Chapter 12 Indefinite Integrals

1. Find a function $g(x)$ such that $g'(x) = x^8$.

   A) $g(x) = \frac{1}{9}x^9$

   B) $g(x) = \frac{1}{8}x^8$

   C) $g(x) = \frac{1}{7}x^7$

   D) $g(x) = 8x^7$

   E) $g(x) = 9x^9$

   Ans: A

2. Evaluate the integral $\int 15x^9 dx$.

   A) $135x^8 + C$

   B) $150x^{10} + C$

   C) $\frac{15}{8}x^8 + C$

   D) $\frac{3}{2}x^{10} + C$

   E) $\frac{5}{3}x^9 + C$

   Ans: D

3. Evaluate the integral $\int (2^2 + x^8) dx$.

   A) $\frac{1}{9}x^9 + \frac{8}{3} + C$

   B) $\frac{1}{9}x^9 + 4x + C$

   C) $\frac{1}{9}x^9 + \frac{8}{3}x + C$

   D) $8x^7 + 4 + C$

   E) $8x^7 + C$

   Ans: B

4. Evaluate the integral $\int (9 + x^{2/3})\,dx$.

A) $9x + \frac{3}{5}x^{5/3} + C$

B) $9x + \frac{5}{3}x^{5/3} + C$

C) $\frac{81}{2} + \frac{3}{5}x^{5/3} + C$

D) $\frac{2}{3}x^{-1/3} + C$

E) $\frac{2}{3}x^{5/3} + C$

Ans: A

5. Evaluate the integral $\int (x^5 - x^4 - 7)\,dx$.

A) $\frac{1}{6}x^6 - \frac{1}{5}x^5 - \frac{49}{2} + C$

B) $\frac{1}{6}x^6 - \frac{1}{5}x^5 - \frac{49}{2}x + C$

C) $\frac{1}{6}x^6 - \frac{1}{5}x^5 - 7x + C$

D) $\frac{1}{5}x^5 - \frac{1}{4}x^4 - 7x + C$

E) $\frac{1}{4}x^4 - \frac{1}{3}x^3 - 7x + C$

Ans: C

6. Evaluate the integral $\int (-2x^2 - 9x - 7)\,dx$.

A) $-6x^3 - 18x^2 - 7x + C$

B) $-\frac{2}{3}x^3 - \frac{9}{2}x^2 + \frac{49}{2} + C$

C) $-\frac{2}{3}x^3 - \frac{9}{2}x^2 + \frac{49}{2}x + C$

D) $-\frac{2}{3}x^3 - \frac{9}{2}x^2 - 7x + C$

E) $-4x - 9 + C$

Ans: D

7. Evaluate the integral $\int(-1+\sqrt{x^{13}})\,dx$.

A) $-x+\frac{13}{15}\sqrt[15]{x^{13}}+C$

B) $-\frac{1}{2}+\frac{13}{15}\sqrt[15]{x^{13}}+C$

C) $-x+\frac{2}{15}\sqrt{x^{15}}+C$

D) $-x+\frac{2}{13}\sqrt{x^{13}}+C$

E) $-\frac{1}{2}+\frac{2}{15}\sqrt{x^{15}}+C$

Ans: C

8. Evaluate the integral $\int 33\sqrt[3]{x^2}\,dx$.

A) $\int 33\sqrt[3]{x^2}\,dx=\frac{33}{5}x^{5/3}+C$

B) $\int 33\sqrt[3]{x^2}\,dx=\frac{99}{5}x^{5/3}+C$

C) $\int 33\sqrt[3]{x^2}\,dx=\frac{99}{5}x^{2/3}+C$

D) $\int 33\sqrt[3]{x^2}\,dx=\frac{66}{5}x^{5/2}+C$

E) $\int 33\sqrt[3]{x^2}\,dx=\frac{66}{5}x^{2/3}+C$

Ans: B

9. Evaluate the integral $\int\frac{3}{x^8}\,dx$.

A) $3\ln(x^8)+C$

B) $\frac{1}{3x^9}+C$

C) $-\frac{3}{7}\ln(x^7)+C$

D) $-\frac{1}{3x^9}+C$

E) $-\frac{3}{7x^7}+C$

Ans: E

10. Evaluate the integral $\int \frac{2dx}{5\sqrt{x^3}}$.

A) $\int \frac{2dx}{5\sqrt{x^3}} = -\frac{4\sqrt{x}}{5} + C$

B) $\int \frac{2dx}{5\sqrt{x^3}} = -\frac{2}{5\sqrt{x}} + C$

C) $\int \frac{2dx}{5\sqrt{x^3}} = -\frac{4}{5\sqrt{x}} + C$

D) $\int \frac{2dx}{5\sqrt{x^3}} = \frac{4}{5\sqrt{x}} + C$

E) $\int \frac{2dx}{5\sqrt{x^3}} = -\frac{2\sqrt{x}}{5} + C$

Ans: C

11. Evaluate the integral $\int \left(x^4 + 9 - \frac{4}{x^6} \right) dx$.

A) $\frac{x^5}{5} + 9x + \frac{4}{7x^7} + C$

B) $\frac{x^5}{5} + 9x + \frac{4}{5x^5} + C$

C) $\frac{x^5}{5} + \frac{81}{2} + \frac{4}{5x^5} + C$

D) $\frac{x^5}{5} + 9x - 4\ln(x^6) + C$

E) $\frac{x^5}{5} + \frac{81}{2} - 4\ln(x^6) + C$

Ans: B

12. Evaluate the integral $\int\left(9x^{26}+\frac{4}{x^8}-\frac{4}{\sqrt[4]{x}}\right)dx$.

A) $\int\left(9x^{26}+\frac{4}{x^8}-\frac{4}{\sqrt[4]{x}}\right)=\frac{x^{27}}{3}-\frac{4}{7x^7}-\frac{16}{3}x^{3/4}+C$

B) $\int\left(9x^{26}+\frac{4}{x^8}-\frac{4}{\sqrt[4]{x}}\right)=\frac{x^{27}}{3}+\frac{4}{7x^7}-\frac{16}{3}x^{5/4}+C$

C) $\int\left(9x^{26}+\frac{4}{x^8}-\frac{4}{\sqrt[4]{x}}\right)=\frac{x^{27}}{3}-\frac{4}{7x^7}-\frac{4}{3}x^{3/4}+C$

D) $\int\left(9x^{26}+\frac{4}{x^8}-\frac{4}{\sqrt[4]{x}}\right)=\frac{x^{27}}{3}+\frac{4}{7x^7}-\frac{16}{5}x^{3/4}+C$

E) $\int\left(9x^{26}+\frac{4}{x^8}-\frac{4}{\sqrt[4]{x}}\right)=\frac{x^{27}}{3}+\frac{4}{7x^7}+\frac{4}{3}x^{5/4}+C$

Ans: A

13. Use algebra to rewrite the integrand; then integrate and simplify.

$\int x(x^3-3)^2\,dx$

A) $\frac{1}{7}x^7-\frac{3}{2}x^4+\frac{81}{2}+C$

B) $\frac{1}{7}x^7-\frac{3}{2}x^4+9x+C$

C) $\frac{1}{8}x^8-\frac{6}{5}x^5+\frac{81}{2}+C$

D) $\frac{1}{8}x^8-\frac{6}{5}x^5+\frac{9}{2}x^2+C$

E) $\frac{1}{8}x^8-\frac{3}{5}x^5+\frac{9}{2}x^2+C$

Ans: D

14. Use algebra to rewrite the integrand; then integrate and simplify.

$$\int \frac{x-13}{\sqrt{x}}\,dx$$

A) $\frac{2}{3}x\sqrt{x}-13\sqrt{x}+C$

B) $\frac{2}{3}x\sqrt{x}-26\sqrt{x}+C$

C) $\frac{2}{3}x\sqrt{x}-39\sqrt{x}+C$

D) $\frac{1}{2}x^2-39\sqrt{x}+C$

E) $\frac{1}{2}x^2-26\sqrt{x}+C$

Ans: B

15. If $\int g(x)\,dx = 11x^9 - 5x^5 + C$, find $g(x)$.

A) $g(x) = 99x^8 - 25x^4$

B) $g(x) = 88x^9 - 20x^5$

C) $g(x) = 110x^{10} - 30x^6$

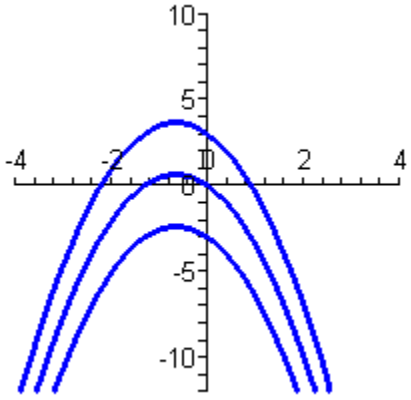
D) $g(x) = \frac{11}{10}x^{10} - \frac{5}{6}x^6$

E) $g(x) = \frac{11}{8}x^8 - \frac{5}{4}x^4$

Ans: A

16. A family of functions is given and the graph of some members of the family are shown. Write the indefinite integral that gives the family.

$$F(x) = -\frac{3}{2}x^2 - 2x + C$$



A) $\int (-3x - 2)dx$

B) $\int (-x + 1)dx$

C) $\int (x + 3)dx$

D) $\int (2x + 1)dx$

E) $\int (x - 4)dx$

Ans: A

17. If the marginal revenue (in dollars per unit) for a month is given by $\overline{MR} = -0.008x + 39$, find the total revenue from the sale of 200 units to the nearest cent.

