Chapter 13 Definite Integrals: Techniques of Integration

1. Approximate the area under the curve defined by the function $f(x) = 4x^4$ over the interval $x = 0$ to $x = 3$ using the right-hand endpoints of three subintervals (rectangles).
   A) $A \approx 68$ square units
   B) $A \approx 392$ square units
   C) $A \approx 328$ square units
   D) $A \approx 388$ square units
   E) $A \approx 1352$ square units
   Ans: B

2. Approximate the area under the curve over the specified interval by using the indicated number of subintervals (or rectangles) and evaluating the function at the *right-hand* endpoints of the subintervals. Compute the approximate area using up to 4 decimal places as needed.

   $f(x) = x^2 + x + 7$ from $x = -1$ to $x = 1$; 8 subintervals
   A) 7.4687 square units
   B) 14.4375 square units
   C) 0.25 square unit
   D) 14.9375 square units
   E) 29.875 square units
   Ans: D

3. Approximate the area under the curve defined by the function $f(x) = 8x^4$ over the interval $x = 0$ to $x = 3$ using the left-hand endpoints of three subintervals (rectangles).
   A) $A \approx 784$ square units
   B) $A \approx 776$ square unit
   C) $A \approx 656$ square units
   D) $A \approx 136$ square units
   E) $A \approx 2704$ square units
   Ans: D

4. Approximate the area under the curve over the specified interval by using the indicated number of subintervals (or rectangles) and evaluating the function at the *left-hand* endpoints of the subintervals. Compute the approximate area using up to 4 decimal places as needed.

   $f(x) = 12 - x^2$ from $x = 1$ to $x = 3$; 2 subintervals
   A) 9.5000 square units
   B) 19.0000 square units
   C) 11.0000 square units
   D) 38.0000 square units
   E) 4.0000 square units
   Ans: B

5. When the area under $f(x) = x^2 + x$ from $x = 0$ to $x = 2$ is approximated, the formulas for the sum of *n* rectangles using *left-hand* endpoints and *right-hand* endpoints are:

Left-hand endpoints: $S_L = \frac{14}{3} - \frac{6}{n} + \frac{4}{3n^2}$

Right-hand endpoints: $S_R = \frac{14n^2 + 18n + 4}{3n^2}$

Find $S_L(250)$ and $S_R(250)$. Round to 4 decimal places.

A)
$S_L(250) = 9.2854$
$S_R(250) = 9.3814$

B)
$S_L(250) = 3.2499$
$S_R(250) = 3.2835$

C)
$S_L(250) = 4.6427$
$S_R(250) = 4.6907$

D)
$S_L(250) = 13.9281$
$S_R(250) = 14.0721$

E)
$S_L(250) = 7.4283$
$S_R(250) = 7.5051$

Ans: C

6. When the area under $f(x) = x^2 + x + 5$, from $x = 0$ to $x = 2$ is approximated, the formulas for the sum of n rectangles using *left-hand* endpoints and *right-hand* endpoints are:

Left-hand endpoints: $S_L = \frac{44}{3} - \frac{6}{n} + \frac{4}{3n^2}$

Right-hand endpoints: $S_R = \frac{44n^2 + 18n + 4}{3n^2}$

Find $\lim_{n\to\infty} S_L$ and $\lim_{n\to\infty} S_R$. Round to 4 decimal places.

A)

$\lim_{n\to\infty} S_L = \frac{49}{3}$

$\lim_{n\to\infty} S_R = \frac{49}{3}$

B)

$\lim_{n\to\infty} S_L = \frac{32}{3}$

$\lim_{n\to\infty} S_R = \frac{32}{3}$

C)

$\lim_{n\to\infty} S_L = \frac{41}{3}$

$\lim_{n\to\infty} S_R = \frac{41}{3}$

D)

$\lim_{n\to\infty} S_L = \frac{37}{3}$

$\lim_{n\to\infty} S_R = \frac{37}{3}$

E)

$\lim_{n\to\infty} S_L = \frac{44}{3}$

$\lim_{n\to\infty} S_R = \frac{44}{3}$

Ans: E

7. Find the value of the sum $\sum_{k=1}^{3} 6x_k$, if $x_1 = 8, x_2 = 8, x_3 = -4, x_4 = 7.$

A) 120
B) 138
C) 66
D) 72
E) 114
Ans: D

8. Find the value of the sum $\sum_{i=3}^{5} \left(2i^2 + 1\right).$

A) 100
B) 103
C) 102
D) 77
E) 61
Ans: B

9. Find the value of the given sum and round to 4 decimal places.

$$\sum_{i=4}^{7} \left(\frac{4(i-4)}{i^2} \right)$$

A) 0.6271
B) 0.8153
C) 0.2508
D) 1.3797
E) 0.4703
Ans: A

10. Find the numerical value of $\sum_{k=1}^{58} 8$ by using the sum formulas.

A) 66
B) 8
C) 464
D) 465
E) 70
Ans: C

11. Use the sum formulas to find the value of the sum that follows.

$$\sum_{k=1}^{50}(7k^2+1)$$

A) 66,215
B) 104,405
C) 155,020
D) 300,525
E) 569,687
Ans: D

12. Find the numerical value of $\sum_{i=1}^{n}\left(8-\frac{8i}{n}+\frac{i^2}{n^2}\right)\left(\frac{3}{n}\right)$ by using the sum formulas.

A) $\frac{24n^2-33n+1}{4n^2}$
B) $\frac{26n^2-33n+1}{2n^2}$
C) $\frac{26n^2-24n+1}{4n^2}$
D) $\frac{24n^2-24n+1}{2n^2}$
E) $\frac{26n^2-21n+1}{2n^2}$
Ans: E

13. Use the function $y=10x$ from x = 0 to x = 1 and n equal subintervals with the function evaluated at the *left-hand* endpoints of each subinterval. Find a formula for the sum of the areas of the n rectangles (call this S).

A) $S(n)=\frac{5(n-3)}{n}$
B) $S(n)=\frac{5(n-1)}{n}$
C) $S(n)=\frac{5(2n-3)}{n}$
D) $S(n)=\frac{5(2n+3)}{n}$
E) $S(n)=\frac{5(n+1)}{n}$
Ans: B

14. Use the function $y = 16x$ from $x = 0$ to $x = 1$ and n equal subintervals with the function evaluated at the *left-hand* endpoints of each subinterval. Find $S(25)$ by using the formula for the sum of the areas of the n rectangles (call this S).

A) $S(25) = \dfrac{136}{25}$

B) $S(25) = \dfrac{208}{25}$

C) $S(25) = \dfrac{176}{25}$

D) $S(25) = \dfrac{128}{25}$

E) $S(25) = \dfrac{192}{25}$

Ans: E

15. Use the function $y = 7x^2$ from $x = 0$ to $x = 1$ and n equal subintervals with the function evaluated at the *right-hand* endpoints of each subinterval. Find a formula for the sum of the areas of the n rectangles (call this S).

A) $\dfrac{7(2n+1)}{6n^2}$

B) $\dfrac{7(n+1)(2n+3)}{8n^2}$

C) $\dfrac{7(n+1)(2n+1)}{6n^2}$

D) $\dfrac{7(n+2)(2n+3)}{6n^3}$

E) $\dfrac{7(n+1)(2n+1)}{8n^3}$

Ans: C

16. Use the function $y = 21x^2$ from $x = 0$ to $x = 1$ and n equal subintervals with the function evaluated at the *right-hand* endpoints of each subinterval. Let the sum of the areas of the rectangles be S. Find $\lim_{n\to\infty} S$ by using the formula for the sum of the areas of the n rectangles.

A) 7
B) 21
C) 42
D) 9
E) 11
Ans: A

17. Use rectangles to find the area between $y = 9x - x^2$ and the x-axis from $x = 0$ to $x = 2$.

A) $A = \frac{82}{3}$

B) $A = \frac{100}{3}$

C) $A = \frac{46}{3}$

D) $A = \frac{28}{3}$

E) $A = \frac{64}{3}$

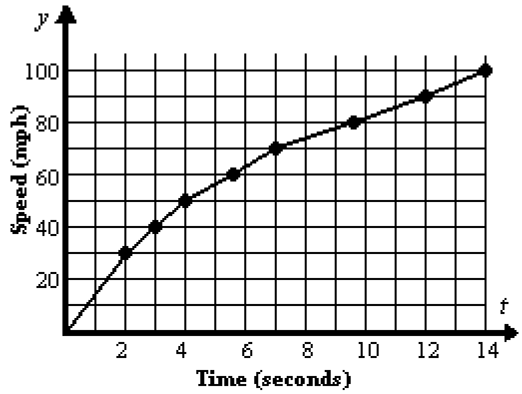
Ans: C

18. The following table shows the rate of oil consumption (in thousands of barrels per year) by a certain city. Estimate the total consumption of oil by the city from 1999 -2004 by using 5 equal subdivisions and left-hand endpoints to estimate the area under the graph that corresponds to the table from 1999 to 2004.

