Chapter 11 Derivatives Continued

1. Find the derivative of the following function.
   $y = \ln 3x$
   A) $\frac{1}{x}$
   B) $\frac{3}{x}$
   C) $\frac{1}{3x}$
   D) $\frac{1}{x^2}$
   E) $\frac{1}{3x^2}$
   Ans: A

2. Find the derivative of the following function.
   $y = 8 + \ln 3x$
   A) $\frac{1}{x}$
   B) $\frac{3}{x}$
   C) $\frac{1}{3x}$
   D) $\frac{1}{x^2}$
   E) $\frac{1}{3x^2}$
   Ans: A

3. Find the derivative of the following function.
   $y = \ln x^5$
   A) $\frac{1}{x}$
   B) $\frac{5}{x}$
   C) $\frac{1}{5x}$
   D) $\frac{1}{x^2}$
   E) $\frac{1}{5x^2}$
   Ans: B

4. Find the derivative of the following function.
   $y = \ln(9x+4)$
   A) $\dfrac{4x}{9x+4}$
   B) $\dfrac{9x}{9x+4}$
   C) $\dfrac{1}{9x+4}$
   D) $\dfrac{9}{9x+4}$
   E) $\dfrac{4}{9x+4}$
   Ans: D

5. Find the derivative of the following function.
   $y = \ln(6x^3 - 7x) - 4x$
   A) $\dfrac{18x^2 - 7x}{x(6x^2 - 7)} - 4$
   B) $\dfrac{1}{x(6x^2 - 7)} - 4$
   C) $\dfrac{18x^2 - 7}{x(6x^2 - 7)} - 4$
   D) $\dfrac{18x^2}{x(6x^2 - 7)} - 4$
   E) $\dfrac{1}{x(6x^2 - 1)} - 4$
   Ans: C

6. Find $\dfrac{ds}{dq}$ if $s = \ln\left(\dfrac{q^2}{3} + 4\right)$.
   A) $\dfrac{2q}{q^2 + 12}$
   B) $\dfrac{24q}{q^2 + 12}$
   C) $\dfrac{24q}{q^2 + 3}$
   D) $\dfrac{2q}{q^2 + 4}$
   E) $\dfrac{2q}{q^2 + 3}$
   Ans: A

7. Find the derivative of the following function.
   $y = \ln(x-7) + \ln(6x+5)$
   A) $\dfrac{12x}{(x-7)(6x+5)}$
   B) $\dfrac{6x-37}{(x-7)(6x+5)}$
   C) $\dfrac{6x-42}{(x-7)(6x+5)}$
   D) $\dfrac{12x-42}{(x-7)(6x+5)}$
   E) $\dfrac{12x-37}{(x-7)(6x+5)}$
   Ans: E

8. Find the derivative of the following function.
   $y = 5\ln(x^7 - 4)$
   A) $\dfrac{5}{x^7 - 4}$
   B) $\dfrac{7x^6}{x^7 - 4}$
   C) $\dfrac{7}{x^7 - 4}$
   D) $\dfrac{35x^6}{x^7 - 4}$
   E) $\dfrac{5x^6}{x^7 - 4}$
   Ans: D

9. Which of the following functions has the same derivative as the function below?

   $y = 9\ln(x^3 - 3)$
   A) $y = 27\ln x/\ln 3$
   B) $y = 9\ln(x^3)$
   C) $y = 3\ln(x^3 - 3)$
   D) $y = \ln(x^3)$
   E) $y = \ln[(x^3 - 3)^9]$
   Ans: E