A) $7638.98
B) $7637.80
C) $7640.00
D) $37.40
E) $36.20

Ans: C

18. Suppose that when a sense organ receives a stimulus at time *t*, the total number of action potentials is *P*(*t*). If the rate at which action potentials are produced is $t^3 + 7t^5 + 7$, and if there are 0 action potentials when $t = 0$, find the formula for *P*(*t*).

A) $P(t) = 3t^2 + 35t^4$

B) $P(t) = \frac{1}{3}t^3 + \frac{7}{5}t^5 + 7t$

C) $P(t) = \frac{1}{4}t^4 + \frac{7}{6}t^6 + 7t$

D) $P(t) = 3t^2 + 7t^5$

E) $P(t) = \frac{1}{2}t^2 + \frac{7}{6}t^6 + 7t$

Ans: C

19. Suppose that a particle has been shot into the air in such a way that the rate at which its height *H* (in feet per second) is changing is $v = 1000 - 100t$. If the particle is 5000 feet high when $t = 10$ seconds, write the formula for the height of the particle at any time *t.*

A) $H(t) = 1000t - 100t^2$

B) $H(t) = 1000t - 50t^2$

C) $H(t) = 1000t - 200t^2$

D) $H(t) = 1000t - 101t^2$

E) $H(t) = 1000t - 400t^2$

Ans: B

20. The DeWitt Company has found that the rate of change of its average cost of producing a product is $\bar{C}' = \frac{1}{2} - \frac{160}{x^2}$, where *x* is the number of units and cost is in dollars. The average cost of producing 20 units is $\$40.00$. Find the average cost of producing 160 units of the product. Round to the nearest dollar.

A) \$91
B) \$93
C) \$96
D) \$98
E) \$103

Ans: E

21. Suppose an oil tanker hits a reef and begins to leak. The efforts of the workers repairing the leak cause the rate at which the oil is leaking to decrease. The oil was leaking at a rate of 34 barrels per hour at the end of the first hour after the accident, and the rate is decreasing at a rate of one barrel per hour. What formula describes the rate of loss in terms of the time t that has lapsed since the leak began?
A) $-t+35$
B) $t+35$
C) $-t+33$
D) $t-35$
E) $t-33$
Ans: A

22. Suppose an oil tanker hits a reef and begins to leak. The efforts of the workers repairing the leak cause the rate at which the oil is leaking to decrease. The oil was leaking at a rate of 42 barrels per hour at the end of the first hour after the accident, and the rate is decreasing at a rate of one barrel per hour. How many barrels of oil will leak in the first 6 hours?
A) 234 barrels
B) 150 barrels
C) 240 barrels
D) 249 barrels
E) 243 barrels
Ans: C

23. Find du if $u = -9x^5 + 2x^4$.
A) $du = \left(-\frac{3}{2}x^6 + \frac{2}{5}x^5\right)$
B) $du = (-45x^4 + 8x^3)$
C) $du = (-45x^5 + 8x^4)\,dx$
D) $du = \left(-\frac{3}{2}x^6 + \frac{2}{5}x^5\right)dx$
E) $du = (-45x^4 + 8x^3)\,dx$
Ans: E