Year	**Rate**
1999	3.087
2000	3.329
2001	3.427
2002	3.304
2003	3.437
2004	3.397

A) 17.234 thousand barrels
B) 16.584 thousand barrels
C) 17.573 thousand barrels
D) 16.894 thousand barrels
E) 16.275 thousand barrels
Ans: B

19. The graph in the following figure gives the times that it takes a vehicle to reach speeds from 0 mph to 100 mph, in increments of 10 mph, with a curve connecting them. Count the squares under the curve to estimate this distance. Estimate the distance traveled by the vehicle in 14 seconds, to a speed of 100 mph. (Be careful with time units.)

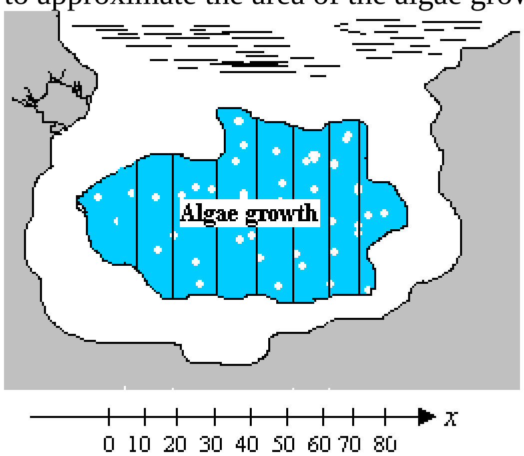


A) 1/4 mile
B) 3/8 mile
C) 5/7 mile
D) 8/9 mile
E) 1/8 mile
Ans: A

20. Suppose the presence of phosphates in certain waste products dumped into a lake promotes the growth of algae. Rampant growth of algae affects the oxygen supply in the water, so an environmental group wishes to estimate the area of algae growth. The group measures the length across the algae growth (see the figure) and obtains the following data (in feet).

x	Length	x	Length
0	0	50	35
10	22	60	34
20	25	70	33
30	24	80	0
40	37		

Use 8 rectangles with bases of 10 feet and lengths measured at the left-hand endpoints to approximate the area of the algae growth.



A) 1430 sq ft
B) 1416 sq ft
C) 1716 sq ft
D) 2100 sq ft
E) 2124 sq ft
Ans: D

21. Suppose spending for a wireless communications services (in billions of dollars per year) can be modeled by the function $S(t) = 16.230t + 7.075$ where $t = 0$ represents 1995. Use $n = 10$ equal subdivisions with right-hand endpoints to approximate the area under the graph of $S(t)$ between $t = 5$ and $t = 10$. Round your answer to one decimal place.

A) 623.7 billion dollars
B) 579.6 billion dollars
C) 708.4 billion dollars
D) 543.1 billion dollars
E) 664.3 billion dollars
Ans: E

22. The United States' spending for military (in billions of dollars per year) can be modeled by $M(t) = -87.189 + 267.9\ln(t)$, where $t = 0$ represents 1993. Estimate the total spending for the United States military between 2000 and 2005 by using 10 equal subdivisions and right-hand endpoints to approximate the area under the graph of $M(t)$ between $t = 7$ and $t = 12$. Round to 3 decimal places.
    A) $2527.436 billion dollars
    B) $2310.376 billion dollars
    C) $2816.579 billion dollars
    D) $2690.231 billion dollars
    E) $2599.635 billion dollars
    Ans: E

23. Evaluate the definite integral $\int_1^{11} -4\,dy$.
    A) 8
    B) –48
    C) –4
    D) –40
    E) –44
    Ans: D

24. Evaluate $\int_0^5 5\sqrt[3]{x^2}\,dx$.
    A) $\int_0^5 5\sqrt[3]{x^2}\,dx = 15\sqrt[3]{25}$
    B) $\int_0^5 5\sqrt[3]{x^2}\,dx = 15\sqrt[5]{9}$
    C) $\int_0^5 5\sqrt[3]{x^2}\,dx = 25\sqrt[3]{25}$
    D) $\int_0^5 5\sqrt[3]{x^2}\,dx = 25\sqrt[3]{9}$
    E) $\int_0^5 5\sqrt[3]{x^2}\,dx = 15\sqrt[5]{25}$
    Ans: A

25. Evaluate the definite integral $\int_0^7 (6x^4 - x^3 - 6x)\,dx$.
    A) $\dfrac{388,423}{15}$
    B) $\dfrac{388,423}{20}$
    C) $\dfrac{388,423}{12}$
    D) $\dfrac{388,423}{25}$
    E) $\dfrac{388,423}{4}$
    Ans: B

26. Evaluate the definite integral $\int_5^7 (x-7)^9\,dx$.

A) $\frac{1024}{9}$
B) $-\frac{1024}{11}$
C) $-\frac{1024}{9}$
D) $\frac{512}{5}$
E) $-\frac{512}{5}$

Ans: E

27. Evaluate the definite integral $\int_1^2 \left(16x-8x^2\right)^3\left(8-8x\right)dx$.

A) 0
B) 512
C) –512
D) –1024
E) 1024

Ans: C

28. Evaluate the definite integral $\int_0^1 \sqrt{3x+7}\,dx$.

A) $\frac{\left(-14\sqrt{7}+20\sqrt{10}\right)}{9}$
B) $\frac{\left(-6\sqrt{7}+20\sqrt{10}\right)}{7}$
C) $\frac{\left(-28\sqrt{7}+40\sqrt{10}\right)}{15}$
D) $\frac{\left(-28\sqrt{7}+12\sqrt{10}\right)}{9}$
E) $\frac{\left(-6\sqrt{7}+14\sqrt{10}\right)}{9}$

Ans: A

29. Evaluate the definite integral $\int_1^4 \frac{2}{z^4}\,dz$.

A) $\frac{21}{128}$

B) $\frac{21}{64}$

C) $\frac{21}{16}$

D) $\frac{7}{32}$

E) $\frac{21}{32}$

Ans: E

30. Evaluate the definite integral $\int_0^3 -4e^{6x}\,dx$.

A) $-\frac{3\left(e^{18}-1\right)}{2}$

B) $-\frac{2\left(e^{18}-1\right)}{3}$

C) $-\frac{2\left(e^{19}-1\right)}{3}$

D) $\frac{2e^{19}}{3}$

E) $-\frac{3e^{19}}{2}$

Ans: B

31. Evaluate $\int_1^{11e} 8y^{-1}dy$.

A) $\int_1^{11e} 8y^{-1}dy = 8\ \ln 11$

B) $\int_1^{11e} 8y^{-1}dy = 8\left(\ln 11+1\right)$

C) $\int_1^{11e} 8y^{-1}dy = 8\left(\ln 11+2\right)$

D) $\int_1^{11e} 8y^{-1}dy = 8$

E) $\int_1^{11e} 8y^{-1}dy = 19$

Ans: B

32. Evaluate $\int_0^2 8x^2e^{-x^3}dx$.

A) $\int_0^2 8x^2e^{-x^3}dx=\frac{8}{3}\left(\frac{1}{e^8}-1\right)$

B) $\int_0^2 8x^2e^{-x^3}dx=\frac{3}{8}\left(\frac{1}{e^8}-1\right)$

C) $\int_0^2 8x^2e^{-x^3}dx=\frac{8}{3}\left(1-\frac{1}{e^8}\right)$

D) $\int_0^2 8x^2e^{-x^3}dx=\frac{8}{3}\left(1-\frac{1}{e^4}\right)$

E) $\int_0^2 8x^2e^{-x^3}dx=\frac{3}{8}\left(\frac{1}{e^4}-1\right)$

Ans: C

33. Evaluate the definite integral $\int_0^2 \frac{-x^3}{4x^4+1}\,dx$.

A) $-\frac{\ln(65)}{16}$

B) $-\frac{\ln(65)}{4}$

C) $-\frac{\ln(33)}{4}$

D) $-\frac{\ln(33)}{16}$

E) $-\frac{\ln(32)}{16}$

Ans: A

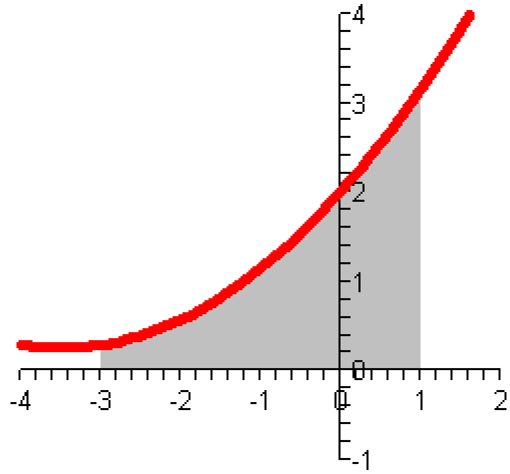
34. Evaluate the given integral with the Fundamental Theorem of Calculus $\int_1^4 \frac{8\sqrt{x}+5}{\sqrt{x}}dx$.

A) 39
B) 40
C) 37
D) 30
E) 34
Ans: E

35. True or false. For the function $f(x)=x^4-2$, $\int_0^2 f(x)dx$ gives the area between the graph of $f(x)$ and the x-axis from $x=0$ to $x=2$.