10. Find the derivative of the following function.

$y = 4\ln x - \ln(x-8)$

A) $\dfrac{3x-32}{x(x-8)}$

B) $\dfrac{3x+32}{x(x-8)}$

C) $\dfrac{3x+4}{x(x-8)}$

D) $\dfrac{3x-4}{x(x-8)}$

E) $\dfrac{32}{x(x-8)}$

Ans: A

11. Which of the following functions has the same derivative as the function below?

$y = 5\ln x - \ln(x-9)$

A) $y = \ln\left(\dfrac{5x}{x-9}\right)$

B) $y = \ln\left(\dfrac{x^9}{x-5}\right)$

C) $y = \ln\left(\dfrac{x^5}{x-9}\right)$

D) $y = \ln\left(\dfrac{9x}{x-5}\right)$

E) $y = \ln\left(\dfrac{9x^5}{x-9}\right)$

Ans: C

12. Find $\frac{dp}{dq}$ if $p = \ln\left(\frac{2q^2 - 5}{q}\right)$.

A) $\frac{2q^2 - 5}{q(2q^2 - 5)}$

B) $\frac{2q^2 + 5}{q(2q^2 - 5)}$

C) $\frac{4q^2 + 5}{q(2q^2 - 5)}$

D) $\frac{4q^2 - 5}{q(2q^2 - 5)}$

E) $\frac{4q^2 + 2}{q(2q^2 - 5)}$

Ans: B

13. Find $\frac{ds}{dt}$ if $s = \ln\left[t^2(t^9 - 4)\right]$.

A) $\frac{9t^2 - 4}{t(t^9 - 4)}$

B) $\frac{2t^9 + 9t^8 - 2}{t(t^9 - 4)}$

C) $\frac{11t^8 - 2}{t(t^9 - 4)}$

D) $\frac{11t^9 - 8}{t(t^9 - 4)}$

E) $\frac{2t^9 + 9t^8 - 8}{t(t^9 - 4)}$

Ans: D

14. Find $\frac{dy}{dx}$ if $y = \ln\left(\frac{3x+4}{x^2-2}\right)^{1/7}$.

A) $\frac{3x^2+8x+3}{7(3x+4)(x^2-2)}$

B) $-\frac{3x^2+4x+6}{(3x+4)(x^2-2)}$

C) $\frac{3x^2+4x+6}{7(3x+4)(x^2-2)}$

D) $\frac{3x^2+8x+6}{(3x+4)(x^2-2)}$

E) $-\frac{3x^2+8x+6}{7(3x+4)(x^2-2)}$

Ans: E

15. Find $\frac{dy}{dx}$ if $y = \ln(x^3\left(x+5\right)^{\frac{1}{2}})$.

A) $\frac{3\left(2x+5\right)}{2x(x+5)}$

B) $\frac{7x+30}{2x(x+5)}$

C) $\frac{3\left(2x+10\right)}{x(x+5)}$

D) $\frac{7x+15}{x(x+5)}$

E) $\frac{7x+6}{x(x+5)}$

Ans: B

16. Find $\frac{dy}{dx}$ if $y = \ln(x^2(x^8 - x + 3))$.

A) $\dfrac{10x^8 - 3x + 6}{x\left(x^8 - x + 3\right)}$

B) $\dfrac{10x^8 + 3x - 6}{x\left(x^8 - x + 3\right)}$

C) $\dfrac{10x^8 + 3x + 2}{x\left(x^8 - x + 3\right)}$

D) $\dfrac{8x^8 - 3x - 2}{x\left(x^8 - x + 3\right)}$

E) $\dfrac{8x^8 + 3x + 6}{x\left(x^8 - x + 3\right)}$

Ans: A

17. Find y'.

$y = x^5 \ln(8x + 3)$

A) $\dfrac{5x^4}{8x+3} + 8x^4 \ln(8x+3)$

B) $\dfrac{8x^4}{8x+3} + 5x^5 \ln(8x+3)$

C) $\dfrac{8x^5}{8x+3} + 5x^4 \ln(8x+3)$

D) $\dfrac{5x^5}{8x+3} - 8x^4 \ln(8x+3)$

E) $\dfrac{8x^4}{8x+3} - 8x^5 \ln(8x+3)$

Ans: C

18. Find y'.

$y = \frac{7+\ln x}{x^5}$

A) $\frac{5\ln x+34}{x^4}$

B) $-\frac{35\ln x+4}{x^4}$

C) $-\frac{5\ln x+34}{x^6}$

D) $-\frac{7\ln x+4}{x^6}$

E) $\frac{35\ln x-34}{x^6}$

Ans: C

19. Find y'.

$y = \ln(8x+5)^{1/9}$

A) $\frac{8}{9(8x+5)}$

B) $\frac{5}{8(8x+5)}$

C) $\frac{5}{9(8x+5)}$

D) $\frac{40}{9(8x+5)}$

E) $\frac{72}{5(8x+5)}$

Ans: A

20. Find y'.

$y = 9(\ln x)^{-5}$

A) $-\frac{81}{x(\ln x)^6}$

B) $-\frac{25}{x(\ln x)^6}$

C) $-\frac{45}{x(\ln x)^6}$

D) $-\frac{45}{x(\ln x)^4}$

E) $-\frac{25}{x(\ln x)^4}$

Ans: C

21. Find y'.

$y = [\ln(x^4 + 9)]^7$

A) $\frac{28x^3 \ln(x^4+9)^6}{\left(x^4+9\right)}$

B) $\frac{7x^2 \ln(x^4+9)^6}{\left(x^4+9\right)}$

C) $-\frac{7x^3 \ln(x^4+9)^6}{\left(x^4+9\right)}$

D) $-\frac{4x^3 \ln(x^4+9)^6}{\left(x^4+9\right)}$

E) $-\frac{56x^2 \ln(x^4+9)^6}{\left(x^4+9\right)}$

Ans: A

22. Find y'.

$y = \sqrt{\ln\left(7x+2\right)}$

A) $-\frac{14}{3(7x+2)\sqrt{\ln(7x+2)}}$

B) $\frac{2}{3(7x+2)\sqrt{\ln(7x+2)}}$

C) $-\frac{2}{(7x+2)\sqrt{\ln(7x+2)}}$

D) $\frac{7}{(7x+2)\sqrt{\ln(7x+2)}}$

E) $\frac{7}{2(7x+2)\sqrt{\ln(7x+2)}}$

Ans: E

23. Find y'.

$y = 4\log_5 x$

A) $\dfrac{4}{x\ln 5}$

B) $\dfrac{5}{x\ln 4}$

C) $\dfrac{4}{x}$

D) $\dfrac{4\ln 5}{x}$

E) $\dfrac{x}{4\ln 5}$

Ans: A

24. Find y'.

$y = \log_8(9 - x - x^5)$

A) $\dfrac{5x^6 + x}{(\ln 8)(x^5 + x - 9)}$

B) $\dfrac{x^4 + x}{(\ln 8)(x^5 + x - 9)}$

C) $\dfrac{5x^4 + x}{(x^5 + x - 9)}$

D) $\dfrac{5x^5 + 1}{(x^5 + x - 9)}$

E) $\dfrac{5x^4 + 1}{(\ln 8)(x^5 + x - 9)}$

Ans: E

25. Find the *y*-value at the relative minima, and use a graphing utility to check your result.

$y = 3x^4 \ln x$

A) $y = -\dfrac{3}{4e}$

B) $y = -\dfrac{4}{3e}$

C) $y = -\dfrac{4}{3}$

D) $y = 0$

E) does not exist

Ans: A

26. Find the relative minima, and use a graphing utility to check your results.
$y = 3\ln x - 8x$
A) $-\frac{8}{3}$
B) $-\frac{3}{8}$
C) $-\frac{1}{8}$
D) 0
E) does not exist
Ans: E

27. Find the relative maxima, and use a graphing utility to check your results.
$y = 6\ln x - 7x$
A) $y = -7.24$
B) $y = -6.92$
C) $y = -12.68$
D) $y = 0.00$
E) does not exist
Ans: B

28. Suppose that the total cost (in dollars) for a product is given by $C(x) = 1100 + 200\ln(6x+1)$, where x is the number of units produced. Find the marginal cost function.
A) $C'(x) = \frac{200}{6x+1}$
B) $C'(x) = \frac{1200}{6x+1}$
C) $C'(x) = -\frac{1200}{6x+1}$
D) $C'(x) = -\frac{200}{6x+1}$
E) $C'(x) = \frac{6}{6x+1}$
Ans: B

29. Suppose that the total cost (in dollars) for a product is given by $C(x) = 1200 + 300\ln(2x+1)$, where x is the number of units produced. Find the marginal cost when 200 units are produced, and interpret your result.
A) $1.50. It will cost approximately $1.50 to make the 201st unit.
B) $0.75. It will cost approximately $0.75 to make the 201st unit.
C) $150.00. It will cost approximately $150.00 to make the 201st unit.
D) $600.00. It will cost approximately $600.00 to make the 201st unit.
E) $0.25. It will cost approximately $0.25 to make the 201st unit.
Ans: A

30. Suppose that the total cost (in dollars) for a product is given by $C(x) = 1500 + 400 \ln(5x+1)$, where x is the number of units produced. Total cost functions always increase because producing more items costs more. What then must be true of the marginal cost function $\overline{MC}$?
    A) $\overline{MC} = 0$
    B) $\overline{MC} < 0$
    C) $\overline{MC} > 0$
    D) $\overline{MC} > 1500$
    E) $\overline{MC} < 1500$
    Ans: C

31. Suppose that the supply of x units of a product at price p dollars per unit is given by $p = 50 + 30\ln(9x+6)$. Find the rate of change of supply price with respect to the number of units supplied.
    A) $\frac{dp}{dx} = \frac{30}{9x+6}$
    B) $\frac{dp}{dx} = \frac{9}{9x+6}$
    C) $\frac{dp}{dx} = \frac{900}{9x+6}$
    D) $\frac{dp}{dx} = \frac{270}{9x+6}$
    E) $\frac{dp}{dx} = \frac{180}{9x+6}$
    Ans: D

32. Suppose that the supply of x units of a product at price p dollars per unit is given by $p = 20 + 60\ln(8x+3)$. Approximate the price increase associated with the number of units supplied changing from 35 to 36.
    A) $4.37
    B) $13.12
    C) $233.33
    D) $262.50
    E) $1.70
    Ans: E

33. The demand function for a product is given by $p = 3000/\ln(x+8)$, where p is the price per unit in dollars when x units are demanded. Find the second derivative to see whether the rate at which the price is changing at 10 units is increasing or decreasing.
    A) increasing
    B) decreasing
    Ans: A

34. The pH of a solution is given by $\text{pH} = -\log_{10}[\text{H}^+]$, where $[\text{H}^+]$ is the concentration of hydrogen ions (in gram atoms per liter). What is the rate of change of pH with respect to $[\text{H}^+]$ if $[\text{H}^+] = 0.0055$?

A) –18.18
B) –1818.18
C) –78.96
D) –181.82
E) 5.20
Ans: C

35. The loudness of sound (*L*, measured in decibels) perceived by the human ear depends on intensity levels (*I*) according to $L = 10\log_{10}(I/I_0)$, where I_0 is the standard threshold of audibility. If $x = I/I_0$ then using the change-of-base formula, we get $L = \dfrac{10\ln(x)}{\ln 10}$.
At what rate is the loudness changing with respect to *x* when the intensity is 1000 times the standard threshold of audibility (that is, when *x* = 1000)?

A) $\dfrac{1}{1000\ln 10}$
B) $\dfrac{1}{100\ln 10}$
C) $\dfrac{1}{1000}$
D) $\dfrac{1}{100}$
E) $\dfrac{1}{50}$
Ans: B

36. Between the years 1960 and 2002, the percent of women in the work force can be modeled by $w(x) = 2.552 + 14.569\ln x$, where *x* is the number of years past 1950 (*Source:* U.S. Bureau of Labor Statistics). If this model is accurate beyond 2002, at what rate will the percent be changing in 2013?

