

45. If $f(t) = 2t^3 - 4t^2 + 3t - 1$, find $f'(t)$ and $f''(t)$.

49. Find the equation of the line tangent to the graph of f at $(1, 1)$, where f is given by $f(x) = 2x^3 - 2x^2 + 1$.

55. The cost to produce q items is $C(q) = 1000 + 2q^2$ dollars. Find the marginal cost of producing the 25^{th} item. Interpret your answer in terms of costs.

63. If the demand curve is a line, we can write $p = b + mq$, where p is the price of the product, q is the quantity sold at that price, and b and m are constants.

(a) Write the revenue as a function of quantity sold.
(b) Find the marginal revenue function.

Problems for Section 3.2

Differentiate the functions in Problems 1–28. Assume that A, B, and C are constants.

1. $f(x) = 2e^x + x^2$

3. $y = 5t^2 + 4e^t$

5. $y = 2^x + \dfrac{2}{x^3}$

7. $f(x) = 2^x + 2 \cdot 3^x$

9. $y = 3x - 2 \cdot 4^x$

11. $f(t) = e^{3t}$

13. $y = e^{-4t}$

15. $P = 50e^{-0.6t}$

17. $P(t) = 3000(1.02)^t$

19. $P(t) = Ce^t$.

21. $f(x) = Ae^x - Bx^2 + C$

23. $R = 3 \ln q$

25. $y = t^2 + 5 \ln t$

27. $y = x^2 + 4x - 3 \ln x$

Section 3.1

1 0

3 $12x^{11}$

5 $\frac{4}{3}x^{1/3}$

7 $12t^3 - 4t$

9 $-4x^{-5}$

11 $2x + 5$

13 $6x + 7$

15 $8.4q - 0.5$

17 $-5t^{-6}$

19 $-(7/2)r^{-9/2}$

21 $-(1/3)\theta^{-4/3}$

23 $15t^4 - \frac{5}{2}t^{-1/2} - 7t^{-2}$

25 $6t - 6/t^{3/2} + 2/t^3$

27 $(3/2)x^{1/2} + (1/2)x^{-1/2}$

29 $2kx$

31 $2aP + 3bP^2$

33 $b/(2\sqrt{t})$

35 $3ab^2$

Section 3.1

41 Height $= 625$ cm,
Changing (eroding) at -30 cm/year

43 $f(10) = 400$ tons;
$f'(10) = 60$ tons per year;
Relative rate $= 15\%$ per year

45 $f'(t) = 6t^2 - 8t + 3$
$f''(t) = 12t - 8$

47 (a) $f(100) = 11.11$ seconds
(b) $f'(100) = 0.05555$ seconds per foot

49 $y = 2x - 1$

55 \$100

57 (a) 770 bushels per acre
(b) 40 bushels per acre per pound of fertilizer
(c) Use more fertilizer

59 (a) $dC/dq = 0.24q^2 + 75$
(b) $C(50) = \$14{,}750$; $C'(50) = \$675$ per item

61 $f'(x) = 3x^2 - 12x - 15$,
$x = -1$ and $x = 5$

63 (a) $R(q) = bq + mq^2$
(b) $R'(q) = b + 2mq$

Section 3.2

1 $2e^x + 2x$

3 $10t + 4e^t$

5 $(\ln 2)2^x - 6x^{-4}$

7 $(\ln 2)2^x + 2(\ln 3)3^x$

9 $3 - 2(\ln 4)4^x$

11 $3e^{3t}$

13 $-4e^{-4t}$

15 $-30e^{-0.6t}$

17 $3000(\ln 1.02)(1.02)^t$

19 Ce^t

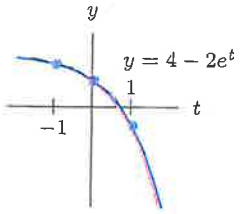
21 $Ae^x - 2Bx$

23 $3/q$

25 $2t + 5/t$

27 $2x + 4 - 3/x$

29 $f'(-1) \approx -0.736$
$f'(0) = -2$
$f'(1) \approx -5.437$



31 $y = -2t + 1$

33 (a) 13, 394 fish
(b) 8037 fish/month

35 $f(2) = 6065$, $f'(2) = -1516$

37 $f(5) = \$563.30$;
$f'(5) = \$70$ per week;
Relative rate $= 12.4\%$ per week

39 -444.3 people/year

41 $c = -1/\ln 2$

43 $C(50) \approx 1365$, $C'(50) \approx 18.27$

45 (a) 0.021 micrograms/year
(b) 779.4 years old in 1998

47 (a) $P = 1.166(1.015)^t$
(b) $\frac{dP}{dt} = 1.166(1.015)^t(\ln 1.015)$
$\frac{dP}{dt}|_{t=0} = 0.017$ billion people per year
$\frac{dP}{dt}|_{t=25} = 0.025$ billion people per year

49 (a) $y = x - 1$
(b) 0.1; 1
(c) Yes