A) false
B) true
Ans: A

36. Find the shaded area between the given function and the *x*-axis.



$$f(x) = \frac{1}{7}x^2 + x + 2$$

A) $\frac{80}{3}$

B) $\frac{16}{3}$

C) $\frac{61}{21}$

D) $\frac{16}{9}$

E) $\frac{16}{21}$

Ans: B

37. Find the area between the curve $y = -6x^2 + 7x + 5$ and the *x*-axis from $x = -2$ to $x = 3$.

A) $-\frac{55}{2}$

B) $-\frac{385}{2}$

C) $-\frac{275}{6}$

D) $-\frac{275}{2}$

E) $-\frac{55}{4}$

Ans: A

38. Find the area between the curve $y = x^2 e^{x^3}$ and the x-axis from $x = 1$ to $x = 2$.

A) $\frac{1}{3}\left(e^8 - 1\right)$

B) $\frac{1}{3}\left(e^8 - e\right)$

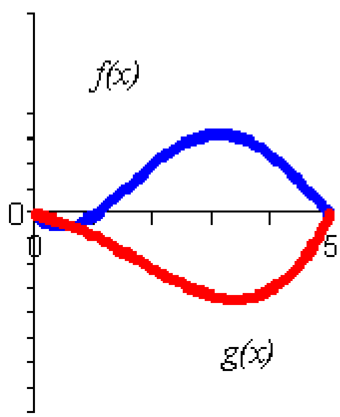
C) $\frac{1}{3}\left(e^9 - e\right)$

D) $\frac{1}{4}\left(e^8 - e\right)$

E) $\frac{1}{4}\left(e^9 - 1\right)$

Ans: B

39. Use the figure to decide which of $\int_0^5 f(x)dx$ or $\int_0^5 g(x)\,dx$ is larger, or if they are equal.



A) $\int_0^5 f(x)\,dx > \int_0^5 g(x)\,dx$

B) $\int_0^5 f(x)\,dx < \int_0^5 g(x)\,dx$

C) $\int_0^5 f(x)\,dx = \int_0^5 g(x)\,dx$

Ans: A

40. Evaluate $\int_4^4 \sqrt{x^2-3}\ dx$.

A) $\int_4^4 \sqrt{x^2-3}\ dx = 3$

B) $\int_4^4 \sqrt{x^2-3}\ dx = 2$

C) $\int_4^4 \sqrt{x^2-3}\ dx = 8$

D) $\int_4^4 \sqrt{x^2-3}\ dx = 4$

E) $\int_4^4 \sqrt{x^2-3}\ dx = 0$

Ans: E

41. The rate of depreciation of a building is given by $D'(t) = 8,400(15-t)$ dollars per year, $0 \le t \le 15$. Use the definite integral to find the total depreciation over the first 15 years.

A) $945,000

B) $63,000

C) $472,500

D) $270,000

E) $1,890,000

Ans: A

42. Assume that a store finds that its sales revenue changes at a rate given by $S'(t) = -27t^2 + 366t$ dollars per day, where t is the number of days after an advertising campaign ends and $0 \le t \le 30$. Find the total sales for the second week after the campaign ends $(t = 7 \text{ to } t = 14)$.

A) $5292

B) $6510

C) $3696

D) $11,634

E) $1134

Ans: A

43. Suppose that a vending machine service company models its income by assuming that money flows continuously into the machines, with the annual rate of flow given by $f(t) = 140e^{0.01t}$ in thousands of dollars per year. Find the total income from the machines predicted by the model over the first 5 years. Round your answer to the nearest thousand dollars.

A) $866,000

B) $571,000

C) $718,000

D) $28,718,000

E) $28,571,000

Ans: C

44. Market revenue for Hammer Inc. (in millions of dollars per year) can be modeled by $R(t) = 53.57t + 83.95$, where $t = 0$ represents 1990. Evaluate $\int_{15}^{25} R(t)\, dt$.
A) \$1,507.15
B) \$17,330.25
C) \$103,981.50
D) \$11,553.50
E) \$57,767.50
Ans: D

45. Suppose the rate of production of a new line of products is given by $\frac{dx}{dt} = 150\left[1 + \frac{400}{(t+40)^2}\right]$, where x is the number of items produced and t is the number of weeks the products have been in production. How many units were produced in the first 4 weeks? Round your answer to the nearest unit produced.
A) 464 units
B) 736 units
C) 886 units
D) 314 units
E) 586 units
Ans: B

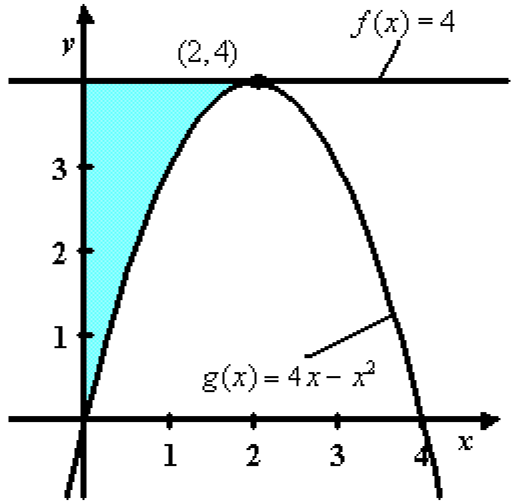
46. Suppose in a small city the response time t (in minutes) of the fire company is given by the probability density function $f(t) = \frac{90t^2 - 4t^3}{69{,}984}$, $0 \le t \le 18$. For a fire chosen at random, find the probability that the response time is 10 minutes or less. Round your answer to three decimal places.
A) 0.724
B) 0.470
C) 0.286
D) 0.276
E) 0.714
Ans: C

47. The average life for a particular brand of car battery is given by the following probability density function where t is in years.

$$f(t) = 0.34e^{-0.34t}, \qquad t \ge 0$$

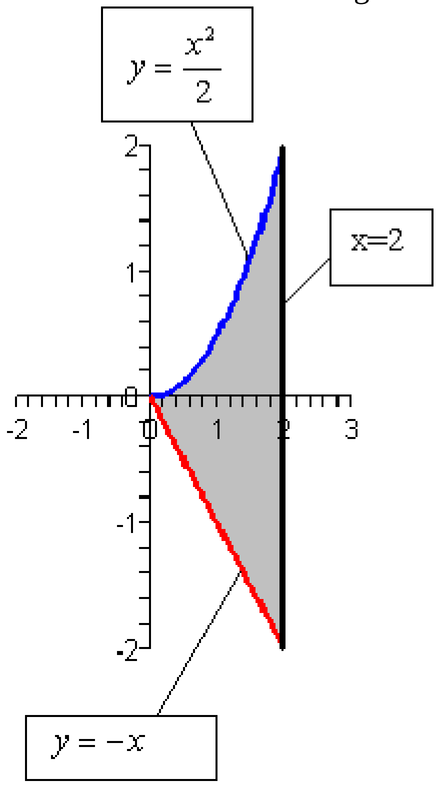
Find the probability that a battery chosen at random lasts between 3 and 8 years.
A) 0.12
B) 0.29
C) 0.37
D) 0.24
E) 0.44
Ans: B

48. Find the area of the shaded region for the graph given below.



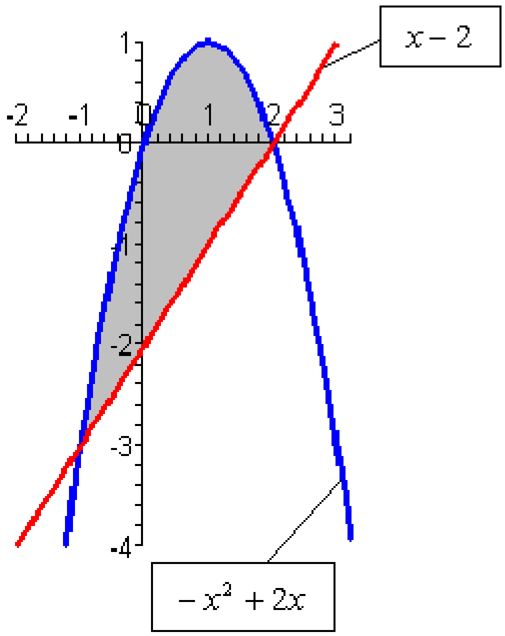
A) $\frac{8}{3}$
B) $\frac{4}{3}$
C) $\frac{16}{3}$
D) 8
E) 16
Ans: A