A) In 2013, the rate will be changing at 113.000% per year.
B) In 2013, the rate will be changing at 63.000% per year.
C) In 2013, the rate will be changing at 0.469% per year.
D) In 2013, the rate will be changing at 0.007% per year.
E) In 2013, the rate will be changing at 0.231% per year.
Ans: E

37. Find the derivative of the following function.

$y = 3x^4 - 3e^x$

A) $y' = 12x^3 - 3xe^{x-1}$

B) $y' = 3x^3 - 3xe^{x-1}$

C) $y' = 3x^3 - 3e^x$

D) $y' = 12x^3 - e^x$

E) $y' = 12x^3 - 3e^x$

Ans: E

38. Find the derivative of the following function.

$f(x) = 6e^x - 5\ln x$

A) $f'(x) = 6e^x - \frac{5}{x}$

B) $f'(x) = 6xe^x - \frac{5}{x^2}$

C) $f'(x) = 6 - \frac{5}{x^2}$

D) $f'(x) = 6xe^{x-1} - \frac{1}{x}$

E) $f'(x) = 6xe^{x-1} - \frac{5}{x}$

Ans: A

39. Find the derivative of the following function.

$y = 9e^{7x^2-3}$

A) $y' = 63xe^{7x^2-3}$

B) $y' = 126xe^{7x^2-3}$

C) $y' = 126e^{7x^2-3}$

D) $y' = 63e^{7x^2-3}$

E) $y' = 18xe^{7x^2-3}$

Ans: B

40. Find the derivative of the following function.

$y = 2 - 9e^{-x^8}$

A) $y' = 72x^7 e^{-x^8}$

B) $y' = -72x^7 e^{-x^8}$

C) $y' = 9e^{-x^8}$

D) $y' = 9x^8 e^{-x^8}$

E) $y' = -9x^8 e^{-x^8}$

Ans: A

41. Find the derivative of the following function.

$y = 4e^{\sqrt{x^8 - 8}}$

A) $y' = \dfrac{2e^{\sqrt{x^8-8}}}{\sqrt{x^8 - 8}}$

B) $y' = \dfrac{32x^7 e^{\sqrt{x^8-8}}}{\sqrt{x^8 - 8}}$

C) $y' = \dfrac{16x^7 e^{\sqrt{x^8-8}}}{\sqrt{x^8 - 8}}$

D) $y' = \dfrac{2x^7 e^{\sqrt{x^8-8}}}{\sqrt{x^8 - 8}}$

E) $y' = \dfrac{8e^{\sqrt{x^8-8}}}{\sqrt{x^8 - 8}}$

Ans: C

42. Find the derivative of the following function.

$y = 4e^6 + 6e^{\ln x}$

A) $y' = 24e^5 + 6$

B) $y' = 24e^5 + 6xe^{\ln x}$

C) $y' = 6x$

D) $y' = 6$

E) $y' = 0$

Ans: D

43. Find the derivative of the following function.

$y = 3e^{6\sqrt{x}} + 8$

A) $y' = \dfrac{9e^{6\sqrt{x}}}{\sqrt{x}}$

B) $y' = \dfrac{3e^{6\sqrt{x}}}{\sqrt{x}}$

C) $y' = \dfrac{18e^{6\sqrt{x}}}{\sqrt{x}}$

D) $y' = \dfrac{3e^{6\sqrt{x}}}{\sqrt{x}}$

E) $y' = \dfrac{6e^{6\sqrt{x}}}{\sqrt{x}}$

Ans: A

44. Find the derivative of the following function.

$y = \dfrac{9}{e^{12x}} + \dfrac{e^{12x}}{4}$

A) $y' = \dfrac{108}{e^{12x}} + 108e^{12x}$

B) $y' = \dfrac{3}{e^{12x}} + 108e^{12x}$

C) $y' = -\dfrac{27}{e^{12x}} + e^{12x}$

D) $y' = -\dfrac{108}{e^{12x}} + 3e^{12x}$

E) $y' = -\dfrac{12}{e^{12x}} + e^{12x}$

Ans: D

45. Find the derivative of the following function.

$p = 8qe^{q^9}$

A) $p' = 8e^{q^9}(9q^9 + 1)$

B) $p' = 8e^{q^9}(9q^8 + 1)$

C) $p' = 8e^{q^9}(q^9 + 8)$

D) $p' = 8e^{q^9}(9q^9 + 8)$

E) $p' = 8e^{q^9}(9q^8 + 8)$

Ans: A

46. Find the derivative of the following function.

$y = 3(e^x)^8 - 4e^{x^8}$

A) $y' = -8x^7 e^{x^8}$

B) $y' = 32e^{8x} - 24x^7 e^{x^8}$

C) $y' = 24e^{8x} - 32x^7 e^{x^8}$

D) $y' = 24e^{8x} - 4e^{x^8}$

E) $y' = 3e^{8x} - 32e^{x^8}$

Ans: C

47. Find the derivative of the following function.

$y = \ln(e^{8x} + 9)$

A) $y' = \dfrac{72}{e^{8x} + 9}$

B) $y' = \dfrac{1}{e^{8x} + 9}$

C) $y' = \dfrac{e^{8x}}{e^{8x} + 9}$

D) $y' = \dfrac{9e^{8x}}{e^{8x} + 9}$

E) $y' = \dfrac{8e^{8x}}{e^{8x} + 9}$

Ans: E

48. Find the derivative of the following function.

$y = \dfrac{x}{8 + e^{5x}}$

A) $y' = \dfrac{8 + e^{5x} + 5xe^{5x}}{(8 + e^{5x})^2}$

B) $y' = \dfrac{5 - e^{5x} - 8xe^{5x}}{(8 + e^{5x})^2}$

C) $y' = \dfrac{8 - e^{5x} + 5xe^{5x}}{(8 + e^{5x})^2}$

D) $y' = \dfrac{8 + e^{5x} - 5xe^{5x}}{(8 + e^{5x})^2}$

E) $y' = \dfrac{5 + e^{5x} - 8xe^{5x}}{(8 + e^{5x})^2}$

Ans: D

49. Find the derivative of the following function.

$y = 8^{3x+1}$

A) $y' = (8\ln 3)8^{3x+1}$

B) $y' = (3\ln 8)8^{3x+1}$

C) $y' = (\ln 3)8^{3x+1}$

D) $y' = (\ln 8)8^{3x+1}$

E) $y' = (\ln 24)8^{3x+1}$

Ans: B

50. Write the equation of the line tangent to the graph of $y = 9xe^{-x} + 8$ at $x = 1$.

A) $y = 9e^{-1}x + 8$

B) $y = 9e^{-1}x - 8$

C) $y = 9e^{-1}x$

D) $y = 9e^{-1} + 8$

E) $y = 9e^{-1} - 8$

Ans: D

51. Write the equation of the line tangent to the graph of $y = 9e^{-x}/(6 + e^{-x})$ at $x = 0$.

A) $y = -\frac{54}{49}x + \frac{9}{7}$

B) $y = -\frac{54}{49}x - \frac{9}{7}$

C) $y = \frac{54}{49}x + \frac{9}{7}$

D) $y = \frac{54}{49}x - \frac{9}{7}$

E) $y = \frac{54}{49}x$

Ans: A

52. Find any relative maxima and minima. Use a graphing utility to check your results.

$y = \dfrac{e^{9x}}{7x}$

A) relative minimum at $\left(\dfrac{1}{9}, \dfrac{9e}{7}\right)$.