24. Evaluate the integral $\int (4x^5 - 9)^4 (20x^4) dx$.

A) $\frac{1}{3}(4x^5 - 9)^3 + C$

B) $\frac{1}{4}(4x^5 - 9)^4 + C$

C) $\frac{1}{4}(4x^5 - 9)^5 + C$

D) $\frac{1}{5}(4x^5 - 9)^5 + C$

E) $\frac{1}{5}(4x^5 - 9)^4 + C$

Ans: D

25. Evaluate the integral $\int (8x^7 + 5x^6)^6 (56x^6 + 30x^5)\, dx$.

A) $\frac{1}{7}(8x^7 + 5x^6)^7 + C$

B) $\frac{1}{7}(8x^7 + 5x^6)^6 + C$

C) $\frac{1}{6}(8x^7 + 5x^6)^7 + C$

D) $\frac{1}{6}(8x^7 + 5x^6)^6 + C$

E) $\frac{1}{5}(8x^7 + 5x^6)^5 + C$

Ans: A

26. Evaluate the integral $\int (2x^3 + 5)^8 x^2\, dx$.

A) $\frac{1}{42}(2x^3 + 5)^7 + C$

B) $\frac{2}{3}(2x^3 + 5)^9 + C$

C) $\frac{3}{4}(2x^3 + 5)^8 + C$

D) $\frac{1}{54}(2x^3 + 5)^9 + C$

E) $\frac{1}{48}(2x^3 + 5)^8 + C$

Ans: D

27. Evaluate the integral $\int (7x^4 - 6)^{-4}(-24x^3)\,dx$.

A) $\frac{6}{35}(7x^4 - 6)^{-5} + C$

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

C) $\frac{3}{14}(7x^4 - 6)^{-4} + C$

D) $\frac{32}{7}(7x^4 - 6)^{-3} + C$

E) $\frac{24}{7}(7x^4 - 6)^{-4} + C$

Ans: B

28. Evaluate the integral $\int \left(12x^{23} - x\right)\left(x^{24} - x^2\right)^{12}\,dx$.

A) $\frac{\left(x^{24} - x^2\right)^{12}}{24} + C$

B) $\frac{\left(12x^{23} - x\right)^{13}}{26} + C$

C) $\frac{\left(x^{24} - x^2\right)^{13}}{26} + C$

D) $\frac{\left(x^{24} - x\right)^{12}}{26} + C$

E) $\frac{\left(12x^{23} - x\right)^{12}}{24} + C$

Ans: C

29. Evaluate the integral $\int 6x^7\sqrt{x^8 + 4}\,dx$.

A) $\frac{1}{2}(x^8 + 4)^{3/2} + C$

B) $\frac{3}{2}(x^8 + 4)^{3/2} + C$

C) $\frac{9}{8}(x^8 + 4)^{3/2} + C$

D) $\frac{3}{4}x^8 + C$

E) $\frac{6}{7}x^8 + C$

Ans: A

30. Evaluate the integral $\int \sqrt{x^4 - 4x}\left(x^3 - 1\right) dx$.

A) $\frac{1}{6}\left(x^4 - 4x\right)^{1/2} + C$

B) $\frac{1}{6}\left(x^3 - 4x\right)^{3/2} + C$

C) $\frac{1}{12}\left(x^3 - 4x\right)^{1/2} + C$

D) $\frac{1}{12}\left(x^4 - 4x\right)^{3/2} + C$

E) $\frac{1}{6}\left(x^4 - 4x\right)^{3/2} + C$

Ans: E

31. Evaluate the integral $\int \frac{7x^4 dx}{(5x^5 - 7)^6}$.

A) $\frac{7}{125(5x^5 - 7)^5} + C$

B) $\frac{-7}{125(5x^5 - 7)^5} + C$

C) $\frac{-7}{150(5x^5 - 7)^6} + C$

D) $\frac{7}{150(5x^5 - 7)^6} + C$

E) $\frac{-7}{150(5x^5 - 7)^5} + C$

Ans: B

32. Evaluate the integral $\int \frac{x^{10} - 6x}{\sqrt{x^{11} - 33x^2 + 7}} dx$.

A) $\frac{1}{11}\left(x^{11} - 33x^2 + 7\right)^{3/2} + C$

B) $\frac{1}{6}\left(x^{11} - 33x^2 + 7\right)^{1/2} + C$

C) $\frac{2}{11}\left(x^{11} - 33x^2 + 7\right)^{3/2} + C$

D) $\frac{1}{6}\left(x^{11} - 33x^2 + 7\right)^{3/2} + C$

E) $\frac{2}{11}\left(x^{11} - 33x^2 + 7\right)^{1/2} + C$

Ans: E

33. If $\int g(x)dx = (7x^3 + 4)^3 + C$, find $g(x)$.

A) $g(x) = 3(7x^3 + 4)^2$

B) $g(x) = 21x^2(7x^3 + 4)^2$

C) $g(x) = 63x^2(7x^3 + 4)^2$

D) $g(x) = 21x^2(7x^3 + 4)^3$

E) $g(x) = 3(7x^3 + 4)^3$

Ans: C

34. Evaluate the integral $\int (2x + 5)^{1/5} dx$.

A) $\frac{5}{6}(2x + 5)^{6/5} + C$

B) $\frac{6}{5}(2x + 5)^{-4/5} + C$

C) $\frac{5}{3}(2x + 5)^{-4/5} + C$

D) $\frac{12}{5}(2x + 5)^{6/5} + C$

E) $\frac{5}{12}(2x + 5)^{6/5} + C$

Ans: E

35. Evaluate the integral $\int \frac{6dx}{(4x - 7)^{3/5}}$.

A) $\frac{15}{4}(4x - 7)^{3/5} + C$

B) $\frac{4}{15}(4x - 7)^{3/7} + C$

C) $\frac{15}{4}(4x - 7)^{2/5} + C$

D) $\frac{4}{15}(4x - 7)^{3/5} + C$

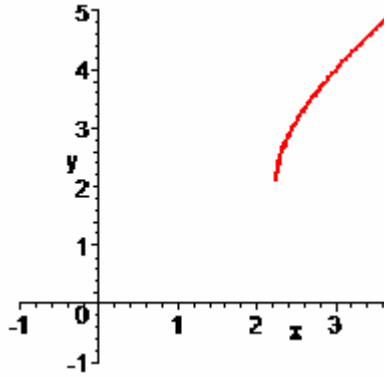
E) $\frac{4}{15}(4x - 7)^{2/7} + C$

Ans: C

36. Evaluate the integral below and sketch the graph of the family member that passes through the point (3,4).

$$\int \frac{x^2\,dx}{(2x^3+10)^{1/3}}$$

A)



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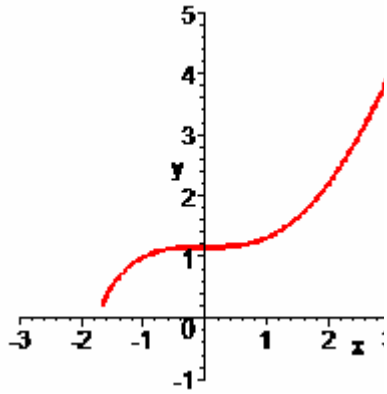

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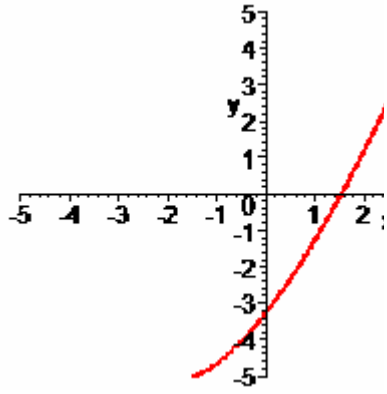

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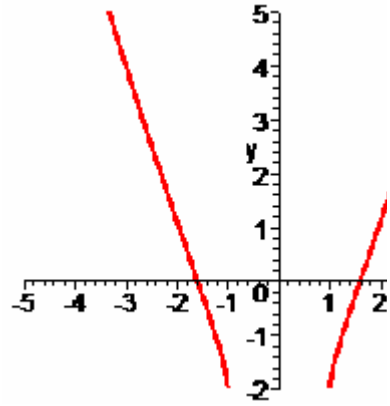
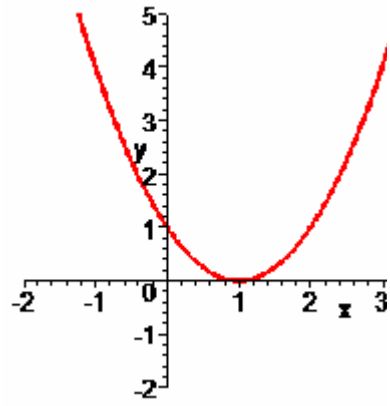


E)



Ans: B

37. Write the indefinite integral that gives the family associated with $F(x) = 48(4x^4 + 1)^{-4} + C$.

A) $\int \frac{3072x^3}{(4x^4+1)^5}\,dx$

B) $\int \frac{192}{(4x^4+1)^5}\,dx$

C) $-\int \frac{192}{(4x^4+1)^5}\,dx$

D) $-\int \frac{3072x^3}{(4x^4+1)^5}\,dx$

E) $-\int \frac{48}{(4x^4+1)^4}\,dx$

Ans: D

38. Which of the following integrals **cannot** be integrated by using the methods studied so far?

(a) $\int \frac{(5x^3 - 7)^{9/2}}{10x^2}\,dx$

(b) $\int 15x(5x^3 - 7)^{9/2}\,dx$

(c) $\int \frac{10x^3}{(5x^4 - 7)^{9/2}}\,dx$

(d) $\int \sqrt{5x - 7}\,dx$

(e) $\int 10x^3\sqrt{5x - 7}\,dx.$

A) a, b
B) a, b, e
C) b, c, e
D) c, d
E) d, e
Ans: B

39. The marginal revenue for a new calculator is given by $\overline{MR} = 40,000 - \frac{20,000}{(5+x)^2}$, where x represents hundreds of calculators and revenue is in dollars. Find the total revenue function for these calculators.

A) $R(x) = 40,000x + \frac{60,000}{(5+x)^3} - 480$

B) $R(x) = 40,000x + \frac{60,000x}{(5+x)^3}$

C) $R(x) = 40,000x + \frac{20,000}{5+x} - 4,000$

D) $R(x) = 40,000x - \frac{20,000x}{5+x} + 4,000$

E) $R(x) = 40,000x - \frac{20,000x}{5+x}$

Ans: C

40. The total physical output of a number of machines or workers is called *physical productivity* and is a function of the number of machines or workers. If $P = f(x)$ is the productivity, dP/dx is the marginal physical productivity. If the marginal physical productivity for bricklayers is $dP/dx = 90(x+4)^2$, where P is the number of bricks laid per day and x is the number of bricklayers, find the physical productivity of 4 bricklayers. (*Note:* $P = 0$ when $x = 0$.)
A) 13,440 bricks laid per day
B) 120,960 bricks laid per day
C) 115,200 bricks laid per day
D) 11,200 bricks laid per day
E) 96,000 bricks laid per day
Ans: A

41. The rate of production of a new line of products is given by $\frac{dx}{dt} = 100\left[1 + \frac{700}{(t+70)^2}\right]$ where x is the number of items produced and t is the number of weeks the product has been in production. Assuming that $x = 0$ when $t = 0$, find the total number of items produced as a function of time t.
A) $x = 100t + \frac{70,000}{t+70} + 1000$
B) $x = 100t - \frac{70,000}{t+70} + 7000$
C) $x = 100t - \frac{70,000}{t+70} - 7000$
D) $x = 100t - \frac{70,000}{t+70} + 1000$
E) $x = 100t + \frac{70,000}{t+70} - 1000$
Ans: D

42. The rate of production of a new line of products is given by $\frac{dx}{dt} = 300\left[1 + \frac{5000}{(t+50)^2}\right]$ where x is the number of items and t is the number of weeks the product has been in production. Assuming that $x = 0$ when $t = 0$, find out the number of items produced in the fifth week. Round your answer to the nearest integer.
A) 787 items are produced during the fifth week
B) 54,470 items are produced during the fifth week
C) 6,246 items are produced during the fifth week
D) 294 items are produced during the fifth week
E) 805 items are produced during the fifth week
Ans: E

43. Because a new employee must learn an assigned task, the employee's production will increase with time. Suppose that for the average new employee, the rate of performance is given by $\frac{dN}{dt} = \frac{1}{2(t+1)^{1/2}}$, where N is the number of units completed t hours after beginning a new task. If 2 units are completed after 3 hours, how many units are completed after 48 hours?
A) 6
B) 7
C) 8
D) 10
E) 11
Ans: B

44. An inferior product with a large advertising budget does well when it is introduced, but sales decline as people discontinue use of the product. Suppose that the rate of weekly sales revenue is given by $S'(t) = \frac{400}{(t+10)^3} - \frac{200}{(t+10)^2}$ where S is the sales in thousands of dollars and t is the time in weeks. Find the function that describes the weekly sales revenue if $S = 18$ thousand dollars when $t = 0$.
A) $S(t) = -\frac{200}{(t+10)^2} + \frac{200}{t+10}$
B) $S(t) = -\frac{400}{(t+10)^2} + \frac{200}{t+10} + 200$
C) $S(t) = -\frac{400}{(t+10)^2} + \frac{200}{t+10} + 2$
D) $S(t) = \frac{200}{(t+10)^2} - \frac{200}{t+10}$
E) $S(t) = \frac{400}{(t+10)^2} - \frac{200}{t+10} - 200$
Ans: A

45. Because of job outsourcing, a western Pennsylvania town predicts that its public school population will decrease at the rate $\frac{dN}{dx} = \frac{-300}{\sqrt{x+16}}$ where x is the number of years and N is the total school population. If $N = 8{,}600$ when $x = 0$, what population size is expected in 5 years? Round your answer to nearest integer when applicable.
A) 7,050 students
B) 8,425 students
C) 9,625 students
D) 8,250 students
E) 11,000 students
Ans: D

46. A new fast-food firm predicts that the number of franchises for its products will grow at the rate $\frac{dn}{dt} = 24(t+1)^{1/2}$, where t is the number of years. If there is one franchise $(n = 1)$ at present $(t = 0)$, how many franchises are predicted for 35 years from now?