49. Find the area of the shaded region. Round to the nearest hundredth if necessary.



A) 2
B) 2.67
C) 3.33
D) 4
E) 7
Ans: C

50. Find the area of the shaded region.



A) $\frac{7}{12}$

B) $\frac{9}{2}$

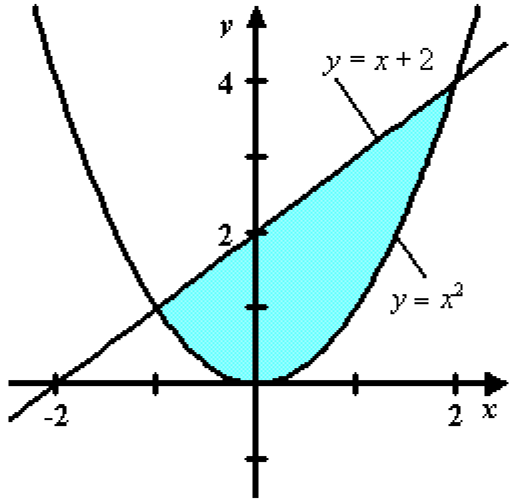
C) $\frac{5}{12}$

D) $\frac{7}{6}$

E) $\frac{5}{6}$

Ans: B

51. Find the area of the shaded region for the graph given below.



A) $\frac{125}{24}$

B) $\frac{125}{6}$

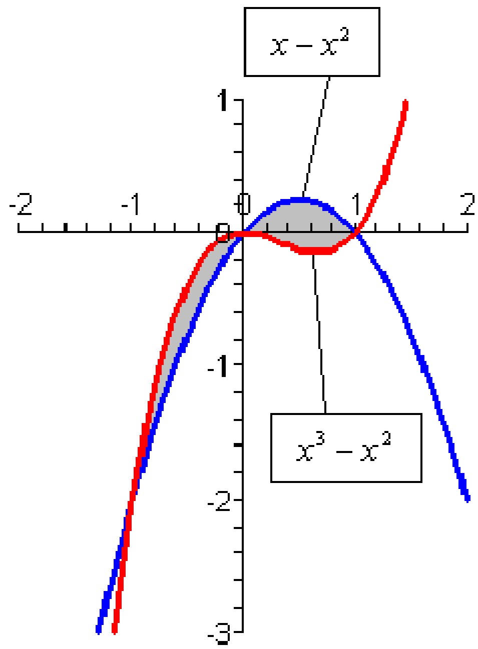
C) $\frac{9}{2}$

D) $\frac{3}{14}$

E) $\frac{14}{3}$

Ans: C

52. Find the area of the shaded region.



A) $\frac{7}{8}$

B) $\frac{1}{2}$

C) $\frac{1}{8}$

D) $\frac{7}{2}$

E) $\frac{7}{9}$

Ans: B

53. Find the area of the region enclosed by

$f(x) = 3x^2, g(x) = -\frac{1}{10}(10 + x), x = 0,$ and $x = 3.$

A) $\frac{289}{10}$

B) $\frac{609}{20}$

C) $\frac{601}{20}$

D) $\frac{569}{20}$

E) $\frac{309}{10}$

Ans: B

54. Equations are given whose graphs enclose a region. Find the area of the region.

$y = x^2 - 2x + 1; \quad y = 9x^2 - 20x - 11; \quad x = 1; \quad x = 2$

A) $\frac{61}{3}$

B) $\frac{122}{9}$

C) $\frac{122}{5}$

D) $\frac{122}{7}$

E) $\frac{61}{6}$

Ans: A

55. Equations are given whose graphs enclose a region. Find the area of the region.

$g(x) = 2x^2 - 14x; \quad h(x) = x^2 - 48$

A) $\frac{4}{3}$

B) $\frac{8}{13}$

C) $\frac{2}{3}$

D) $\frac{4}{13}$

E) $\frac{4}{9}$

Ans: A

56. Equations are given whose graphs enclose a region. Find the area of the region.

$f(x) = x^3; \quad g(x) = 7x^2 - 12x$

A) $\frac{71}{2}$
B) $\frac{142}{3}$
C) $\frac{71}{3}$
D) $\frac{71}{6}$
E) $\frac{71}{9}$
Ans: D

57. Find the area of the region enclosed by the graphs of $f(x) = \frac{17}{x}$ and $g(x) = 18 - x$.

A) $144 - 17 \ln 18$
B) $144 - 18 \ln 18$
C) $144 - 17 \ln 17$
D) $162 - 17 \ln 17$
E) $162 - 18 \ln 18$
Ans: C

58. Find the area of the region bounded by $y = \sqrt{x + 192}, x = -192,$ and $y = 14$.

A) $\frac{2744}{5}$
B) $\frac{2747}{5}$
C) $\frac{2743}{3}$
D) $\frac{2746}{3}$
E) $\frac{2744}{3}$
Ans: E

59. Find the average value of the function $f(x) = 10 - x^2$ over $[0, 3]$.

A) 21
B) 27
C) 13
D) 7
E) 1
Ans: D

60. Find the average value of the given function over the given interval.

$f(x) = \frac{1}{6}x^3 - 7$ over $[-2, 3]$

A) $\frac{31}{4}$

B) $-\frac{155}{24}$

C) $\frac{155}{48}$

D) $\frac{155}{72}$

E) $\frac{155}{4}$

Ans: B

61. Find the average value of the function $f(x) = \sqrt{x} - 2$ over $[1, 16]$.

A) $-\frac{6}{5}$

B) $\frac{6}{5}$

C) $\frac{4}{5}$

D) $-\frac{4}{5}$

E) $\frac{41}{45}$

Ans: C

62. For a certain product, the total revenue is given by $R(x)=\dfrac{x^2+2}{2}$, and the total cost is given by $C(x)=\dfrac{x^2}{4}$. Write an integral that gives the average profit for the product over the interval from 3 to 9.

A) $AP=\dfrac{1}{6}\int_3^9\left(\dfrac{x^2}{4}-\dfrac{x^2+2}{2}\right)dx$

B) $AP=\dfrac{1}{6}\int_3^9\left(\dfrac{x^2+2}{2}-\dfrac{x^2}{4}\right)dx$

C) $AP=\int_3^9\left(\dfrac{x^2}{4}-\dfrac{x^2+2}{2}\right)dx$

D) $AP=\int_3^9\left(\dfrac{x^2+2}{2}-\dfrac{x^2}{4}\right)dx$

E) $AP=27\int_3^9\left(\dfrac{x^2}{4}-\dfrac{x^2+2}{2}\right)dx$

Ans: B

63. The cost of producing x units of a certain item is $C(x)=x^2+770x+3100$. Find the average value of the cost function $C(x)$ over the interval from 0 to 1000. Round answer to nearest penny.

A) $721,433.33

B) $2,164,300.00

C) $424,372.55

D) $2,885,733.33

E) $1,659,296.67

Ans: A

64. Suppose the number of daily sales of a product was found to be given by $S=140xe^{-x^2}+140$, x days after the start of an advertising campaign for this product. Find the average daily sales during the first 20 days of the campaign—that is, from $x=0$ to $x=20$. Round your answer to the nearest dollar.

A) $144

B) $140

C) $137

D) $287

E) $273

Ans: A

65. The demand function for a certain product is given by $p = 400 + \frac{1500}{q+1}$, where p is the price and q is the number of units demanded. Find the average price as demand ranges from 22 to 96 units. Round your answer to the nearest penny.
A) $579.38
B) $291.95
C) $1244.60
D) $429.17
E) $987.10
Ans: D

66. Assume that the tax burden per capita (in dollars) for selected years from 1950 to 1992 can be modeled by $T(t) = 257.8e^{0.065t}$, where $t = 0$ represents 1950. If the model remains valid, find the predicted average federal tax burden per capita from 1990 to 2000. Round your answer to the nearest dollar.
A) $4444 average federal tax per capita
B) $4889 average federal tax per capita
C) $9365 average federal tax per capita
D) $10,405 average federal tax per capita
E) $5432 average federal tax per capita
Ans: B

67. Suppose that the income from a slot machine in a casino flows continuously at a rate of $f(t) = 290e^{0.15t}$, where t is the time in hours since the casino opened. The total income during the first 13 hours is given by $\int_0^{13} 290e^{0.15t}\,dt$. Find the average income over the first 13 hours.
A) $582.19
B) $500.88
C) $1,165.55
D) $896.57
E) $1,524.18
Ans: D

68. A drug manufacturer has developed a time-release capsule with the number of milligrams of the drug in the bloodstream given by $S = 30x^{18/7} - 210x^{11/7} + 490x^{4/7}$, where x is in hours and $0 \le x \le 3$. Find the average number of milligrams of the drug in the bloodstream for the first 3 hours after a capsule is taken. Round your answer to the nearest milligram.
A) 400 mg
B) 305 mg
C) 267 mg
D) 200 mg
E) 229 mg
Ans: C

69. The Lorenz curve for the income distribution in a certain country in 2005 is given by $y = x^{2.2084}$. Find the Gini coefficient of income for 2005 for this country.
    A) 0.3766
    B) 0.4896
    C) 0.5913
    D) 0.2216
    E) 0.2811
    Ans: A

70. In an effort to make the distribution of income more nearly equal, the government of a country passes a tax law that changes the Lorenz curve from $y = 0.94x^{2.16}$ for 2004 to $y = 0.25x^{1.94} + 0.68x$ for 2005. Find the Gini coefficient of income for both years.
    A) 2004: 0.307692
    2005: 0.111878
    B) 2004: 0.405063
    2005: 0.149932
    C) 2004: 0.248062
    2005: 0.089231
    D) 2004: 0.207792
    2005: 0.074209
    E) 2004: 0.592593
    2005: 0.227216
    Ans: B

71. Suppose the Gini coefficient of income for a certain country is $6/7$. If the Lorenz curve for this country is $L(x) = \frac{1}{19}x + \frac{18}{19}x^p$, find the value of p.
    A) 20
    B) 21
    C) 19
    D) 18
    E) 22
    Ans: A

