Problems for Section 3.2

31. Find the equation of the tangent line to $y = e^{-2t}$ at $t = 0$. Check by sketching the graphs of $y = e^{-2t}$ and the tangent line on the same axes.

35. The demand curve for a product is given by

$$q = f(p) = 10{,}000e^{-0.25p},$$

where q is the quantity sold and p is the price of the product, in dollars. Find $f(2)$ and $f'(2)$. Explain in economic terms what information each of these answers gives you.

41. Find the value of c in Figure 3.16, where the line l tangent to the graph of $y = 2^x$ at $(0, 1)$ intersects the x-axis.
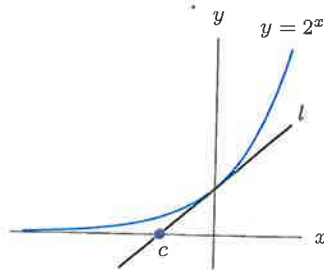

**Figure 3.16**

Problems for Section 3.3

Find the derivative of the functions in Problems 1–28.

1. $(4x^2 + 1)^7$

3. $R = (q^2 + 1)^4$

5. $w = (t^3 + 1)^{100}$

7. $y = \sqrt{s^3 + 1}$

9. $C = 12(3q^2 - 5)^3$

11. $y = 5e^{5t+1}$

13. $w = e^{\sqrt{s}}$

15. $f(x) = \ln(1 - x)$

17. $f(x) = \ln(1 - e^{-x})$

19. $f(t) = 5\ln(5t + 1)$

21. $y = 5 + \ln(3t + 2)$

23. $y = 5x + \ln(x + 2)$

25. $P = (1 + \ln x)^{0.5}$

27. $f(x) = \sqrt{1 - x^2}$

53 (a) $dA/dr = 2\pi r$
   (b) Circumference of a circle

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

$y = 4 - 2e^t$
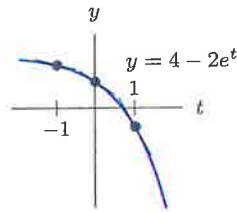
31 $y = -2t + 1$

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

Section 3.3

1 $56x(4x^2 + 1)^6$

3 $8q(q^2 + 1)^3$

5 $300t^2(t^3 + 1)^{99}$

7 $3s^2/(2\sqrt{s^3 + 1})$

9 $216q(3q^2 - 5)^2$

11 $25e^{5t+1}$

13 $(e^{\sqrt{s}})/(2\sqrt{s})$

15 $1/(x - 1)$

17 $e^{-x}/(1 - e^{-x})$

19 $25/(5t + 1)$

21 $3/(3t + 2)$

23 $5 + 1/(x + 2)$

25 $0.5/(x(1 + \ln x)^{0.5})$

27 $-x/\sqrt{1 - x^2}$

29 $10/(10t + 5)$

31 5

33 $2/t$

35 1.5

37 $2/t$

39 $y = 3x - 5$

41 $v(t) = 10e^{\frac{t}{2}}$

43 $f(10) = 31.640$ feet;
   $f'(10) = 4.741$ ft/sec;
   Relative rate $= 15\%$ per second

45 0

47 1/2

49 Approx 1

51 Approx 1.9