B) relative maximum at $\left(\dfrac{1}{9}, \dfrac{9e}{7}\right)$

C) relative minimum at $\left(1, \dfrac{e^9}{7}\right)$

D) relative maximum at $\left(1, \dfrac{e^9}{7}\right)$

E) relative maximum at $\left(0, \dfrac{1}{7}\right)$

Ans: A

53. Find any relative maxima and minima. Use a graphing utility to check your results.

$y = \dfrac{3x}{e^{4x}}$

A) relative minimum at $\left(\dfrac{1}{4}, \dfrac{3}{4e}\right)$

B) relative maximum at $\left(\dfrac{1}{4}, \dfrac{3}{4e}\right)$

C) relative minimum at $\left(1, \dfrac{3}{e^4}\right)$

D) relative maximum at $\left(1, \dfrac{3}{e^4}\right)$

E) relative minimum at $(0, 0)$

Ans: B

54. The future value that accrues when \$100 is invested at 8%, compounded continuously, is $s(t) = 100e^{0.08t}$, where t is the number of years. At what rate is the money in this account growing when $t = 5$?

A) \$1.49 per year
B) \$8.41 per year
C) \$149.18 per year
D) \$104.08 per year
E) \$11.93 per year

Ans: E

55. The sales decay for a product is given by $S = 600e^{-2t}$, where S is the daily sales in dollars and t is the number of days since the end of a promotional campaign. Find the rate of change of sales decay.

A) $\frac{dS}{dt} = -1200e^{-2t}$

B) $\frac{dS}{dt} = 1200e^{-2t}$

C) $\frac{dS}{dt} = -2400e^{-2t}$

D) $\frac{dS}{dt} = 2400e^{-2t}$

E) $\frac{dS}{dt} = -600e^{-2t}$

Ans: A

56. Suppose that the revenue in dollars from the sale of x units of a product is given by $R(x) = 7000xe^{-x/35}$. Find the marginal revenue function.

A) $\overline{MR} = 200e^{-x/35}(7000 + x)$

B) $\overline{MR} = 7000e^{-x/35}(35x - 1)$

C) $\overline{MR} = 35e^{-x/35}(7000 - x)$

D) $\overline{MR} = 200e^{-x/35}(35 - x)$

E) $\overline{MR} = 7000e^{-x/35}(35x + 1)$

Ans: D

57. Suppose the concentration $C(t)$, in mg/ml, of a drug in the bloodstream t minutes after an injection is given by $C(t) = 50te^{-0.08t}$. Find the maximum concentration and when it occurs.

A) Maximum concentration of 229.92 mg/ml occurs after 12.50 minutes.
B) Maximum concentration of 343.36 mg/ml occurs after 15.00 minutes.
C) Maximum concentration of 145.23 mg/ml occurs after 4.00 minutes.
D) Maximum concentration of 0.83 mg/ml occurs after 110.00 minutes.
E) Maximum concentration of 215.77 mg/ml occurs after 17.50 minutes.

Ans: A

58. For selected years from 1978 to 2000, the number of mutual funds N, excluding money market funds, can be modeled by $N = 298.8e^{0.1011t}$ where t is the number of years past 1975. Find and interpret the rate of change of the number of mutual funds in 2003.

A) The number of mutual funds have increased from the previous year by 214.
B) The number of mutual funds have increased from the previous year by 567.
C) The number of mutual funds have increased from the previous year by 512.
D) The number of mutual funds have increased from the previous year by 461.
E) The number of mutual funds have increased from the previous year by 378.

Ans: C

59. Medical research has shown that between heartbeats, the pressure in the aorta of a normal adult is a function of time in seconds and can be modeled by the equation $P = 77e^{-0.169t}$. Use the derivative to find the rate at which the pressure is changing after 4.8 seconds.

A) $P'(4.8) = 34.21$

B) $P'(4.8) = -34.21$

C) $P'(4.8) = 5.78$

D) $P'(4.8) = -5.78$

E) $P'(4.8) = 0.00$

Ans: D

60. Total personal income in the U.S. (in billions of dollars) for selected years from 1960 to 2002 is given in the following table.

Year	**1960**	**1970**	**1980**	**1990**	**2000**	**2002**
Personal income	433.69	465.14	478.91	556.44	556.61	581.92

These data can be modeled by $I = 433.69e^{0.007x}$, where x is the number of years past 1960. If this model is accurate, find the rate of change of the total U.S. personal income in 2001.

A) $4.19 billion per year
B) $4.05 billion per year
C) $12.65 billion per year
D) $2.12 billion per year
E) $4.02 billion per year
Ans: B

61. Total personal income in the U.S. (in billions of dollars) for selected years from 1960 to 2002 is given in the following table.

Year	**1960**	**1970**	**1980**	**1990**	**2000**	**2002**
Personal income	297.30	359.44	417.69	495.09	563.36	594.99

These data can be modeled by $I = 297.30e^{0.017x}$, where x is the number of years past 1960. Use the data to find the average rate of change from 2000 to 2002, which can be used to approximate the rate of change in 2002.

A) $11.05 billion per year
B) $10.15 billion per year
C) $15.81 billion per year
D) $8.32 billion per year
E) $9.32 billion per year
Ans: C

62. Find *dy*/*dx* at the given point without first solving for *y*.
$4x^2 - 16y + 400 = 0$ at $(30, 250)$
A) 0
B) –15
C) 15
D) –240
E) 240
Ans: C

63. Find *dy*/*dx* at the given point without first solving for *y*.
$6e^{4y} = x - 7$ at $(13, 0)$
A) $\frac{1}{13}$
B) $\frac{1}{52}$
C) $\frac{1}{6}$
D) $\frac{1}{4}$
E) $\frac{1}{24}$
Ans: E

64. Find *dy*/*dx* at the given point without first solving for *y*.
$2x^2 + 8xy + 6 = 0$ at $(1, -1)$
A) –0.50
B) 4.00
C) 0.50
D) –1.50
E) 1.00
Ans: C