A) 1,147
B) 1,721
C) 3,441
D) 6,882
E) 10,323

Ans: C

47. Suppose the rate of change of the interest paid on the public debt of the United States as a percent of federal expenditures can be modeled by $\frac{dD}{dt} = -0.0788(0.1t+3)^3 + 1.596(0.1t+3)^2 - 10.26(0.1t+3) + 20.96$, where t is the number of years past 1930. Use integration and the fact that in 1980, the interest paid as a percent of Federal Expenditures was 18.9, to find the function $D(t)$ that models the interest paid on the public debt of the United States as a percent of federal expenditures.

A) $D(t) = -0.197(0.1t+3)^4 + 5.32(0.1t+3)^3 - 51.3(0.1t+3)^2 + 20.96t + 322.17$
B) $D(t) = -0.197(0.1t+3)^4 + 5.32(0.1t+3)^3 - 51.3(0.1t+3)^2 + 20.96t + 337.17$
C) $D(t) = -0.197(0.1t+3)^4 + 5.32(0.1t+3)^3 - 51.3(0.1t+3)^2 + 20.96(0.1t+3) - 352.17$
D) $D(t) = -0.263(0.1t+3)^4 + 7.798(0.1t+3)^3 - 102.6(0.1t+3)^2 + 20.96(0.1t+3) - 342.1$
E) $D(t) = -0.263(0.1t+3)^4 + 7.798(0.1t+3)^3 - 102.6(0.1t+3)^2 + 20.96t + 327.17$

Ans: B

48. Evaluate the integral $\int e^{15x}dx$.

A) $\frac{1}{15}e^{15x} + C$
B) $15e^{15x} + C$
C) $\frac{1}{16}e^{16x} + C$
D) $15e^{14x} + C$
E) $\frac{1}{14}e^{14x} + C$

Ans: A

49. Evaluate the integral $\int 950e^{0.5x}\,dx$.

A) $475e^{0.5x}+C$
B) $633.3e^{1.5x}+C$
C) $1900e^{0.5x}+C$
D) $475e^{-0.5x}+C$
E) $475e^{1.5x}+C$
Ans: C

50. Evaluate the integral $\int \frac{500e^{6/x}}{x^2}\,dx$.

A) $-\frac{250}{3}e^{6/x}+C$
B) $-\frac{500}{7}e^{7/x}+C$
C) $\frac{250}{3x^2}e^{6/x}+C$
D) $-\frac{500}{7x^2}e^{7/x}+C$
E) $\frac{250}{3}e^{6/x}+C$
Ans: A

51. Evaluate the integral $\int x^7e^{5x^8}\,dx$.

A) $\frac{1}{8}e^{5x^8}+C$
B) $40e^{5x^8}+C$
C) $\frac{1}{40}e^{5x^8}+C$
D) $8e^{5x^8}+C$
E) $\frac{1}{40}x^8e^{5x^8}+C$
Ans: C

52. Evaluate the integral $\int \frac{14}{e^{4-7x}}dx$.

A) $4e^{7x-4}+C$
B) $e^{4-7x}+C$
C) $2e^{4-7x}+C$
D) $4e^{7x+4}+C$
E) $2e^{7x-4}+C$
Ans: E

53. Evaluate the integral $\int \frac{x^6}{e^{9x^7}}\,dx$.

A) $\frac{1}{9e^{9x^7}} + C$

B) $\frac{1}{63e^{9x^7}} + C$

C) $-\frac{1}{9e^{9x^7}} + C$

D) $-\frac{x^7}{63e^{9x^7}} + C$

E) $-\frac{1}{63e^{9x^7}} + C$

Ans: E

54. Evaluate the integral $\int\left(xe^{4x^2} - \frac{7}{e^{x/7}}\right)dx$.

A) $\frac{8}{e^{4x^2}} + \frac{1}{49}e^{x/7} + C$

B) $\frac{1}{8}e^{4x^2} - \frac{49}{e^{x/7}} + C$

C) $\frac{1}{8}e^{4x^2} + \frac{49}{e^{x/7}} + C$

D) $\frac{1}{49}e^{4x^2} - \frac{8}{e^{x/7}} + C$

E) $\frac{1}{8}e^{4x^2} + \frac{1}{49}e^{x/7} + C$

Ans: C

55. Evaluate the integral $\int \frac{y^5}{y^6 - 1}\,dy$.

A) $\ln|y| + \frac{y^6}{6} + C$

B) $\ln\left|y^6 - 1\right| + C$

C) $6\ln\left|y^6 - 1\right| + C$

D) $\frac{1}{6}\ln\left|y^6 - 1\right| + C$

E) $\frac{1}{7}\ln\left|y^6 - 1\right| + C$

Ans: D

56. Evaluate the integral $\int \frac{4x^{-7}}{x^{-6}-3}dx$.

A) $\ln\left|x^{-6}-3\right|+C$

B) $-\frac{2}{3}\ln\left|x^{-6}-3\right|+C$

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

D) $4\ln|x|+\frac{2}{9}x^{-6}+C$

E) $-\frac{4}{5}\ln\left|x^{-5}-3\right|+C$

Ans: B

57. Evaluate the integral $\int \frac{5x^4+4x^3}{x^5+x^4}dx$.

A) $\ln\left|x^6+x^5\right|+C$

B) $\ln\left|x^5+x^4\right|+C$

C) $5\ln\left|x^5+x^4\right|+C$

D) $\frac{1}{20}\ln\left|x^5+x^4\right|+C$

E) $\frac{1}{9}\ln\left|x^5+x^4\right|+C$

Ans: B

58. Evaluate the integral $\int \frac{(x^3+3)dx}{x^4+12x+9}$.

A) $3\ln\left|x^4+12x+9\right|+C$

B) $4\ln\left|x^4+12x+9\right|+C$

C) $\frac{1}{3}\ln\left|x^4+12x+9\right|+C$

D) $\frac{1}{4}\ln\left|x^4+12x+9\right|+C$

E) $\frac{1}{5}\ln\left|x^4+12x+9\right|+C$

Ans: D

59. Evaluate the integral $\int \frac{9x^4 + x^3 + 9x + 10}{9x + 1} dx$.

A) $\frac{1}{4}x^4 + x + \ln|9x+1| + C$

B) $\frac{1}{3}x^3 + x + \ln|9x+1| + C$

C) $\frac{1}{5}x^5 + x + \ln|9x+1| + C$

D) $\frac{1}{4}x^4 + \frac{10}{9}\ln|9x+1| + C$

E) $\frac{1}{4}x^4 + 9\ln|9x+1| + C$

Ans: A

60. Given the functions below, decide which function is $f(x)$, and which is a member of the family $\int f(x)dx$.

$g(x) = -19e^{-19x}$

$h(x) = e^{-19x}$

$p(x) = 19e^{-19x}$

A) $g(x) = f(x)$ and $h(x)$ is a member of the family of $\int f(x)dx$

B) $h(x) = f(x)$ and $g(x)$ is a member of the family of $\int f(x)dx$

C) $p(x) = f(x)$ and $h(x)$ is a member of the family of $\int f(x)dx$

D) $g(x) = f(x)$ and $p(x)$ is a member of the family of $\int f(x)dx$

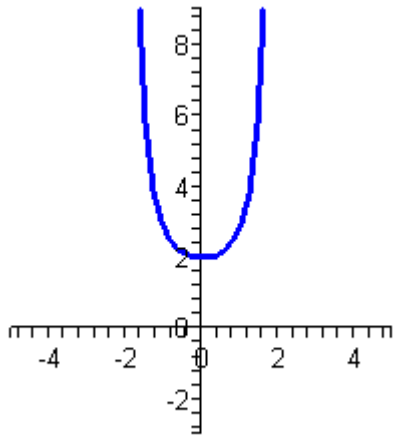
E) $h(x) = f(x)$ and $p(x)$ is a member of the family of $\int f(x)dx$