72. Suppose that the Carter Car Service franchise finds that the income generated by its stores can be modeled by assuming that the income is a continuous stream with a monthly rate of flow at time t given by $f(t) = 12{,}000e^{0.05t}$ (dollars per month). Find the total income from a Carter Car Service store for years 3 through 7 of operation and round to the nearest penny.
    A) \$8,412,025.47
    B) \$19,937,341.56
    C) \$9,152,706.95
    D) \$14,552,804.06
    E) \$10,248,453.56
    Ans: D

73. A small brewery considers the output of its bottling machine as a continuous income stream with an annual rate of flow at time t given by $f(t) = 90e^{-0.1t}$ in thousands of dollars per year. Find the income from this stream for the next 30 years. Round your answer to the nearest dollar.
A) $855,192
B) $859,456
C) $845,690
D) $864,694
E) $850,479
Ans: A

74. A franchise models the profit from its store as a continuous income stream with a monthly rate of flow at time t given by $f(t) = 3000e^{0.004t}$ (dollars per month). When a new store opens, its manager is judged against the model, with special emphasis on the second half of the first year. Find the total profit for the second 6-month period $(t = 6 \text{ to } t = 12)$. Round your answer to the nearest dollar.
A) $32,755
B) $28,160
C) $23,256
D) $18,660
E) $24,880
Ans: D

75. The Carter Car Service franchise has a continuous income stream with a monthly rate of flow modeled by $f(t) = 7,000e^{0.04t}$ (dollars per month). Find the average flow of income over years 4 to 6.
A) $58,510.65
B) $50,414.83
C) $138,676.08
D) $80,159.59
E) $56,450.41
Ans: D

76. A continuous income stream has an annual rate of flow at time t given by $f(t) = 12,000e^{0.07t}$ (dollars per year). Find the present value of this income stream for the next 11 years, if the money is worth 7% compounded continuously. Round to the nearest dollar.
A) $112,941
B) $255,360
C) $422,400
D) $349,440
E) $192,000
Ans: E

77. Suppose that a printing firm considers the production of its presses as a continuous income stream. If the annual rate of flow at time *t* is given by $f(t) = 89.5e^{-0.2(t+2)}$ in thousands of dollars per year, and if money is worth 6% compounded continuously, find the present value and future value of the presses over the next 10 years. Round your answer to the nearest dollar.
    A) Present Value: \$252,444; Future Value: \$459,983
    B) Present Value: \$213,607; Future Value: \$389,217
    C) Present Value: \$173,555; Future Value: \$316,238
    D) Present Value: \$228,425; Future Value: \$416,217
    E) Present Value: \$187,480; Future Value: \$341,611
    Ans: B

78. Suppose that a vending machine company is considering selling some of its machines. Suppose further that the income from these particular machines is a continuous stream with an annual rate of flow at time *t* given by $f(t) = 10,000e^{-0.6(t+2)}$. Find the present value and future value of the machines over the next 4 years if the money is worth 12% compounded continuously. Round answers to the nearest dollar.
    A) $\text{PV} = \$4,565$
    $\text{FV} = \$7,377$
    B) $\text{PV} = \$4,565$
    $\text{FV} = \$6,381$
    C) $\text{PV} = \$3,948$
    $\text{FV} = \$6,381$
    D) $\text{PV} = \$3,948$
    $\text{FV} = \$7,377$
    E) $\text{PV} = \$5,528$
    $\text{FV} = \$7,377$
    Ans: C

79. A 58-year-old couple are considering opening a business of their own. They will either purchase an established Gift and Card Shoppe or open a new Video Rental Palace. The Gift Shoppe has a continuous income stream with an annual rate of flow at time *t* given by $G(t) = 20,000$ (dollars per year) and the Video Palace has a continuous income stream with a projected annual rate of flow at time *t* given by $V(t) = 21,600e^{0.08t}$ (dollars per year). The initial investment is the same for both businesses, and money is worth 10% compounded continuously. Find the present value of the Video Palace over the next 7 years (until the couple reach age 65). Round your answer to the nearest dollar.
    A) \$100,683
    B) \$110,107
    C) \$159,685
    D) \$177,908
    E) \$141,093
    Ans: E

80. A 58-year-old couple are considering opening a business of their own. They will either purchase an established Gift and Card Shoppe or open a new Video Rental Palace. The Gift Shoppe has a continuous income stream with an annual rate of flow at time *t* given by $G(t) = 40,000$ (dollars per year) and the Video Palace has a continuous income stream with a projected annual rate of flow at time *t* given by $V(t) = 20,600e^{0.08t}$ (dollars per year). The initial investment is the same for both businesses, and money is worth 10% compounded continuously. Determine which is the better buy by finding the present value of each business over the next 8 years (until the couple reach age 66).

A) the Gift Shoppe
B) the Video Palace
Ans: A

81. The demand function for a product is $p = 44 - x^2$ where *p* is in millions of dollars and *x* is the number of thousands of units. If the equilibrium price is $8 million, what is the consumer's surplus? Round your answer to the nearest million dollars.

A) 232 million dollars
B) 256 million dollars
C) 144 million dollars
D) 156 million dollars
E) 328 million dollars
Ans: C

82. The demand function for a product is $p = 100 - 2x$, where *p* is the number of dollars and *x* is the number of units. If the equilibrium price is $\$20$, what is the consumer's surplus?

A) $1525
B) $1600
C) $1725
D) $1570
E) $1690
Ans: B

83. The demand function for a product is $p = 120/(2 + x)$, where *p* is the number of dollars and *x* is the number of units. If the equilibrium quantity is $\$8$, what is the consumer's surplus?

A) $46.25
B) $57.14
C) $97.13
D) $126.27
E) $233.12
Ans: C

84. The demand function for a certain product is $p = 81 - x^2$ and the supply function is $p = x^2 + 4x + 11$ where *p* is in millions of dollars and *x* is the number of thousands of units. Find the equilibrium point (*x*, *p*) and the consumer's surplus there. Round your answer to the nearest million dollars, where applicable.

A) Equilibrium point: (5, 56); Consumer's surplus: 83 million dollars
B) Equilibrium point: (4, 56); Consumer's surplus: 164 million dollars
C) Equilibrium point: (11, 56); Consumer's surplus: 245 million dollars
D) Equilibrium point: (5, 11); Consumer's surplus: 220 million dollars
E) Equilibrium point: (4, 11); Consumer's surplus: 139 million dollars
Ans: A

85. The demand function for a product is $p = 47 - x^2$ and the supply function is $p = -x + 17$, where *p* is the number of dollars and *x* is the number of units. Find the equilibrium point and the consumer's surplus there. Round to the nearest cent.

A) $110.77
B) $144.00
C) $244.80
D) $302.40
E) $172.80
Ans: B

86. If the demand function for a product is $p = \frac{147}{(x+1)}$ and the supply function is $p = 3 + 0.2x$ where *p* is in millions of dollars and *x* is the number of thousands of units. Find the consumer's surplus. Round your answer to the nearest million dollars.

A) 391 million dollars
B) 387 million dollars
C) 377 million dollars
D) 308 million dollars
E) 350 million dollars
Ans: D

87. The total cost function for a product is $C = \frac{3}{2}x^2 + 730$, and the demand function is $p = -\frac{1}{3}x^2 + 108$, where *p* is the number of dollars and *x* is the number of units. Find the consumer's surplus at the point where the product has maximum profit. Round to the nearest cent.

A) $108.00
B) $124.62
C) $243.00
D) $162.00
E) $77.14
Ans: D

88. The supply function for a good is $p = 0.4x^2 + 3x + 9$, where *p* is the number of dollars and *x* is the number of units. If the equilibrium price is $\$35,$ what is the producer's surplus at the equilibrium price? Round to the nearest cent.
A) $129.04
B) $58.39
C) $42.17
D) $113.86
E) $75.90
Ans: E

89. If the supply function for a commodity is $p = 7e^{x/4}$ where *p* is in millions of dollars and *x* is the number of thousands of units. What is the producer's surplus when 12 thousand units are sold? Round your answer to the nearest million dollars.
A) 13,224 million dollars
B) 1153 million dollars
C) 1146 million dollars
D) 17,867 million dollars
E) 1209 million dollars
Ans: B

90. If the supply function for a commodity is $p = 30 + 90(x+1)^2$ where *p* is in millions of dollars and *x* is the number of thousands of units. What is the producer's surplus at $x = 25$? Round your answer to the nearest million dollars.
A) 994,415 million dollars
B) 1,516,641 million dollars
C) 930,605 million dollars
D) 1,113,000 million dollars
E) 993,750 million dollars
Ans: E

91. Find the producer's surplus for a product if its demand function is $p = 82 - x^2$ and its supply function is $p = 2x + 2$ where *p* is in millions of dollars and *x* is the number of thousands of units. Round your answer to the nearest million dollars.
A) 85 million dollars
B) 72 million dollars
C) 64 million dollars
D) 56 million dollars
E) 80 million dollars
Ans: C

92. Find the producer's surplus for a product with demand function $p = \frac{156}{(x+1)}$ and supply function $p = 1 + 0.2x$ where p is in millions of dollars and x is the number of thousands of units. Round your answer to one decimal place.