65. Find dy/dx for the following equation:
$2x + y^2 - 9y + 9 = 0.$

A) $\frac{dy}{dx} = \frac{9}{2-2y}$

B) $\frac{dy}{dx} = \frac{2}{9-2y}$

C) $\frac{dy}{dx} = \frac{1}{9-y}$

D) $\frac{dy}{dx} = \frac{9}{9-y}$

E) $\frac{dy}{dx} = \frac{1}{2-y}$

Ans: B

66. Find dy/dx for the following equation:
$2x^2 - 7x + y^3 - 8y - 2 = 0.$

A) $\frac{dy}{dx} = \frac{7+2x}{3y^2-8}$

B) $\frac{dy}{dx} = \frac{7+4x}{3y^2-16}$

C) $\frac{dy}{dx} = \frac{7-2x}{3y^2}$

D) $\frac{dy}{dx} = \frac{7-4x}{3y^2-8}$

E) $\frac{dy}{dx} = \frac{7+4x}{3y^2}$

Ans: D

67. Find dp/dq for the following equation:
$p^2 + 5p - 3q = 6.$

A) $\frac{dp}{dq} = \frac{3}{2p+5}$

B) $\frac{dp}{dq} = \frac{5}{2p+3}$

C) $\frac{dp}{dq} = \frac{3}{2p}$

D) $\frac{dp}{dq} = \frac{5}{2p}$

E) $\frac{dp}{dq} = \frac{15}{2p}$

Ans: A

68. Find dy/dx for the following equation:
$x^2 - 9y^4 = 6x^5 + 2y^3 - 3.$

A) $\frac{dy}{dx} = \frac{2x(1-15x^3)}{y^2(18y+1)}$

B) $\frac{dy}{dx} = \frac{x(1-15x^3)}{3y^2(6y+1)}$

C) $\frac{dy}{dx} = \frac{x(1-30x^3)}{6y^2(3y+1)}$

D) $\frac{dy}{dx} = \frac{x(1-60x^3)}{6y^2(36y+1)}$

E) $\frac{dy}{dx} = \frac{x(1-30x^3)}{3y^2(36y+1)}$

Ans: B

69. Find dy/dx for the following equation:
$7x^2 + 8x^2y^4 = 2y + 4.$

A) $\frac{dy}{dx} = \frac{7x}{1-16x^2y^3}$

B) $\frac{dy}{dx} = \frac{x\left(7+8y^4\right)}{1-16x^2y^3}$

C) $\frac{dy}{dx} = \frac{x\left(7+8y^4\right)}{16x^2y^3}$

D) $\frac{dy}{dx} = \frac{x\left(7-8y^4\right)}{16x^2y^3}$

E) $\frac{dy}{dx} = \frac{7x}{1+16x^2y^3}$

Ans: B

70. Find *dy*/*dx* for the following equation:

$(5x+8y)^2 = 2x^4y^3.$

A) $\frac{dy}{dx} = \frac{4x^3y^3 - 25x - 40y}{40x + 64y - 3x^4y^2}$

B) $\frac{dy}{dx} = \frac{4x^3y^3 - 5x - 8y}{40x + 64y - 3x^4y^2}$

C) $\frac{dy}{dx} = \frac{4x^3y^3 - 25x - 40y}{5x + 8y - 3x^4y^2}$

D) $\frac{dy}{dx} = \frac{4x^3y^3 - 40x - 25y}{40x + 64y - 3x^4y^2}$

E) $\frac{dy}{dx} = \frac{4x^3y^3 - 25x - 40y}{25x + 64y - 3x^4y^2}$

Ans: A

71. Find *dy*/*dx* for the following equation:

$4x + 10y = \sqrt{x^2 + y^2 + 6}.$

A) $\frac{dy}{dx} = \frac{2\sqrt{x^2 + y^2 + 6} - x}{y - 5\sqrt{x^2 + y^2 + 6}}$

B) $\frac{dy}{dx} = \frac{4\sqrt{x^2 + y^2 + 6} - x}{y - 30\sqrt{x^2 + y^2 + 6}}$

C) $\frac{dy}{dx} = \frac{4\sqrt{x^2 + y^2 + 6} - x}{y - 10\sqrt{x^2 + y^2 + 6}}$

D) $\frac{dy}{dx} = \frac{5\sqrt{x^2 + y^2 + 6} - x}{y - 10\sqrt{x^2 + y^2 + 6}}$

E) $\frac{dy}{dx} = \frac{5\sqrt{x^2 + y^2 + 6} - x}{y - 3\sqrt{x^2 + y^2 + 6}}$

Ans: C

72. For the given equation, find the slope of the tangent to the curve at the point $(3, –5)$.

$x^2 + 9x + y^2 + 10y - 11 = 0$

A) –1.78
B) –0.60
C) –1.67
D) 0.00
E) undefined
Ans: E

73. For the given equation, find the slope of the tangent to the curve at the point $(-3, 2)$.

$y^2 + 12y + x^2 + 6x - 19 = 0$

A) –0.83
B) –0.67
C) –1.50
D) 0.00
E) undefined
Ans: D

74. For the given equation, find the slope of the tangent to the curve at the point $(0,1)$.

$9y + 7x^2 = 9$

A) 0.00
B) 0.86
C) –0.05
D) –0.90
E) –1.56
Ans: A

75. Write the equation of the line tangent to the curve $18xy + 3y^2 = 0$ at the point $(-1, 0)$.

A) $y = -3x + 18$
B) $y = 3x + 3$
C) $y = 3x$
D) $y = -3x$
E) $y = 0$
Ans: E

76. If $\ln(8x + 9y) = 2y^2$, find dy/dx.

A) $y' = \dfrac{1}{36y^2 - 32xy + 1}$
B) $y' = \dfrac{1}{36y^2 + 32xy + 9}$
C) $y' = \dfrac{1}{72y^2 - 32xy - 9}$
D) $y' = \dfrac{8}{72y^2 - 32xy + 1}$
E) $y' = \dfrac{8}{36y^2 + 32xy - 9}$
Ans: E

77. If $\ln 3xy = 2,$ find $dy/dx.$

A) $\frac{dy}{dx} = -\frac{y}{x}$

B) $\frac{dy}{dx} = -\frac{3y}{x}$

C) $\frac{dy}{dx} = -\frac{y}{3x}$

D) $\frac{dy}{dx} = -\frac{3y}{2x}$

E) $\frac{dy}{dx} = -\frac{2y}{3x}$

Ans: A

78. Write the equation of the line tangent to the curve $x\ln y + 7xy = 28$ at the point $(4,1).$

A) $32y - 7x = 60$

B) $32y + 7x = -60$

C) $7x - 32y = 60$

D) $7x + 32y = 60$

E) $7x + 32y = 0$

Ans: D

79. If $6x + e^{5xy} = 6,$ find $dy/dx.$

A) $\frac{dy}{dx} = -\frac{6 + 5ye^{5xy}}{5xe^{5xy}}$

B) $\frac{dy}{dx} = -\frac{6 + 5xe^{5xy}}{5ye^{5xy}}$

C) $\frac{dy}{dx} = \frac{6 + 5ye^{5xy}}{6xe^{5xy}}$

D) $\frac{dy}{dx} = \frac{6 + 5xe^{5xy}}{5ye^{5xy}}$

E) $\frac{dy}{dx} = \frac{6 + 5ye^{5xy}}{xe^{5xy}}$

Ans: A

80. If $x - 2xe^{6y} = 5,$ find dy/dx.

A) $\frac{dy}{dx} = \frac{1-2e^{6y}}{24e^{6y}}$

B) $\frac{dy}{dx} = \frac{1+6e^{6y}}{12xe^{6y}}$

C) $\frac{dy}{dx} = \frac{1-2e^{6y}}{12xe^{6y}}$

D) $\frac{dy}{dx} = \frac{1+2e^{6y}}{24xe^{6y}}$

E) $\frac{dy}{dx} = \frac{1-6e^{6y}}{12e^{6y}}$

Ans: C

81. If $x^4 y = 3e^{x+y},$ find dy/dx.

A) $\frac{dy}{dx} = \frac{3e^{x+y} - 4x^4 y}{x^4 + 3e^{x+y}}$

B) $\frac{dy}{dx} = \frac{3e^{x+y} - 4x^3 y}{x^4 - 3e^{x+y}}$

C) $\frac{dy}{dx} = \frac{3e^{x+y} + x^3 y}{x^4 - 3e^{x+y}}$

D) $\frac{dy}{dx} = \frac{e^{x+y} - 4x^3 y}{x^4 - e^{x+y}}$

E) $\frac{dy}{dx} = \frac{3e^{x+y} + x^4 y}{x^4 - e^{x+y}}$

Ans: B

82. Write the equation of the line tangent to the curve $ye^x = 3y + 16$ at the point $(0, -8)$.

A) $y = -4x - 8$

B) $y = 4x + 8$

C) $y = 4x - 8$

D) $y = -4x + 8$

E) $y = -4x$

Ans: A

83. At what x-value does the curve defined by $x^2 + 2y^2 - 8x - 3 = 0$ have a horizontal tangent?

A) $x = 4$

B) $x = -4$

C) $x = 8$

D) $x = -8$

E) $x = 0$

Ans: A

84. At what *y*-value does the curve defined by $x^2 + 6y^2 - 4x - 2 = 0$ have a vertical tangent?
A) $y = 2$
B) $y = -2$
C) $y = 4$
D) $y = -4$
E) $y = 0$
Ans: E

85. At what *x*-value does the curve defined by $8x^2 + 9y^2 - 2 = 0$ have a horizontal tangent?
A) $x = 9$
B) $x = -9$
C) $x = 8$
D) $x = -8$
E) $x = 0$
Ans: E

