Homework #12
math-211

Problems for Section 3.4

For Problems 3–33, find the derivative. Assume that a, b, c, and k are constants.

3. $f(x) = xe^x$
5. $y = 5xe^{x^2}$
7. $y = x \ln x$
9. $z = (3t+1)(5t+2)$
11. $P = t^2 \ln t$
13. $f(t) = \frac{5}{t} + \frac{6}{t^2}$
15. $y = te^{-t^2}$
17. $g(p) = p \ln(2p+1)$
19. $f(w) = (5w^2+3)e^{w^2}$
21. $w = (t^3+5t)(t^2-7t+2)$
23. $f(x) = \frac{x}{e^x}$
25. $z = \frac{1-t}{1+t}$
27. $w = \frac{3y+y^2}{5+y}$

Problems for Section 3.5

Differentiate the functions in Problems 1–20. Assume that A and B are constants.

1. $y = 5 \sin x$
3. $y = t^2 + 5 \cos t$
5. $R(q) = q^2 - 2 \cos q$
7. $f(x) = \sin(3x)$
9. $W = 4 \cos(t^2)$
11. $y = \sin(x^2)$
13. $z = \cos(4\theta)$
15. $f(x) = x^2 \cos x$
17. $f(\theta) = \theta^3 \cos \theta$
19. $f(t) = \frac{t^2}{\cos t}$

Problems for Section 3.4

For Problems 3–33, find the derivative. Assume that a, b, c, and k are constants.

23. $f(x) = \frac{x}{e^x}$
25. $z = \frac{1-t}{1+t}$
27. $w = \frac{3y+y^2}{5+y}$

39. For positive constants c and k, the *Monod growth curve* describes the growth of a population, P, as a function of the available quantity of a resource, r:

$$P = \frac{cr}{k+r}.$$

Find dP/dr and interpret it in terms of the growth of the population.

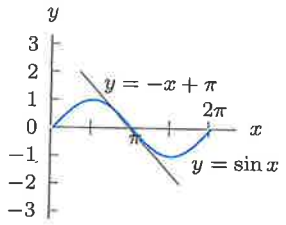
Solutions

Section 3.4

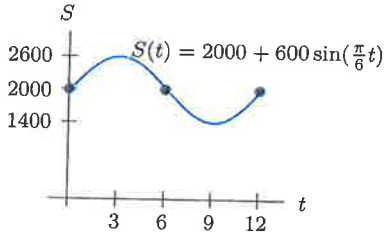
1 $f'(x) = 12x - 1$
3 $e^x(x+1)$
5 $5e^{x^2} + 10x^2e^{x^2}$
7 $\ln x + 1$
9 $30t + 11$
11 $t + 2t\ln t$
13 $-(5/t^2) - (12/t^3)$
15 $e^{-t^2}(1 - 2t^2)$
17 $2p/(2p+1) + \ln(2p+1)$
19 $2we^{w^2}(5w^2 + 8)$
21 $(3t^2+5)(t^2-7t+2) + (t^3+5t)(2t-7)$
23 $(1-x)/e^x$
25 $-2/(1+t)^2$
27 $(15 + 10y + y^2)/(5+y)^2$
29 $(ak - bc)/(cx + k)^2$
31 $ae^{-bx} - abxe^{-bx}$
33 $(1-2\alpha)e^{-2\alpha}e^{\alpha e^{-2\alpha}}$
35 $y = 0$
37 60.65 mg, 30.33 mg/hr,
41.04 mg, −12.31 mg/hr
39 $(kc)/(k+r)^2$;
Approx change in P per unit increase in r
41 Revenue $R(10) \approx 22{,}466$.
$R'(10) \approx \$449$/dollar.
43 $1/t$
45 $(fg)'/(fg) = (f'/f) + (g'/g)$

Section 3.5

1 $5\cos x$
3 $2t - 5\sin t$
5 $2q + 2\sin q$
7 $3\cos(3x)$
9 $-8t\sin(t^2)$
11 $2x\cos(x^2)$
13 $-4\sin(4\theta)$
15 $2x\cos x - x^2\sin x$
17 $3\theta^2\cos\theta - \theta^3\sin\theta$
19 $(2t\cos t + t^2\sin t)/(\cos t)^2$
21 $y = -x + \pi$



23 Decreasing, concave up
25 (a) max \$2600; min \$1400; April 1



(b) $S(2) \approx 2519.62$; $S'(2) \approx 157.08$
27 (a) Falling, 0.38 m/hr
(b) Rising, 3.76 m/hr
(c) Rising, 0.75 m/hr
(d) Falling, 1.12 m/hr
29 (a) $H'(t) = (-10\pi/3)\sin((\pi/15)t)$
(b) $t = 0, 15, 30$ days; the percentage illuminated is not changing
(c) $H'(t)$ negative for $0 < t < 15$ and positive for $15 < t < 30$