Ans: A

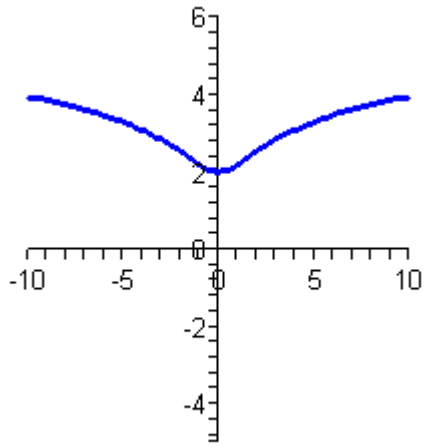
61. A function $f(x)$ is given below. Find the graph the of the member of the family $F(x) = \int f(x)dx$ that satisfies $F(0) = 0$.

$$f(x) = \frac{1}{x+2}$$

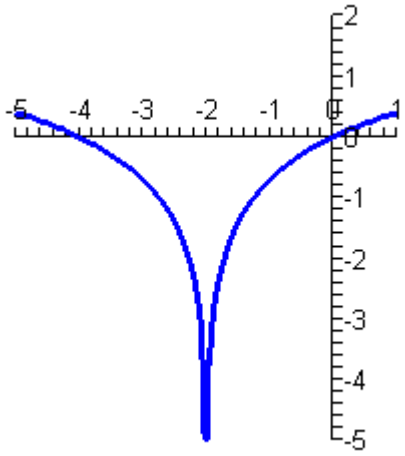
A)



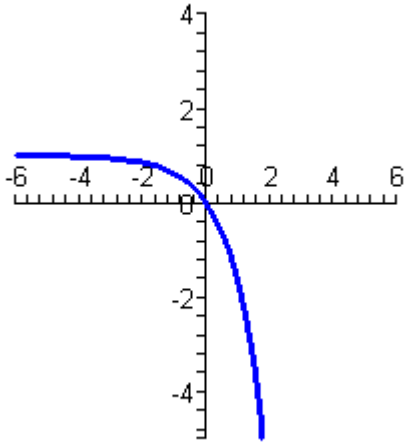
B)



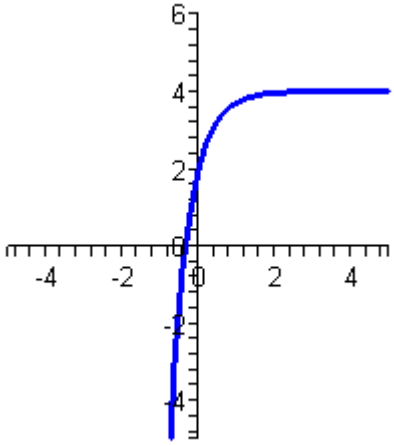
C)



D)



E)



Ans: C

62. A family of functions is given below. Find the function $f(x)$ such that the family is given by $\int f(x)dx$.

$F(x) = -1\text{n}\,(x^7 + 4) + C$

A) $f(x) = -\dfrac{1}{x^7 + 4}$

B) $f(x) = \dfrac{7x^6}{x^7 + 4}$

C) $f(x) = -\dfrac{x^8}{x^9 + 4}$

D) $f(x) = -\dfrac{7x^7}{x^8 + 4}$

E) $f(x) = -\dfrac{7x^6}{x^7 + 4}$

Ans: E

63. A family of functions is given below. Find the function $f(x)$ such that the family is given by $\int f(x)dx$.

$F(x) = e^{0.9x} + e^{-0.8x} + C$

A) $f(x) = e^{0.9x} + e^{-0.8x}$

B) $f(x) = e^{1.9x} + e^{0.2x}$

C) $f(x) = 1.9e^{1.9x} + 0.2e^{0.2x}$

D) $f(x) = -0.9e^{0.9x} + 0.8e^{-0.8x}$

E) $f(x) = 0.9e^{0.9x} - 0.8e^{-0.8x}$

Ans: E

64. Suppose that the marginal revenue (in dollars) from the sale of x units of a product is $\overline{MR} = R'(x) = 3e^{0.02x}$. What is the revenue from the sale of 150 units of the product? Round your answer to the nearest cent.

A) \$3,012.83
B) \$2,862.83
C) \$4,344.62
D) \$3,387.00
E) \$3,820.62

Ans: B

65. The rate of vocabulary memorization of the average student in a certain foreign language course is given by $\frac{dv}{dt} = \frac{35}{t+1}$, where t is the number of continuous hours of study, $0 < t \le 4$, and v is the number of words. About how many words would the average student memorize in 1 hour?
A) 22 words
B) 24 words
C) 26 words
D) 27 words
E) 29 words
Ans: B

66. If \$$P$ is invested for n years at 39% compounded continuously, the rate at which the future value is growing is $\frac{dS}{dn} = 0.39Pe^{0.39n}$. What function describes the future value at the end of n years?
A) $S = 39Pe^{0.39n} - 38P$
B) $S = \frac{P}{e^{0.39n}} + 3$
C) $S = \frac{39}{Pe^{0.39n}} + \frac{P^2 - 39}{P}$
D) $S = \frac{39P}{e^{0.39n}} + 1$
E) $S = Pe^{0.39n}$
Ans: E

67. If \$$P$ is invested for n years at 13% compounded continuously, the rate at which the future value is growing is $\frac{dS}{dn} = 0.13Pe^{0.13n}$. In how many years will the future value double? Round your answer to one decimal place.
A) 8.5 years
B) 7.3 years
C) 5.3 years
D) 10.5 years
E) 10.3 years
Ans: C

68. Suppose that the rate at which blood pressure decreases in the aorta of a normal adult after a heartbeat is $\frac{dp}{dt} = -38.897e^{-0.401t}$ where t is the time in seconds. Use the function that describes the blood pressure in the aorta if $p = 97$ when $t = 0$ to find the blood pressure 0.9 second after a heartbeat. Round your answer to two decimal places.
A) 69.70
B) 139.16
C) 62.40
D) 64.33
E) 67.61
Ans: E

69. A store finds that its sales decline after the end of an advertising campaign, with its daily sales for the period declining at the rate $S'(t) = -147.74e^{-0.2t}, 0 \le t \le 100,$ where t is the number of days since the end of the campaign. Suppose that $S = 7387$ units when $t = 0$. About how many sales should the store expect 32 days after the end of the advertising campaign?
A) 6,650 sales
B) 6,654 sales
C) 6,657 sales
D) 6,659 sales
E) 6,662 sales
Ans: A

70. Suppose the rate of change of the expected life span l at birth of people born in the United States can be modeled by $\frac{dl}{dt} = \frac{16.27}{t+20}$ where t is the number of years past 1920. Use integration and the data point for 2007, to find the function that models the life span.

Year	Life Span (years)	Year	Life Span (years)
1920	57.0	1990	81.5
1930	63.6	1992	81.8
1940	68.3	1994	82.2
1950	71.9	1996	82.5
1960	74.9	1998	82.9
1970	77.4	2000	83.2
1975	78.5	2001	83.4
1980	79.6	2003	83.7
1985	80.6	2005	84.0
		2007	84.3

A) $l(t) = \frac{16.27}{\ln|t+20|} + 8.273$

B) $l(t) = 16.27 \ln|t+20| + 8.273$

C) $l(t) = \frac{16.27}{\ln|t+20|} + 12.273$

D) $l(t) = 16.27 + \ln|t+20| + 12.273$

E) $l(t) = 16.27 + \ln|t+20| + 8.273$

Ans: B

71. Suppose the rate of change of the percent P of U.S. households with cable TV can be modeled by $\frac{dP}{dt} = \frac{39.48}{t+5}$, where t is the number of years past 1975. If in 1985 46.2% of households had cable TV, predict the percent of households that will have cable TV in 2020.

A) 77.9%
B) 83.6%
C) 86.3%
D) 89.4%
E) 93.7%

Ans: E

72. Suppose the rate of change of total personal income I in the United States (in billions of dollars) can be modelled by $\frac{dI}{dt} = 37.74e^{0.0705t}$ where t is the number of years past 1960. Find the total personal income in 2012 by using the arbitrary constant that is evaluated by using the data point from 1960. Also find the rate of change of total personal income in 2012. Round your answers to two decimal places.