86. At what y-value does the curve defined by $2x^2 + 5y^2 - 4 = 0$ have a vertical tangent?
A) $y = 5$
B) $y = -5$
C) $y = 2$
D) $y = -2$
E) $y = 0$
Ans: E

87. Find y' implicitly for $9x^8 - y^8 = 5$.
A) $y' = \frac{9x^8}{y^8}$
B) $y' = \frac{y^8}{9x^8}$
C) $y' = \frac{9x^7}{y^7}$
D) $y' = \frac{y^7}{9x^7}$
E) $y' = \frac{x^7}{9y^7}$
Ans: C

88. Find $y'' \lim_{x\to\infty} \lim_{x\to\infty}$ for $9\sqrt{x}+7\sqrt{y}=5$ and simplify.

A) $y''=\dfrac{45}{98x\sqrt{x}}$

B) $y''=\dfrac{9}{98\sqrt{x}}$

C) $y''=\dfrac{5}{98\sqrt{x}}$

D) $y''=\dfrac{9}{49x\sqrt{x}}$

E) $y''=\dfrac{45}{49\sqrt{x}}$

Ans: A

89. Find the maximum value of *y*. Use a graphing utility to verify your conclusion.
$6x^2+4y^2-9x=0$

A) 0.750
B) 0.844
C) 1.837
D) 1.591
E) 0.919
Ans: E

90. Suppose that a company's sales volume *y* (in dollars) is related to its advertising expenditures *x* (in dollars) according to $xy-72x+10y=0$. Find the rate of change of sales volume, with respect to advertising expenditures when $x=\$10.00$.

A) 3.60
B) –3.60
C) –1.80
D) 1.80
E) 0.36
Ans: D

91. Suppose that the number of mosquitoes *N* (in thousands) in a certain swampy area near a community is related to the number of pounds of insecticide *x* sprayed on the nesting areas according to $Nx-4x+N=600$. Find the rate of change of *N*, with respect to *x* when 22 pounds of insecticide are used.

A) –1.19
B) –25.91
C) –27.27
D) –2.43
E) –1.13
Ans: E

92. Suppose that production of a certain agricultural crop is related to the number of hours of labor *x*, and the number of acres of the crop *y*, according to $400x + 5000y = 13xy - 0.001x^2 - 17y$. Find the rate of change of the number of hours, with respect to the number of acres.

A) $\frac{dx}{dy} = \frac{13x - 4983}{400 - 13y + 0.001x}$

B) $\frac{dx}{dy} = \frac{13x - 5017}{400 - 13y + 0.002x}$

C) $\frac{dx}{dy} = \frac{13x - 5017}{400 + 13y + 0.001x}$

D) $\frac{dx}{dy} = \frac{13x + 4983}{400 - 13y - 0.002x}$

E) $\frac{dx}{dy} = \frac{13x + 5017}{400 + 13y + 0.001x}$

Ans: B

93. If the demand function for *q* units of a commodity at $*p* per unit is given by $p^2(9q + 4) = 9000$, find the rate of change of quantity with respect to price when $p = \$25$.

A) 0.128
B) –0.128
C) –3.200
D) 3.200
E) 0.064
Ans: B

94. Suppose the proportion *P* of people affected by a certain disease is described by $\ln\left(\frac{P}{6 - P}\right) = 0.9t$, where *t* is the time in months. Find *dP/dt*, the rate at which *P* grows.

A) $\frac{dP}{dt} = 0.15P(6 - P)$

B) $\frac{dP}{dt} = 6.7P(6 - P)$

C) $\frac{dP}{dt} = 0.15P(P - 6)$

D) $\frac{dP}{dt} = 6.7P(P - 6)$

E) $\frac{dP}{dt} = 0.9P(6 - P)$

Ans: A

95. Assume that *x* and *y* are differentiable functions of *t*. Find *dy/dt* using the given values.
$y = 9x^3 + 2x^2 - x$ for $x = 3,\ dx/dt = 4.$

A) 1020
B) 258
C) 1032
D) 1016
E) 254
Ans: D

96. Assume that *x* and *y* are differentiable functions of *t*. Find *dy/dt* using the given values.
$xy = x + 2$ for $x = 3,\ dx/dt = –5.$

A) 0.13
B) 4.44
C) 1.11
D) 3.33
E) –0.22
Ans: C

97. Assume that *x* and *y* are differentiable functions of *t*. Find *dx/dt* given that $x = 3$, $y = 8$, and $dy/dt = 7$.
$y^2 - x^2 = 55$

A) 2.33
B) 3.43
C) 2.62
D) 56.00
E) 18.67
Ans: E

98. Assume that *x* and *y* are differentiable functions of *t*. If $y^2 = 3xy + 26$, find dx/dt when $x = 7,\ y = 16,$ and $dy/dt = 7.$

A) $\frac{dx}{dt} = \frac{77}{78}$
B) $\frac{dx}{dt} = \frac{371}{48}$
C) $\frac{dx}{dt} = \frac{77}{48}$
D) $\frac{dx}{dt} = \frac{371}{78}$
E) $\frac{dx}{dt} = \frac{7}{4}$
Ans: C

99. Assume that *x* and *y* are differentiable functions of *t*. In each case, find *dx/dt* given that $x = 5$, $y = -6$, and $dy/dt = -140$.
$x^2(y-8) = 12y - 278$
A) –13
B) –5
C) –65
D) –30
E) 37
Ans: A

100. Assume that *x, y,* and *z* are differentiable functions of *t*. If $x^2 + y^2 = z^2$, find dy/dt when $x = -8$, $y = 6$, $z = -10$, $dx/dt = 8$, and $dz/dt = 6$.
A) –12.50
B) 0.67
C) 8.50
D) –20.67
E) –5.33
Ans: B

101. Assume that *s, r,* and *h* are differentiable functions of *t*. If $s = 2\pi r(r+h)$, find dr/dt when $r = 7$, $h = 9$, $dh/dt = 3$, and $ds/dt = 13\pi$.
A) –0.63
B) –0.03
C) 1.72
D) –0.91
E) 1.20
Ans: A

102. Assume that *x* and *y* are differentiable functions of *t*. A point is moving along the graph of the equation $y = 2x^3 - 6x$. At what rate is *y* changing when $x = 4$ and is changing at a rate of 3 units/sec?
A) 288 units/sec
B) 90 units/sec
C) 78 units/sec
D) 270 units/sec
E) 126 units/sec
Ans: D

103. The radius of a circle is increasing at a rate of 9 ft/min. At what rate is its area changing when the radius is 10 ft ?

A) $\frac{dA}{dt} = 180\pi$ sq ft/min

B) $\frac{dA}{dt} = 18\pi$ sq ft/min

C) $\frac{dA}{dt} = 20\pi$ sq ft/min

D) $\frac{dA}{dt} = 10\pi$ sq ft/min

E) $\frac{dA}{dt} = 90\pi$ sq ft/min

Ans: A

104. The area of a circle is changing at a rate of $4 \text{ in.}^2/\text{sec}$. At what rate is its radius changing when the radius is 19 in.?

A) $\frac{19}{4}$ in./sec

B) $\frac{4}{19}$ in./sec

C) $\frac{4}{19\pi}$ in./sec

D) $\frac{2}{19\pi}$ in./sec

E) $\frac{2}{19}$ in./sec

Ans: D

105. The lengths of the edges of a cube are increasing at a rate of 7 ft/min. At what rate is the surface area changing when the edges are 10 ft long?