A) 87.5 million dollars
B) 68.5 million dollars
C) 60.0 million dollars
D) 62.5 million dollars
E) 63.5 million dollars

Ans: D

93. The demand function for a product is $p = 200 + 13x - x^2$, and the supply function for it is $p = 116 + 15x + x^2$, where p is the number of dollars and x is the number of units. If the equilibrium price is $\$242,$ what is the producer's surplus at the equilibrium price? Round to the nearest cent.

A) $\$243.53$
B) $\$414.00$
C) $\$1,076.40$
D) $\$579.60$
E) $\$1,242.00$

Ans: B

94. Use an integral formula to evaluate $\int \frac{dx}{x(8x+3)} dx$.

A) $\frac{1}{8}\ln\left|\frac{x}{8x+3}\right| + C$
B) $\frac{1}{3}\ln\left|\frac{x}{8x+3}\right| + C$
C) $\frac{1}{3}\ln\left|\frac{1}{x(8x+3)}\right| + C$
D) $\frac{1}{8}\ln\left|\frac{1}{x(8x+3)}\right| + C$
E) $\frac{1}{11}\ln\left|\frac{x}{3}\right| + C$

Ans: B

95. Use an integral formula to evaluate $\int \frac{dx}{x\sqrt{16-x^2}}$.

A) $-\frac{1}{16}\ln\left|\frac{16+\sqrt{16-x^2}}{x}\right|+C$

B) $-\frac{1}{16}\ln\left|\frac{4+\sqrt{4-x^2}}{x}\right|+C$

C) $-\frac{1}{4}\ln\left|\frac{16+\sqrt{4-x^2}}{x}\right|+C$

D) $-\frac{1}{4}\ln\left|\frac{4+\sqrt{16-x^2}}{x}\right|+C$

E) $-\frac{1}{4}\ln\left|\frac{16+\sqrt{16-x^2}}{x}\right|+C$

Ans: D

96. Evaluate the integral $\int 3\left(11^x\right)\,dx$.

A) $\int 3\left(11^x\right)\,dx = \frac{11^x}{\ln 11}+C$

B) $\int 3\left(11^x\right)\,dx = 3\cdot 11\ln\left(11^x\right)+C$

C) $\int 3\left(11^x\right)\,dx = \frac{3\cdot 11^x}{\ln 11}+C$

D) $\int 3\left(11^x\right)\,dx = 3\cdot 11^x\ln\left(11\right)+C$

E) $\int 3\left(11^x\right)\,dx = \frac{3}{\ln 11^x}+C$

Ans: C

97. Evaluate the integral $\int_0^3 \frac{qdq}{4q+3}$.

A) $\int_0^3 \frac{qdq}{4q+3} = \frac{3}{4} - \frac{3}{16}\ln\frac{1}{5}$

B) $\int_0^3 \frac{qdq}{4q+3} = \frac{3}{4} + \frac{3}{16}\ln\frac{1}{5}$

C) $\int_0^3 \frac{qdq}{4q+3} = \frac{3}{4} + \frac{3}{16}\ln\frac{1}{5}$

D) $\int_0^3 \frac{qdq}{4q+3} = \frac{3}{4} - \frac{9}{4}\ln\frac{1}{5}$

E) $\int_0^3 \frac{qdq}{4q+3} = \frac{3}{4} + \frac{3}{16}\ln\frac{1}{4}$

Ans: B

98. Use an integral formula to evaluate $\int_{\mathrm{b}}^{\mathrm{c}} \frac{dq}{q\sqrt{\mathrm{a}^\wedge 2 + q^2}}$.

A) $-\frac{1}{\mathrm{a}}\left[\ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(2*\mathrm{bafac})\sqrt{\mathrm{barad}}}{\mathrm{b}}\right) - \ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(3*\mathrm{cafac})\sqrt{\mathrm{carad}}}{\mathrm{c}}\right)\right]$

B) $-\frac{1}{\mathrm{a}}\left[\ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(\mathrm{cafac})\sqrt{\mathrm{carad}}}{\mathrm{c}}\right) - \ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(\mathrm{bafac})\sqrt{\mathrm{barad}}}{\mathrm{b}}\right)\right]$

C) $-\frac{1}{\mathrm{a}}\left[\ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(\mathrm{eafac})\sqrt{\mathrm{earad}}}{\mathrm{b}}\right) - \ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(\mathrm{dafac})\sqrt{\mathrm{darad}}}{\mathrm{c}}\right)\right]$

D) $-\frac{1}{\mathrm{a}}\left[\ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(2*\mathrm{bafac})\sqrt{\mathrm{barad}}}{\mathrm{b}}\right) - \ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(2*\mathrm{cafac})\sqrt{\mathrm{carad}}}{\mathrm{c}}\right)\right]$

E) $-\frac{1}{\mathrm{a}}\left[\ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(\mathrm{dafac})\sqrt{\mathrm{darad}}}{\mathrm{c}}\right) - \ln\left(\frac{\mathrm{a}+\mathrm{leadcoeff}(\mathrm{eafac})\sqrt{\mathrm{earad}}}{\mathrm{b}}\right)\right]$

Ans: B

99. Use an integral formula to evaluate $\int_0^1 \sqrt{x^2+144}$.

A) $\dfrac{\sqrt{145}+145\ln\left(1+\sqrt{145}\right)-145\ln(12)}{2}$

B) $\dfrac{12+145\ln\left(1+\sqrt{145}\right)-144\ln(12)}{2}$

C) $\dfrac{12+145\ln\left(1+\sqrt{145}\right)-145\ln(12)}{2}$

D) $\dfrac{12+144\ln\left(1+\sqrt{145}\right)-145\ln(12)}{2}$

E) $\dfrac{\sqrt{145}+144\ln\left(1+\sqrt{145}\right)-144\ln(12)}{2}$

Ans: E

100. Use an integral formula to evaluate $\int \frac{xdx}{(7x+5)^2}$.

A) $\frac{1}{49}\left(\ln|7x+5|+\frac{5}{(7x+5)^2}\right)+C$

B) $\frac{1}{7}\left(\ln|7x+5|+\frac{5}{(7x+5)^2}\right)+C$

C) $\frac{1}{49}\left(\ln|7x+5|+\frac{5}{7x+5}\right)+C$

D) $\frac{1}{7}\left(\ln|7x+5|+\frac{5}{7x+5}\right)+C$

E) $\frac{1}{8}\left(\ln|7x+5|+\frac{5}{7x+5}\right)+C$

Ans: C

101. Evaluate the integral $\int w\sqrt{16w+5}\ dw$.

A) $\int w\sqrt{16w+5}\ dw = \dfrac{(24w-5)(16w+5)^{3/2}}{960}+C$

B) $\int w\sqrt{16w+5}\ dw = \dfrac{(24w+5)(16w+5)^{1/2}}{704}+C$

C) $\int w\sqrt{16w+5}\ dw = \dfrac{(24w-5)(16w+15)^{5/2}}{768}+C$

D) $\int w\sqrt{16w+5}\ dw = \dfrac{(24w-5)(5w-32)^{1/2}}{832}+C$

E) $\int w\sqrt{16w+5}\ dw = \dfrac{(24w-5)(5w+16)^{7/2}}{1088}+C$

Ans: A

102. Use an integral formula to evaluate $\int \dfrac{dy}{\sqrt{81+y^2}}$.

A) $\ln\left|y+\sqrt{y^2+81}\right|+C$

B) $\ln\left|y^2+\sqrt{y^2+81}\right|+C$

C) $\ln\left|y+\sqrt{y+9}\right|+C$

D) $\ln\left|y^2+\sqrt{y+9}\right|+C$

E) $\ln\left|y^2+\sqrt{y+81}\right|+C$

Ans: A

103. Use an integral formula to evaluate $\int x\sqrt{x^4-25}\,dx$.

A) $\dfrac{x\sqrt{x^2-25}-25\ln\left|x+\sqrt{x^2-25}\right|}{2}+C$

B) $\dfrac{x\sqrt{x^2-5}-5\ln\left|x+\sqrt{x^2-5}\right|}{2}+C$

C) $\dfrac{x^2\sqrt{x^4-5}-5\ln\left|x^2+\sqrt{x^4-5}\right|}{4}+C$

D) $\dfrac{x^2\sqrt{x^4-25}-25\ln\left|x^2+\sqrt{x^4-25}\right|}{4}+C$

E) $\dfrac{x\sqrt{x^2-25}-25\ln\left|x+\sqrt{x^2-25}\right|}{4}+C$

Ans: D

104. Evaluate the integral $\int \frac{11dx}{x\sqrt{49-4x^2}}$.

A) $\int \frac{11dx}{x\sqrt{49-4x^2}} = \ln\left|2x+\sqrt{4x^2-49}\right| + C$

B) $\int \frac{11dx}{x\sqrt{49-4x^2}} = \ln\left|2x+\sqrt{4x^2+49}\right| + C$

C) $\int \frac{11dx}{x\sqrt{49-4x^2}} = -\frac{11}{7}\ln\left|\frac{7+\sqrt{49-4x^2}}{2x}\right| + C$

D) $\int \frac{11dx}{x\sqrt{49-4x^2}} = \frac{1}{7}\ln\left|\frac{11+\sqrt{49+4x^2}}{2x}\right| + C$