Year	1960	1970	1980	1990	1999	2000	2
Personal income	318.3	866.4	1975.6	4220.6	8152.6	8764	10

A) $I(52) \approx \$20,711.40; I'(52) \approx \$2059.79$

B) $I(52) \approx \$2059.79; I'(52) \approx \$1475.45$

C) $I(52) \approx \$21,145.43; I'(52) \approx \$1475.45$

D) $I(52) \approx \$21,145.43; I'(52) \approx \$1956.12$

E) $I(52) \approx \$20,711.40; I'(52) \approx \$1475.45$

Ans: E

73. Suppose the rate of change of total personal income I in the United States (in billions of dollars) can be modeled by $\frac{dI}{dt} = 30.74e^{0.0595t}$ where t is the number of years past 1960. The value of $I(56)$ and $I'(56)$ are approximately \$14,250.89 and \$860.54 respectively which are been evaluated by using the arbitrary constant that is been evaluated by using the data point from 1960. Interpret $I(56)$ and $I'(56)$.

Year	1960	1970	1980	1990	1999	2000	2
Personal income	304.6	724.7	1486.2	2866.9	5047.8	5370.2	6

A) $I(56) \approx \$14,250.89$ and $I'(56) \approx \$860.54$ means that the model predicts that in 2016, the total personal income is predicted to be \$14,250.89 billion dollars and will be decreasing at a rate of \$860.54 billion per year.

B) $I(56) \approx \$14,250.89$ and $I'(56) \approx \$860.54$ means that the model predicts that in 2016, the total personal income is predicted to be \$860.54 billion dollars and will be increasing at a rate of \$14,250.89 billion per year.

C) $I(56) \approx \$14,250.89$ and $I'(56) \approx \$860.54$ means that the model predicts that in 2016, the total personal income is predicted to be \$14,250.89 billion dollars and will be increasing at a rate of \$860.54 billion per year.

D) $I(56) \approx \$14,250.89$ and $I'(56) \approx \$860.54$ means that the model predicts that in 2016, the total personal income is predicted to be \$14,250.89 billion dollars and will be increasing at a rate of \$860.54 billion per month.

E) $I(56) \approx \$14,250.89$ and $I'(56) \approx \$860.54$ means that the model predicts that in 2016, the total personal income is predicted to be \$860.54 billion dollars and will be decreasing at a rate of \$14,250.89 billion per month.

Ans: C

74. If the marginal cost for a product is $\overline{MC} = 10x + 4$, and the production of 13 units results in a total cost of $\$977$, find the total cost function *C*.

A) $C(x) = 2x^2 + 4x + 587$

B) $C(x) = 10x^2 + 2x - 739$

C) $C(x) = 5x^2 + 4x + 80$

D) $C(x) = 10x^2 + 4x - 765$

E) $C(x) = 2x^2 + 2x + 613$

Ans: C

75. If the marginal cost, in dollars, for producing a product is $\overline{MC} = 10x + 20$, with a fixed cost of \$900, what will be the cost of producing 10 units?

A) $\$1,020$

B) \$9,120

C) $\$1,600$

D) $\$9,700$

E) \$700

Ans: C

76. A certain firm's marginal cost for a product is $\overline{MC} = 10x + 2$, its marginal revenue is $\overline{MR} = 210 - 6x$, and its total cost of production of 11 units is $\$697$. Find the optimal level of production.

A) 15 units

B) 11 units

C) 12 units

D) 14 units

E) 13 units

Ans: E

77. A certain firm's marginal cost for a product is $\overline{MC} = 4x + 80$, its marginal revenue is $\overline{MR} = 248 - 8x$, and its total cost of production of 14 units is $\$1632$. Find the profit function *P*.

A) $P(x) = -6x^2 + 168x - 120$

B) $P(x) = 6x^2 - 168x + 120$

C) $P(x) = -2x^2 + 328x - 120$

D) $P(x) = -12x + 168$

E) $P(x) = 12x - 168$

Ans: A

78. A certain firm's marginal cost, in dollars, for a product is $\overline{MC} = 8x + 80$, its marginal revenue, in dollars, is $\overline{MR} = 220 - 2x$, and its total cost of production of 8 items is \$1100. Find the profit or loss at the optimal level of production.
A) \$776 loss
B) \$776 profit
C) \$1235 profit
D) \$1235 loss
E) \$980 loss
Ans: B

79. Suppose that the marginal revenue for a product is $\overline{MR} = 600$ and the marginal cost is $\overline{MC} = 42\sqrt{(x+16)}$, with a fixed cost of \$2632. Find the profit or loss from the production and sale of 9 units.
A) loss of \$390
B) loss of \$3,860
C) profit of \$3,860
D) profit of \$1,060
E) loss of \$1,060
Ans: D

80. Suppose that the marginal revenue for a product is $\overline{MR} = 165$ and the marginal cost is $\overline{MC} = 33\sqrt{(x+4)}$, with a fixed cost of \$992. How many units will result in a maximum profit?
A) 20 units
B) 21 units
C) 22 units
D) 24 units
E) 23 units
Ans: B

81. Suppose that the marginal cost (in dollars) for a product is $\overline{MC} = 75\sqrt{x+1}$ and its fixed cost is \$360.00. If the marginal revenue (in dollars) for the product is $\overline{MR} = 90x$, find the profit or loss from production and sale of 8 units.
A) \$1530 profit
B) \$135 profit
C) \$135 loss
D) \$1220 loss
E) \$1220 profit
Ans: E

82. The average cost of a product changes at the rate $\overline{C}'(x) = \frac{-14}{x^2} + \frac{1}{14}$ and the average cost of 14 units is $\$23.00$. Find the average cost function $\overline{C}$.

A) $\overline{C}(x) = \frac{14}{x} + \frac{x}{14} + 23$

B) $\overline{C}(x) = \frac{14}{x} - \frac{x}{14} + 23$

C) $\overline{C}(x) = -\frac{14}{x} + \frac{x}{14} + 23$

D) $\overline{C}(x) = \frac{14}{x} + \frac{x}{14} + 21$

E) $\overline{C}(x) = -\frac{14}{x} - \frac{x}{14} + 25$

Ans: D

83. The average cost of a product, in dollars, changes at the rate $\overline{C}' = \frac{-9}{x^2} + \frac{1}{9}$ and the average cost of 9 units is $25.00. Find the average cost of 18 units.

A) $450.00
B) $25.50
C) $50.00
D) $30.60
E) $1.50

Ans: B

84. Suppose that the marginal cost for a certain product is given by $\overline{MC} = 1.01(x + 300)^{0.01}$, where x is in thousand of units and cost is in thousands of dollars. Suppose further that fixed costs are $\$170{,}000$. Find $C(x)$. Round your answer to three decimal places, if necessary.

A) $C(x) = (x + 300)^{1.01} - 147.609$

B) $C(x) = (x + 300)^{1.01} - 317.609$

C) $C(x) = (x + 300)^{1.01} + 169,682.391$

D) $C(x) = 1.01(x + 300)^{1.01} - 150.785$

E) $C(x) = (x + 300)^{-1.01} - 147.609$

Ans: A

85. Suppose that the marginal revenue for a certain product is given by $\overline{MR} = \frac{3}{\sqrt{6x+1}} + 1.55$, where x is in thousand of units and revenue is in thousands of dollars. Find $R(x)$.

A) $R(x) = 3(6x+1)\sqrt{(6x+1)} + 1.55x + 3$

B) $R(x) = 3(6x+1)\sqrt{(6x+1)} + 1.55x - 3$

C) $R(x) = \sqrt{(6x+1)} + 1.55x + 1$

D) $R(x) = \sqrt{(6x+1)} + 1.55x$

E) $R(x) = \sqrt{(6x+1)} + 1.55x - 1$

Ans: E

86. If consumption C is \$9 billion when disposable income y is 0, and if the marginal prosperity to consume is 0.90, find the national consumption function C as a function of y (in billions of dollars).

A) $C(y) = 0.90y + 9.00$

B) $C(y) = 9.00y + 0.90$

C) $C(y) = 0.45y^2 + 9.00$

D) $C(y) = 0.45y + 9.00$

E) $C(y) = 4.50y^2 + 0.90$

Ans: A

87. If consumption is \$1 billion when disposable income is 0, and if the marginal propensity to consume is 0.50, what is consumption when disposable income is 20 billion?

A) \$20.50 billion

B) \$101.00 billion

C) \$11.00 billion

D) \$6.00 billion

E) \$200.50 billion

Ans: C

88. If consumption is \$10 billion when disposable income is 0, and if the marginal propensity to consume is $\frac{dC}{dy} = 0.2 + \frac{0.1}{\sqrt{y}}$ (in billions of dollars), find the national consumption function.