A) 294 ft^2/min

B) 840 ft^2/min

C) 420 ft^2/min

D) 2940 ft^2/min

E) 70 ft^2/min

Ans: B

106. Suppose4 that the monthly revenue and cost (in dollars) for x units of a product are $R = 800x - \frac{x^2}{50}$ and $C = 3000 + 90x$. At what rate per month is the profit changing if the number of units produced and sold is 100 and is increasing at a rate of 10 units per month?
A) $70,960 per month
B) $7,060 per month
C) $7,960 per month
D) $860 per month
E) $79,960 per month
Ans: B

107. Suppose that the price p (in dollars) of a product is given by the demand function $p = \frac{7000 - 70x}{700 - x}$ where x represents the quantity demanded. If the daily demand is *decreasing* at a rate of 2 units per day, at what rate is the price changing when the demand is 40 units? Round your answer to two decimal places.
A) The price is decreasing at approximately 0.26 dollars per day.
B) The price is decreasing at approximately 0.19 dollars per day.
C) The price is decreasing at approximately 0.13 dollars per day.
D) The price is decreasing at approximately 0.14 dollars per day.
E) The price is decreasing at approximately 0.10 dollars per day.
Ans: B

108. The supply function for a product is given by $p = 70 + 100\sqrt{3x + 12}$, where x is the number of units supplied and p is the price in dollars. If the price is increasing at a rate of $1 per month, at what rate is the supply changing when $x = 10$?
A) 1.440 units per month
B) 0.130 units per month
C) 0.043 units per month
D) 0.086 units per month
E) 0.022 units per month
Ans: C

109. Boyle's law for enclosed gases states that at a constant temperature, the pressure is related to the volume by the equation $P = k/V$, where k is a constant. If the volume is increasing at a rate of 2 cubic inches per hour, at what rate is the pressure changing when the volume is 20 cubic inches and $k = 3$ inch-pounds?
A) 0.007 lb/in^2/hr
B) –0.007 lb/in^2/hr
C) –4.444 lb/in^2/hr
D) 0.300 lb/in^2/hr
E) –0.015 lb/in^2/hr
Ans: E

110. Suppose that a tumor in a person's body has a spherical shape and that treatment is causing the radius of the tumor to decrease at a rate of 2 millimeters per month. At what rate is the surface area of the tumor decreasing when the radius is 5 mm?

A) Surface area is decreasing at the rate of 100π mm^2/month.
B) Surface area is decreasing at the rate of 200π mm^2/month.
C) Surface area is decreasing at the rate of 16π mm^2/month.
D) Surface area is decreasing at the rate of 160π mm^2/month.
E) Surface area is decreasing at the rate of 80π mm^2/month.
Ans: E

111. For many species of fish, the allometric relationship between the weight *W* and the length *L* is approximately $W = kL^3$, where *k* is a constant. For $k = 8$, find the percent rate of change of the weight as a corresponding percent rate of change of the length.

A) $3\left(\frac{\frac{dL}{dt}}{L}\right)$
B) $24\left(\frac{\frac{dL}{dt}}{L}\right)$
C) $8\left(\frac{\frac{dL}{dt}}{L}\right)$
D) $3\left(\frac{L}{\frac{dL}{dt}}\right)$
E) $24\left(\frac{L}{\frac{dL}{dt}}\right)$
Ans: A

112. The resistance *R* of a blood vessel to the flow of blood is a function of the radius *r* of the blood vessel and is given by $R = \frac{k}{r^4}$, where *k* is a constant. For $k = 5$, find the percent rate of change of the resistance of a blood vessel in terms of the percent rate of change in the radius of the blood vessel.

A) $-20\left(\frac{\frac{dr}{dt}}{r}\right)$
B) $-4\left(\frac{\frac{dr}{dt}}{r}\right)$
C) $-20\left(\frac{\frac{dr}{dt}}{r^3}\right)$
D) $-4\left(\frac{\frac{dr}{dt}}{r^3}\right)$
E) $\left(\frac{\frac{dr}{dt}}{r}\right)$
Ans: B

113. For human beings, the surface area S of the body is related to the body's weight W according to $S = kW^{2/3}$, where k is a constant. For $k = 17$, find the percent rate of change of the body's surface area in terms of the percent rate of change of the body's weight.

A) $\frac{34}{3}\left(\frac{\frac{dW}{dt}}{W}\right)$

B) $\frac{2}{51}\left(\frac{\frac{dW}{dt}}{W}\right)$

C) $\frac{34}{3}\left(\frac{W}{\frac{dW}{dt}}\right)$

D) $\frac{2}{3}\left(\frac{\frac{dW}{dt}}{W}\right)$

E) $\frac{2}{3}\left(\frac{W}{\frac{dW}{dt}}\right)$

Ans: D

114. Assume that water is being purified by causing it to flow through a conical filter that has a height of 12 inches and a radius of 4 inches. If the depth of the water is decreasing at a rate of 3 inches per minute when the depth is 3 inches, at what rate is the volume of water flowing out of the filter at this instant?

A) The water is flowing out at the approximate rate of $9.42\ \text{in}^3$ per minute.
B) The water is flowing out at the approximate rate of $15.71\ \text{in}^3$ per minute.
C) The water is flowing out at the approximate rate of $75.40\ \text{in}^3$ per minute.
D) The water is flowing out at the approximate rate of $25.13\ \text{in}^3$ per minute.
E) The water is flowing out at the approximate rate of $3.14\ \text{in}^3$ per minute.

Ans: A

115. Suppose that air is being pumped into a spherical balloon at a rate of $8\ \text{in.}^3/\text{min}$. At what rate is the radius of the balloon increasing when the radius is 7 in.?

A) $\frac{dr}{dt} = \frac{8}{49\pi}$

B) $\frac{dr}{dt} = \frac{2}{7\pi}$

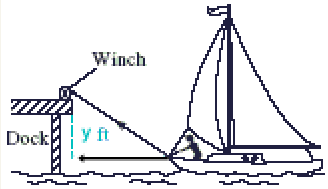
C) $\frac{dr}{dt} = \frac{49}{8\pi}$

D) $\frac{dr}{dt} = \frac{7}{8\pi}$

E) $\frac{dr}{dt} = \frac{2}{49\pi}$

Ans: E

116. Suppose that a boat is being pulled toward a dock by a winch that is 24 ft above the level of the boat deck. If the winch is pulling the cable at a rate of 27 ft/min, at what rate is the boat approaching the dock when it is 32 ft from the dock? Use the figure below.



A) 33.75 ft/min
B) 27.00 ft/min
C) 45.00 ft/min
D) 20.25 ft/min
E) 16.20 ft/min
Ans: A

117. Suppose a 82-ft ladder is leaning against a wall. If the bottom is pulled away from the wall at a rate of 1 ft/sec, at what rate is the top of the ladder sliding down the wall when the bottom is 18 ft from the wall?

A) The top of the ladder is sliding down the wall at the rate of $\frac{9}{41}$ ft/sec.
B) The top of the ladder is sliding down the wall at the rate of $\frac{19}{80}$ ft/sec.
C) The top of the ladder is sliding down the wall at the rate of $\frac{9}{40}$ ft/sec.
D) The top of the ladder is sliding down the wall at the rate of $\frac{18}{83}$ ft/sec.
E) The top of the ladder is sliding down the wall at the rate of $\frac{2}{9}$ ft/sec.

Ans: C

118. Two boats leave the same port at the same time, with boat A traveling north at 20 knots (nautical miles per hour) and boat B traveling east at 35 knots. How fast is the distance between them changing when boat A is 8 nautical miles from port?