E) $\int \frac{11dx}{x\sqrt{49-4x^2}} = \ln\left|\frac{11+\sqrt{49-4x^2}}{2x}\right| + C$

Ans: C

105. Evaluate the integral $\int \frac{dx}{\sqrt{49x^2-16}}$.

A) $\int \frac{dx}{\sqrt{49x^2-16}} = \frac{1}{4}\ln\left|4x+\sqrt{49x^2+16}\right| + C$

B) $\int \frac{dx}{\sqrt{49x^2-16}} = \frac{1}{7}\ln\left|7x+\sqrt{49x^2-16}\right| + C$

C) $\int \frac{dx}{\sqrt{49x^2-16}} = \frac{1}{7}\ln\left|4x+\sqrt{49-16x^2}\right| + C$

D) $\int \frac{dx}{\sqrt{49x^2-16}} = \ln\left|7x+\sqrt{16+49x^2}\right| + C$

E) $\int \frac{dx}{\sqrt{49x^2-16}} = \ln\left|7x+\sqrt{16-49x^2}\right| + C$

Ans: B

106. Use an integral formula to evaluate $\int \frac{dx}{81-121x^2}$.

A) $\frac{1}{18}\ln\left|\frac{9-11x}{9+11x}\right|+C$

B) $\frac{1}{18}\ln\left|\frac{9+11x}{9-11x}\right|+C$

C) $\frac{1}{99}\ln\left|\frac{9-11x}{9+11x}\right|+C$

D) $\frac{1}{198}\ln\left|\frac{9-11x}{9+11x}\right|+C$

E) $\frac{1}{198}\ln\left|\frac{9+11x}{9-11x}\right|+C$

Ans: E

107. Use an integral formula to evaluate $\int_0^1 \frac{xdx}{7+2x}$.

A) $\dfrac{7+2\ln\left(\frac{9}{14}\right)}{49}$

B) $\dfrac{2-7\ln\left(\frac{9}{7}\right)}{4}$

C) $\dfrac{2-7\ln\left(\frac{9}{14}\right)}{4}$

D) $\dfrac{7+2\ln\left(\frac{9}{7}\right)}{49}$

E) $\dfrac{2-7\ln\left(\frac{9}{14}\right)}{49}$

Ans: B

108. Evaluate the integral $\int \frac{dx}{\sqrt{(5x+6)^2+1}}$.

A) $\int \frac{dx}{\sqrt{(5x+6)^2+1}} = \frac{1}{6}\ln\left|5x+6+\sqrt{(5x+6)^2-1}\right|+C$

B) $\int \frac{dx}{\sqrt{(5x+6)^2+1}} = \ln\left|5x+6+\sqrt{(5x+6)^2+1}\right|+C$

C) $\int \frac{dx}{\sqrt{(5x+6)^2+1}} = \ln\left|5x+6+\sqrt{(5x+6)^2-1}\right|+C$

D) $\int \frac{dx}{\sqrt{(5x+6)^2+1}} = \frac{1}{5}\ln\left|5x+6+\sqrt{(5x+6)^2+1}\right|+C$

E) $\int \frac{dx}{\sqrt{(5x+6)^2+1}} = \frac{1}{6}\ln\left|6x+5+\sqrt{(5x+6)^2+1}\right|+C$

Ans: D

109. Evaluate the integral $\int_0^2 x\sqrt{(x^2+1)^2+16}\ dx$.

A) $\int_0^2 x\sqrt{(x^2+1)^2+16} = \frac{1}{4}\left[5\sqrt{41}+16\left(5+\sqrt{41}\right)-\sqrt{17}-\left(1+\sqrt{17}\right)\right]$

B) $\int_0^2 x\sqrt{(x^2+1)^2+16} = \frac{1}{4}\left[5\sqrt{41}+16\ln\left(5+\sqrt{41}\right)-\sqrt{17}-16\ln\left(1+\sqrt{17}\right)\right]$

C) $\int_0^2 x\sqrt{(x^2+1)^2+16} = \frac{1}{4}\left[5\sqrt{41}+16\ln\left(5-\sqrt{41}\right)-\sqrt{17}-\left(1-\sqrt{17}\right)\right]$

D) $\int_0^2 x\sqrt{(x^2+1)^2+16} = \frac{1}{2}\left[17\sqrt{41}+16\ln\left(5+\sqrt{41}\right)+\sqrt{17}+16\ln\left(1+\sqrt{17}\right)\right]$

E) $\int_0^2 x\sqrt{(x^2+1)^2+16} = \frac{1}{2}\left[17\sqrt{41}+4\left(5+\sqrt{41}\right)+\sqrt{17}-4\left(1+\sqrt{17}\right)\right]$

Ans: B

110. Evaluate the integral $\int_1^e x^6 \ln x^7\ dx$.

A) $\int_1^e x^6 \ln x^7\ dx = 1+6e^7$

B) $\int_1^e x^6 \ln x^7\ dx = \frac{1}{7}\left(1-6e^7\right)$

C) $\int_1^e x^6 \ln x^7\ dx = \frac{1}{7}\left(1+6e^7\right)$

D) $\int_1^e x^6 \ln x^7\ dx = 1+7e^6$

E) $\int_1^e x^6 \ln x^7\ dx = \frac{1}{7}\left(1+7e^6\right)$

Ans: C

111. Evaluate the integral $\int e^x\sqrt{3e^x+7}\,dx$.

A) $\int e^x\sqrt{3e^x+7} = \dfrac{\left(3e^x+7\right)^{1/2}}{6}+C$

B) $\int e^x\sqrt{3e^x+7} = \dfrac{2\left(3e^x+7\right)^{3/2}}{9}+C$

C) $\int e^x\sqrt{3e^x+7} = \dfrac{\left(3e^x+7\right)^{3/2}}{6}+C$

D) $\int e^x\sqrt{3e^x+7} = \dfrac{\left(3e^x+7\right)^{1/2}}{9}+C$

E) $\int e^x\sqrt{3e^x+7} = \dfrac{\left(3e^x+7\right)^{3/2}}{15}+C$

Ans: B

112. Use formulas or numerical integration with a graphing calculator or computer to evaluate the given definite integral. Round answer to 3 decimal places.

$$\int_3^9 \frac{8x}{\sqrt{x^4-64}}\,dx$$

A) 6.695
B) 10.043
C) 17.073
D) 28.121
E) 34.147
Ans: B

113. If the supply function for x units of a commodity is $p = 40+80\ln\left(x+1\right)^2$ dollars, what is the producer's surplus at $x = 21$?

A) \$6304
B) \$1508
C) \$2865
D) \$1194
E) \$2092
Ans: C

114. If the demand function for wheat is $p = \frac{1200}{\sqrt{x^2+3}} + 11$ dollars, where x is the number of hundreds of bushels of wheat, estimate the consumer's surplus at $x = 4,\ p = 286.3.$ Round answer to the nearest cent.

A) $\$\,231.65$
B) $\$\,358.01$
C) $\$\,463.31$
D) $\$\,525.08$
E) $\$\,787.62$

Ans: E

115. Suppose the marginal cost for x units of a good is $\overline{MC} = \sqrt{x^2+36}$ (dollars per unit) and if the fixed cost is $300, find the total cost function of the good?

A) $C(x) = \frac{1}{2}\left(x\sqrt{x^2-36} - 36\ln\left(x+\sqrt{x^2-36}\right)\right) + 267.75$
B) $C(x) = \ln\left(x+\sqrt{x^2+36}\right) + 267.75$
C) $C(x) = \frac{1}{2}\left(x\sqrt{x^2+36} + 36\ln\left(x+\sqrt{x^2+36}\right)\right) + 267.75$
D) $C(x) = \ln\left(x-\sqrt{x^2+36}\right) + 267.75$
E) $C(x) = \frac{1}{2}\left(x\sqrt{x^2-36} + 6\ln\left(x+\sqrt{x^2-36}\right)\right) + 267.75$

Ans: C

116. Suppose the marginal cost for x units of a good is $\overline{MC} = \sqrt{x^2+16}$ (dollars per unit) and if the fixed cost is $400. What is the total cost of producing 2 units of this good? Round your answer to the nearest dollar.