A) $C(y) = 0.02 + 0.05\sqrt{y} + 10$

B) $C(y) = 1 - \frac{0.05}{\sqrt{y^3}} + 10$

C) $C(y) = 0.02 + 0.2\sqrt{y} + 10$

D) $C(y) = 0.2y + 0.05\sqrt{y} + 10$

E) $C(y) = 0.2y + 0.2\sqrt{y} + 10$

Ans: E

89. If consumption is \$5.3 billion when disposable income is 0, and if the marginal propensity to consume is $\frac{dC}{dy} = \frac{1}{\sqrt{2y+36}} + 0.5$ (in billions of dollars), find the national consumption function.

A) $C(y) = -\frac{1}{\sqrt[3]{2y+36}} - 0.7$

B) $C(y) = \sqrt{2y+36} + 0.125y - 0.7$

C) $C(y) = \sqrt{2y+36} - 0.825$

D) $C(y) = \sqrt{2y+36} + 0.5y - 0.7$

E) $C(y) = -\frac{1}{\sqrt[3]{2y+36}} - 0.825$

Ans: D

90. Suppose that the marginal propensity to consume is $\frac{dC}{dy} = 0.5 - e^{-4y}$ (in billions of dollars) and that consumption is \$4.75 billion when disposable income is 0. Find the national consumption function *C*.

A) $C = 0.5y + \frac{e^{-4y}}{4} + 19.00$

B) $C = 0.5y + \frac{e^{-4y}}{4} + 4.50$

C) $C = 0.5y + \frac{e^{-4y}}{4} + 5.00$

D) $C = \frac{e^{-4y}}{4} + 4.50$

E) $C = 4e^{-5} + 0.75$

Ans: B

91. Suppose that the marginal propensity to consume is $\frac{dC}{dy} = 0.08 + \frac{\ln(y+1)}{y+1}$ (in billions of dollars), and that consumption is \$5.04 billion when disposable income is 0. Find the national consumption function.

A) $C(y) = \frac{1-\ln(y+1)}{(y+1)^2} + 5.04$

B) $C(y) = 0.0032y + \ln(y+1) + 5.04$

C) $C(y) = 0.08y + \ln(y+1) + 5.04$

D) $C(y) = 0.08y + \frac{1}{2}\left[\ln(y+1)\right]^2 + 5.04$

E) $C(y) = 0.0032y + \frac{1}{2}\left[\ln(y+1)\right]^2 + 5.04$

Ans: D

92. Suppose that the marginal propensity to save is $\frac{dS}{dy} = 0.22$ (in billions of dollars), and that consumption is \$8.1 billion when disposable income is 0. Find the national consumption function.

A) $C(y) = 0.78y + 8.1$

B) $C(y) = 0.22y + 8.1$

C) $C(y) = 0.78y + 7.88$

D) $C(y) = 0.22y + 7.88$

E) $C(y) = 8.12$

Ans: A

93. Suppose that the marginal propensity to save is $\frac{dS}{dy} = 0.5 - \frac{1}{\sqrt{5y+10}}$ (in billions of dollars) and that consumption is \$8 billion when disposable income is 0. Find the national consumption function *C*. Round numbers in our answer to two decimal places when appropriate.

A) $C(y) = \frac{5}{2(5y+10)\sqrt{(5y+10)}} + 7.92$

B) $C(y) = 0.5y + \frac{2}{5}\sqrt{(5y+10)} + 6.74$

C) $C(y) = 0.5y + \frac{5}{2}\sqrt{(5y+10)} + 0.09$

D) $C(y) = 0.5y + 2\sqrt{(5y+10)} + 1.68$

E) $C(y) = 0.5y - \frac{2}{5}\sqrt{(5y+10)} + 9.26$

Ans: B

94. If consumption is \$3 billion when disposable income is 0, and if the marginal propensity to save is $\frac{dS}{dy} = 0.8 + e^{-1.6y}$ (in billions of dollars), find the national consumption function.

A) $C(y) = 0.2y - 1.67e^{-0.6y} + 2.37$

B) $C(y) = 0.8y + 0.63e^{-1.6y} - 3.62$

C) $C(y) = 0.2y - 0.63e^{-1.6y} - 2.37$

D) $C(y) = 0.8y + 0.63e^{-1.6y} + 3.62$

E) $C(y) = 0.2y + 0.63e^{-1.6y} + 2.37$

Ans: E

95. For which of the following differential equations is $y = 8x^5$ a solution?

A) $5y + xy' = 0$

B) $8xy - 5y' = 0$

C) $5y' - 8xy = 0$

D) $5y - xy' = 0$

E) $8xy' + 5y = 0$

Ans: D

96. Consider the following function: $y = 3x^3 + 5$. Of which of the following differential equations is this a solution?