A) The distance between the boats is changing at the rate of 34.73 knots.
B) The distance between the boats is changing at the rate of 47.75 knots.
C) The distance between the boats is changing at the rate of 40.31 knots.
D) The distance between the boats is changing at the rate of 27.29 knots.
E) The distance between the boats is changing at the rate of 81.25 knots.
Ans: C

119. Water is flowing into a barrel in the shape of a right circular cylinder at the rate of 200 in^3 per minute. If the radius of the barrel is 3 in., at what rate is the depth of the water changing when the water is 22 in. deep?
A) 5.85 in. per minute
B) 0.32 in. per minute
C) 0.96 in. per minute
D) 0.13 in. per minute
E) 7.07 in. per minute
Ans: E

120. p is in dollars and q is the number of units. Find the elasticity of the demand function $6p + 3q = 171$ at the price $p = \$25$.
A) –7.14
B) 1.00
C) 7.14
D) –2.00
E) 2.00
Ans: C

121. p is in dollars and q is the number of units. Find the elasticity of the demand function $p^2 + 2p + q = 76$ at $p = \$5$.
A) –12.00
B) –0.12
C) –1.00
D) 1.00
E) 1.46
Ans: E

122. p is in dollars and q is the number of units. Find the elasticity of the demand function $p^2 + 2p + q = 85$ at $p = \$7$, and use it to determine how a price increase will affect total revenue.
A) Since the demand is elastic, an increase in price will decrease the total revenue.
B) Since the demand is elastic, an increase in price will increase the total revenue.
C) Since the demand is inelastic, an increase in price will decrease the total revenue.
D) Since the demand is inelastic, an increase in price will increase the total revenue.
E) No change in revenue.
Ans: A

123. p is in dollars and q is the number of units. Find the elasticity of the demand function $pq = 32$ at $p = \$4$.
A) –1.00
B) –0.12
C) –8.00
D) 1.00
E) 8.00
Ans: D

124. p is in dollars and q is the number of units. Find the elasticity of the demand function $pq = 20$ at $p = \$15$ and use it to determine how a price increase will affect total revenue.

A) Since the demand is elastic, an increase in price will decrease the total revenue.
B) Since the demand is elastic, an increase in price will increase the total revenue.
C) Since the demand is inelastic, an increase in price will decrease the total revenue.
D) Since the demand is inelastic, an increase in price will increase the total revenue.
E) No change in revenue.
Ans: E

125. Suppose that the demand for a product is given by $pq + p = 5200$. Find the elasticity when $p = \$52$ and $q = 99$ and also determine how would revenue be affected by a price increase?

A) $\eta = \frac{53}{52}$
A price increase will decrease the total revenue.
B) $\eta = \frac{100}{99}$
A price increase will decrease the total revenue.
C) $\eta = \frac{100}{99}$
A price increase will increase the total revenue.
D) $\eta = \frac{53}{52}$
A price increase will increase the total revenue.
E) $\eta = \frac{101}{99}$
A price increase will decrease the total revenue.
Ans: B

126. p is in dollars and q is the number of units. Suppose that the demand for a product is given by $2p^2q = 5000 + 1000p^2$. Find the elasticity when $p = \$50$ and $q = 501$.

A) 0.0133
B) 0.0040
C) 0.5050
D) 1.0000
E) 0.0084
Ans: B

127. p is in dollars and q is the number of units. Suppose that the demand for a product is given by $(p+1)\sqrt{q+1}=1900$. Find the elasticity when $p=\$32$.

A) 0.01
B) 1.94
C) 4.09
D) 2.36
E) 0.41
Ans: B

128. Suppose the demand function for a product is given by $p=\frac{1}{2}\ln\left(\frac{3000-q}{q+1}\right)$ where p is in hundreds of dollars and q is the number of tons.
What is the elasticity of demand when the quantity demanded is 6 tons and the price is \$303? Round your answer to one decimal place.

A) $\eta \approx 6.0$
B) $\eta \approx 0.5$
C) $\eta \approx 7.1$
D) $\eta \approx 3.0$
E) $\eta \approx 0.7$
Ans: C

129. Suppose the weekly demand function for a product is $q=\frac{10000}{1+e^{2p}}-1$ where p is the price in thousands of dollars and q is the number of units demanded. What is the elasticity of demand when the price is \$1000 and the quantity demanded is 1191? Round your answer to two decimal places.

A) $\eta \approx 1.76$
B) $\eta \approx 0.21$
C) $\eta \approx 0.37$
D) $\eta \approx 1.41$
E) $\eta \approx 0.96$
Ans: A

130. The demand function for specialty steel products are given, where p is in dollars and q is the number of units demanded. Find the point at which the demand is of unitary elasticity.

$p=26\sqrt{88-q}$

A) $q=0.12$
B) $q=0.17$
C) $q=2.26$
D) $q=58.67$
E) $q=81.00$
Ans: D

131. The demand functions for specialty steel products are given, where p is in dollars and q is the number of units demanded. Find the interval in which the demand is inelastic.
$p = 50\sqrt{65 - q}$
A) $q > 0$
B) $q > 560.00$
C) $0 < q < 560.00$
D) $q > 43.33$
E) $0 < q < 43.33$
Ans: D

132. The demand functions for specialty steel products are given, where p is in dollars and q is the number of units demanded. Find the interval in which the demand is elastic.
$p = 10\sqrt{86 - q}$
A) $q > 0$
B) $q > 61.00$
C) $0 < q < 61.00$
D) $q > 57.33$
E) $0 < q < 57.33$
Ans: E

133. p is the price per unit in dollars and q is the number of units. If the demand and supply functions for a product are $p = 1600 - 3q$ and $p = 700 + 1.40q$, respectively, how many items will maximize the tax revenue?
A) 447
B) 451
C) 429
D) 213
E) 102
Ans: E

134. p is the price per unit in dollars and q is the number of units. If the demand and supply functions for a product are $p = 2000 - 6q$ and $p = 700 + 1.30q$, respectively, find the tax per unit t that will maximize the tax revenue T.
A) \$643.00 per item
B) \$89.00 per item
C) \$613.80 per item
D) \$187.00 per item
E) \$650.30 per item
Ans: E

135. Suppose the weekly demand function is $p = 540 - 8q^2$ and the supply function before taxation is $p = 60 + 12q,$ determine what tax per item will maximize the total tax revenue?
A) $\$232/\text{item}$
B) $\$372/\text{item}$
C) $\$304/\text{item}$
D) $\$427/\text{item}$
E) $\$474/\text{item}$
Ans: C

136. *p* is the price per unit in dollars and *q* is the number of units. The monthly demand function is $p = 1630 - 2q^2$ and the supply function before taxation is $p = 10 + 10q^2$. Find what tax per item will maximize the total revenue and use this to find the maximum tax revenue.
A) $6.00
B) $1188.00
C) $7128.00
D) $7224.00
E) $20.00
Ans: C

137. Suppose the weekly demand for a product is given by $p + 2q = 840$ and the weekly supply before taxation is given by $p = 0.05q^2 + 0.55q + 7.4.$ Find the tax per item that produces maximum tax revenue. Round your answer to the nearest cent.
A) $511.41 tax per item
B) $504.56 tax per item
C) $634.47 tax per item
D) $392.58 tax per item
E) $511.96 tax per item
Ans: B

138. *p* is the price per unit in dollars and *q* is the number of units. If the daily demand for a product is given by the function $p + q = 1000$ and the daily supply before taxation is $p = q^2/10 + 1.5q + 840$, find the tax per item that maximizes tax revenue.
A) $7.50 per item
B) $16.00 per item
C) $56.25 per item
D) $87.72 per item
E) $94.40 per item
Ans: E

139. p is the price per unit in dollars and q is the number of units. The monthly demand function is $p = 1670 - 4q^2$ and the supply function before taxation is $p = 30 + 30q^2$. Find the tax per unit t that will maximize the tax revenue T.

A) $4.00 per item
B) $1096.00 per item
C) $4384.00 per item
D) $3950.00 per item
E) $14.00 per item
Ans: B