A) $3y\,dx - x\,dy = 15\,dx$

B) $2y\,dx - x\,dy = 5\,dx$

C) $3y\,dx + x\,dy = 15\,dx$

D) $2y\,dx - x\,dy = 15\,dx$

E) $3y\,dx - x\,dy = 5\,dx$

Ans: A

97. Use integration to find the general solution to the differential equation $dy = x^7 e^{x^8+2} dx$.

A) $y = e^{x^8+2}(8x^{14} + 7x^6) + C$

B) $y = \frac{1}{9} e^{x^9+2} + C$

C) $y = \frac{1}{7} e^{x^7+2} + C$

D) $y = \frac{1}{8} e^{x^8+2} + C$

E) $y = \frac{1}{6} e^{x^6+2} + C$

Ans: D

98. Use integration to find the general solution to the differential equation $4y\ dy = 3x^2\ dx$.

A) $2y^2 = x^3 + C$

B) $3y^2 = x^2 + C$

C) $2y = 3x^2 + C$

D) $3y^2 = 2x^2 + C$

E) $2y = x^2 + C$

Ans: A

99. Use integration to find the general solution to the differential equation $4y^3 dy = (10x^2 + 9x)\ dx$.

A) $12y^2 = 20x + 9 + C$

B) $y^4 = \frac{10}{3}x^3 + \frac{9}{2}x^2 + C$

C) $y^4 = \frac{10}{3}x^2 + \frac{9}{2}x + C$

D) $y^4 = 10x^3 + 9x^2 + C$

E) $\frac{4}{3}y^4 = \frac{10}{3}x^2 + \frac{9}{2}x + C$

Ans: B

100. Find the particular solution.

$y' = e^{5x+7};\ y(0) = e^7$

A) $y = \frac{1}{5}e^{5x+7} + \frac{6}{5}e^7$

B) $y = \frac{1}{5}e^{5x+7} + \frac{4}{5}e^7$

C) $y = 5e^{5x+7} - 4e^7$

D) $y = 5e^{5x+7} + 6e^7$

E) $y = e^{5x+7}$

Ans: B

101. Find the particular solution.

$$dy = \left(x^6 - \frac{1}{x+1} \right) dx; \qquad y(0) = 8$$

A) $y = \frac{x^7}{7} + 8$

B) $y = 6x^5 + \frac{2}{(x+1)^2} + 8$

C) $y = \frac{x^5}{5} - \ln|x+1| + 8$

D) $y = \frac{x^6}{6} - \ln|x+1| + 8$

E) $y = \frac{x^7}{7} - \ln|x+1| + 8$

Ans: E

102. Find the general solution to the differential equation $y^{11}\,dx = \frac{dy}{x^{11}}$.

A) $x^{12} + \frac{6}{5y^{10}} = C$

B) $x^{12} + \frac{11}{10y^{10}} = C$

C) $x^{11} + \frac{6}{5y^{11}} = C$

D) $x^{11} + \frac{11}{10y^{11}} = C$

E) $x^{12} + \frac{6}{5y^{12}} = C$

Ans: A

103. Find the general solution to the differential equation $dy = (x^9 y^6 + xy^6)dx$.

A) $\frac{x^{10}}{9} + \frac{x^2}{2} + \frac{1}{6y^5} = C$

B) $\frac{x^{10}y^7}{70} + \frac{x^2y^7}{14} = C$

C) $\frac{x^{10}}{10} + \frac{x^2}{2} - \frac{1}{5y^5} = C$

D) $\frac{x^{10}}{10} + \frac{x^2}{2} + \frac{1}{5y^5} = C$

E) $\frac{x^{10}}{10} + \frac{x^2}{2} + \frac{y^7}{7} = C$

Ans: D

104. Find the general solution of the differential equation $\frac{dy}{dx} = \frac{2x^2 + 9x}{6y + 1}$.

A) $6y + 6 = 4x^2 + 27x + C$

B) $18y^2 + 6y = 27x^2 + 4x + C$

C) $18y^2 + 6 = 27x^3 - 4x^2 + C$

D) $6y^2 + 6y = 4x^3 - 27x + C$

E) $18y^2 + 6y = 4x^3 + 27x^2 + C$

Ans: E

105. Find the general solution to the differential equation $x^9 y\frac{dy}{dx} = y^2 + 7$.

A) $\frac{x^{10}y^2}{20} = \frac{y^3}{3} + 7x + C$

B) $\frac{x^{10}y^2}{9} = \frac{y^3}{2} + 7x + C$

C) $y^2 = Ce^{-1/(4x^8)} - 7$

D) $y^2 = Ce^{1/(4x^8)} - 7$

E) $y^2 = Ce^{-2/(9x^9)} - 7$

Ans: C

106. Find the general solution to the differential equation $e^{7x}y\,dy = (y+9)\,dx$.

A) $-\frac{1}{7}e^{-7x} = y - 9\ln|y+9| + C$

B) $\frac{1}{7}e^{-7x} = y - 9\ln|y+9| + C$

C) $-\frac{1}{7}e^{-7x} = y + 9\ln|y+9| + C$

D) $-\frac{1}{7}e^{-7x} = \ln|y+9| + C$

E) $\frac{e^{7x}y^2}{14} = \frac{y^2}{2} + 9x + C$

Ans: A

107. Find the particular solution to the given differential equation.

$\frac{dy}{dx} = \frac{x^9}{y^8}$, when $x = 1, y = 1$

A) $9y^9 - 10x^{10} - 1 = 0$

B) $9y^9 + 10x^{10} + 1 = 0$

C) $10y^9 - 9x^{10} - 1 = 0$

D) $10y^9 - 9x^{10} + 1 = 0$

E) $10y^9 + 9x^{10} - 1 = 0$

Ans: C

108. Find the particular solution to the given differential equation.

$4y^2dx = 8x^2dy$, when $x = 4, y = -1$

A) $\frac{4y^3}{3} + \frac{8x^3}{3} - 9 = 0$

B) $\frac{4y^3}{3} - \frac{8x^3}{3} + 9 = 0$

C) $\frac{8}{y} + \frac{4}{x} + 9 = 0$

D) $\frac{8}{y} - \frac{4}{x} - 9 = 0$

E) $\frac{8}{y} - \frac{4}{x} + 9 = 0$

Ans: E

109. Find the particular solution to the differential equation $x^2e^{2y}dy = \left(x^3 + 2\right)dx$ that satisfies $y = 0$ when $x = 1$.

A) $4xe^{2y} = x^3 - 4 - 2x$
B) $2xe^{2y} = 2x^4 + 2x^2 + 4x$
C) $xe^{2y} = x^3 - 4 + 4x$
D) $2xe^{2y} = x^4 - 4 - 2x$
E) $xe^{2y} = 2x^3 + 2x^2 + 4x$

Ans: C

110. Find the particular solution to the given differential equation.

$xe^{8y}\,dx = (x-1)dy,$ when $x = 2,\ y = 0$

A) $\ln|x-1| = \frac{1}{8}e^{8y} - \frac{17}{8}$
B) $\ln|x-1| = -\frac{1}{8}e^{-8y} + \frac{17}{8}$
C) $x - \ln|x-1| = -\frac{1}{8}e^{-8y} + \frac{17}{8}$
D) $x + \ln|x-1| = -\frac{1}{8}e^{-8y} + \frac{17}{8}$
E) $x + \ln|x-1| = \frac{1}{8}e^{8y} - \frac{17}{8}$

Ans: D

111. When interest is compounded continuously, the rate of change of the amount x of the investment is proportional to the amount present. In this case, the proportionality constant is the annual interest rate r (as a decimal); that is, $\frac{dx}{dt} = rx$. If \$3500 is invested at 6%, compounded continuously, what will be the future value of this investment after 10 years? Round to the nearest cent.

A) \$5600.00
B) \$6267.97
C) \$6321.39
D) \$6367.89
E) \$6377.42

Ans: E

112. When the interest on an investment is compounded continuously, the investment grows at a rate that is proportional to the amount in the account. If $30,000 is invested (when $t = 0$) and the amount in the account after 13 years is $84,876.51, find the interest rate on this investment? Round to one decimal place.
A) 7.5%
B) 8.0%
C) 8.5%
D) 9.0%
E) 9.5%
Ans: B

113. Suppose that in a certain, company, the relationship between the price per unit p of its product and the weekly sales volume y, in thousands of dollars, is given by $\frac{dy}{dp} = -\frac{2}{5}\left(\frac{y}{p+7}\right)$. Solve this differential equation if $y = 8$ when $p = \$25$.
A) $y = 25(p+7)^{2/5}$
B) $y = 32(p+7)^{-2/5}$
C) $y = 34(p+7)^{2/5}$
D) $y = 27(p+7)^{-2/5}$
E) $y = 33(p+7)^{2/5}$
Ans: B

114. A certain radioactive substance has a half-life of 60 hours. Find how long it will take, to the nearest hour, for 70% of the radioactivity to be dissipated if the amount of material x satisfies $\frac{dx}{dt} = kx$ (t in hours).
A) 136 hours
B) 125 hours
C) 111 hours
D) 104 hours
E) 31 hours
Ans: D

115. Suppose that a liquid carries a drug into a 400-cc organ at a rate of 20 cc/s and leaves the organ at the same rate. Suppose that the concentration of the drug entering is 0.05 g/cc. Find the amount A of drug in the organ as a function of time t if initially there is none in the organ.
A) $A = 20e^{-0.05t}$
B) $A = 20\left(1 - e^{-0.05t}\right)$
C) $A = 0.05\left(1 - e^{-0.05t}\right)$
D) $A = 400\left(1 - e^{-0.05t}\right)$
E) $A = 0.000125e^{-0.05t}$
Ans: B

116. Suppose that a liquid carries a drug with concentration 0.07 g/cc into a 150-cc organ at a rate of 8 cc/s and leaves at the same rate. If initially there is 5 g of drug in the organ, find the amount A of drug in the organ as a function of time t.

A) $A = 10.5\left(1 - \mathrm{e}^{-0.0533t}\right)$

B) $A = 150\left(1 - \mathrm{e}^{-0.0533t}\right)$

C) $A = 10.5 - 5.5e^{-0.0533t}$

D) $A = 150 - 5.5e^{-0.0533t}$

E) $A = 10.5 + 5.5e^{-0.0533t}$

Ans: C

117. Let V denote the volume of a tumor, and suppose that the growth rate of the tumor satisfies $\frac{dV}{dt} = 0.7\ Ve^{-0.1t}$. If the initial volume of the tumor is 1.89 units, find an equation for V as a function of t.

A) $V = 1.89e^{7-7e^{-0.1t}}$

B) $V = 0.7e^{e^{-0.1t}}$

C) $V = 1.89e^{e^{-0.1t}}$

D) $V = 0.7e^{7+7e^{-0.1t}}$

E) $V = 1.89e^{7e^{-0.1t}}$

Ans: A

118. The rate of change of atmospheric pressure P with respect to the altitude above sea level h is proportional to the pressure. That is, $\frac{dP}{dh} = kP$. Suppose that the pressure at sea level is denoted by P_0, and at 11,000 ft, the pressure is half of what it is at sea level. Find the pressure, as a percent of P_0, at 26,000 ft.

A) 7.8%
B) 11.6%
C) 15.5%
D) 19.4%
E) 23.3%

Ans: D

119. Newton's law of cooling (and warming) states that the rate of change of temperature $u = u(t)$ of an object is proportional to the temperature difference between the object and its surroundings, where T is the constant temperature of the surroundings. That is, $\frac{du}{dt} = k(u - T)$. Suppose an object at 4°C is placed in a room where the temperature is 20°C. If the temperature of the object is 10°C after 1 hour, how long will it take for the object to reach 15°C?

A) 2.3 hours
B) 2.5 hours
C) 2.8 hours
D) 3.0 hours
E) 3.6 hours

Ans: B

120. The impact of inflation on a fixed pension can be severe. If P represents the purchasing power (in dollars) of a \$70,000 pension, then the effect of a 3.5% inflation rate can be modeled by the differential equation $\frac{dP}{dt} = -0.035P,\ P(0) = 70,000$, where t is in years. Find the purchasing power of the pension after 30 years. Round to the nearest dollar.

A) \$31,845
B) \$29,395
C) \$19,597
D) \$36,744
E) \$24,496

Ans: E