A) $C(2) = 389$ dollars
B) $C(2) = 408$ dollars
C) $C(2) = 411$ dollar
D) $C(2) = 390$ dollars
E) $C(2) = 438$ dollars

Ans: B

117. Suppose that the demand function for an appliance is $p = \frac{200q + 200}{(q+3)^2}$ where q is the number of units and p is in dollars. What is the consumer's surplus if the equilibrium price is \$18 and the equilibrium quantity is 17? Round your answer to the nearest dollar.
A) \$17
B) \$19
C) \$323
D) \$324
E) \$18
Ans: A

118. Suppose that when a new oil well is opened, its production is viewed as a continuous income stream with monthly rate of flow $f(t) = 30\ln(t+1) - 0.6t$, where t is time in months and f is in thousands of dollars per month. Find the total income over the next 30 years (360 months). Round your answer to one decimal place.
A) 13,919.9 thousand dollars
B) 52,976.5 thousand dollars
C) 14,096.5 thousand dollars
D) 24,878.5 thousand dollars
E) 63,776.5 thousand dollars
Ans: C

119. Use integration by parts to evaluate $\int 8xe^{-9x}dx$.
A) $-\frac{(9x+1)(8e^{-9x})}{81} + C$
B) $-\frac{e^{-9x}}{9} + C$
C) $-\frac{(8e^{-9x})}{81} + C$
D) $-\frac{x(8e^{-9x})}{9} + C$
E) $\frac{e^{-9x}}{9} + C$
Ans: A

120. Use integration by parts to evaluate $\int 9x^6 \ln x\, dx$.

A) $\dfrac{-9x^7\left(7\ln(x)+1\right)}{7}+C$

B) $\dfrac{9x^6\left(6\ln(x)+1\right)}{6}+C$

C) $\dfrac{9x^7\left(7\ln(x)+1\right)}{49}+C$

D) $\dfrac{9x^6\left(6\ln(x)-1\right)}{36}+C$

E) $\dfrac{9x^7\left(7\ln(x)-1\right)}{49}+C$

Ans: E

121. Use integration by parts to evaluate the integral $\int_{19}^{21} q\sqrt{q-19}\, dq$.

A) $\dfrac{136\sqrt{3}}{5}$

B) $\dfrac{404\sqrt{2}}{15}$

C) $\dfrac{404\sqrt{2}}{13}$

D) $\dfrac{404\sqrt{3}}{15}$

E) $\dfrac{410\sqrt{2}}{13}$

Ans: B

122. Use integration by parts to evaluate $\int_0^2 y(2-y)^{3/2}\, dy$.

A) $\dfrac{32\sqrt{34}}{35}$

B) $\dfrac{32\sqrt{2}}{35}$

C) $\dfrac{16\sqrt{34}}{35}$

D) $\dfrac{24\sqrt{2}}{35}$

E) $\dfrac{24\sqrt{34}}{35}$

Ans: B

123. Use integration by parts to evaluate the integral $\int \frac{11\ln(11x)\,dx}{x^2}$.

A) $-\frac{11}{x}\ln 11x+\frac{11}{x}+C$

B) $\frac{16}{x}\ln 16x-\frac{16}{x}+C$

C) $-\frac{16}{x}\ln 16x+\frac{16}{x}+C$

D) $\frac{11}{x}\ln 11x-\frac{16}{x}+C$

E) $-\frac{11}{x}\ln 11x-\frac{11}{x}+C$

Ans: E

124. Use integration by parts to evaluate the integral $\int 9x\ln(9x)\,dx$.

A) $\frac{9}{4}x^2\left[2\ln(9x)+5\right]+C$

B) $\frac{9}{2}x^2\left[2\ln(9x)-3\right]+C$

C) $\frac{9}{4}x^2\left[2\ln(9x)-1\right]+C$

D) $\frac{9}{4}x^2\left[2\ln(9x)+3\right]+C$

E) $\frac{9}{2}x^2\left[2\ln(9x)+5\right]+C$

Ans: C

125. Use integration by parts to evaluate $\int \frac{x^3}{\sqrt{25-x^2}}\,dx$.

A) $-\frac{1}{2}\left(25+x^2\right)\sqrt{5-x^2}+C$

B) $-\frac{1}{2}\left(50+x^2\right)\sqrt{5-x^2}+C$

C) $-\frac{1}{2}\left(25+x^2\right)\sqrt{25-x^2}+C$

D) $-\frac{1}{3}\left(25+x^2\right)\sqrt{5-x^2}+C$

E) $-\frac{1}{3}\left(50+x^2\right)\sqrt{25-x^2}+C$

Ans: E

126. Use integration by parts to evaluate $\int x^2 e^{-7x} dx$. Note that evaluation may require integration by parts more than once.

A) $-\dfrac{\left(2+14x+49x^2\right)e^{-7x}}{343}+C$

B) $\dfrac{\left(1+14x-7x^2\right)e^{-7x}}{49}+C$

C) $-\dfrac{\left(2+21x+49x^2\right)e^{-7x}}{343}+C$

D) $\dfrac{\left(2-7x+49x^2\right)e^{-7x}}{49}+C$

E) $-\dfrac{\left(1-7x+49x^2\right)e^{-7x}}{-343}+C$

Ans: A

127. Use integration by parts to evaluate the integral $\int_0^4 5x^3 e^{x^2}$. Note that evaluation may require integration by parts more than once.

A) $\dfrac{75e^{16}+5}{2}$

B) $\dfrac{75e^{4}+5}{2}$

C) $\dfrac{85e^{4}+7}{2}$

D) $\dfrac{85e^{16}+7}{2}$

E) $\dfrac{75e^{4}+7}{2}$

Ans: A

128. Use integration by parts to evaluate the integral $\int 2e^{2x}\sqrt{e^x+9}$. Note that evaluation may require integration by parts more than once.

A) $\frac{4}{15}\left(e^x+12\right)^{5/2}\left(3e^x-18\right)+C$

B) $\frac{4}{15}\left(e^x+9\right)^{5/2}\left(3e^x+18\right)+C$

C) $\frac{4}{15}\left(e^x+12\right)^{3/2}\left(3e^x-18\right)+C$

D) $\frac{4}{15}\left(e^x+9\right)^{3/2}\left(3e^x-18\right)+C$

E) $\frac{4}{15}\left(e^x+12\right)^{3/2}\left(3e^x+18\right)+C$

Ans: D

129. Use integration by parts to evaluate $\int_1^2 (\ln x)^2 dx$. Note that evaluation may require integration by parts more than once.

A) $4\left(\ln 2\right)^2-8\ln 2+6$

B) $4\left(\ln 4\right)^2-8\ln 4+6$

C) $3\left(\ln 2\right)^2-6\ln 2+4$

D) $2\left(\ln 2\right)^2-4\ln 2+2$

E) $3\left(\ln 3\right)^2-6\ln 3+4$

Ans: D

130. Determine the most appropriate method or integral formula for evaluating the given integral. Next, evaluate the integral.

I. Integration by parts
II. $\int e^u du$
III. $\int \frac{du}{u}$
IV. $\int u^n du$

$$\int \frac{x^2 e^{x^3}}{5+e^{x^3}} dx$$

A) I. Integration by parts; $\frac{\left(-6-30x-75x^2+125x^3\right)e^{x^3}}{625}+C$
B) II. $\int e^u du$; $e^{x^3}+C$
C) III. $\int \frac{du}{u}$; $\frac{\ln\left(5+e^{x^3}\right)}{3}+C$
D) IV. $\int u^n du$; $\frac{5+e^{x^3}}{3}+C$
E) not integrable by any of the techniques we have studied
Ans: C

131. Evaluate the integral $\int 4e^x\sqrt{2e^x+2}$.
A) $\frac{8}{3}\sqrt{2e^x+5}+C$
B) $\frac{16}{3}\left(2e^x+2\right)^{3/2}+C$
C) $\frac{16}{3}\sqrt{2e^x+2}+C$
D) $\frac{16}{3}\left(2e^x+5\right)^{3/2}+C$
E) $\frac{8}{3}\left(2e^x+2\right)^{3/2}+C$
Ans: B

132. Determine the most appropriate method or integral formula for evaluating the given integral. Next, evaluate the integral.

I. Integration by parts
II. $\int e^u du$
III. $\int \frac{du}{u}$
IV. $\int u^n du$

$\int x^3 e^{-6x} dx$

A) I. Integration by parts; $\frac{\left(-1-6x-18x^2-36x^3\right)e^{-6x}}{216}+C$
B) II. $\int e^u du$; $e^{-6x}+C$
C) III. $\int \frac{du}{u}$; $\ln\left(-6+e^{-6x}\right)+C$
D) IV. $\int u^n du$ $-\frac{-6+e^{-6x}}{6}+C$
E) not integrable by any of the techniques we have studied
Ans: A

133. Determine the most appropriate method or integral formula for evaluating the given integral. Next, evaluate the integral.

I. Integration by parts
II. $\int e^u du$
III. $\int \frac{du}{u}$
IV. $\int u^n du$

$\int x^4 e^{x^5} dx$

A) I. Integration by parts; $\frac{\left(-6-54x-243x^2+729x^3\right)e^{x^5}}{6561}+C$
B) II. $\int e^u du$; $\frac{e^{x^5}}{5}+C$
C) III. $\int \frac{du}{u}$; $\ln\left(9+e^{x^5}\right)+C$
D) IV. $\int u^n du$; $\frac{9+e^{x^5}}{5}+C$
E) not integrable by any of the techniques we have studied
Ans: B

134. If the supply function for x units of a commodity is $p = 26 + 78\ln(2x+1)^2$ dollars, what is the producer's surplus at x = 30? Round your answer to two decimal places.
A) $4359.35
B) $3250.17
C) $31,293.24
D) $3406.17
E) $31,449.24
Ans: A

135. If the marginal cost function for x units of a product is $\overline{MC} = 5 + 8\ln(x+1)$ dollars per unit, and if the fixed cost is $100, find the total cost function.
A) $-3x + 5\ln(x+1) + 100$
B) $3x + 8(x+1)\ln(x+1) + 40$
C) $-3x + 8(x+1)\ln(x+1) + 100$
D) $-3x + 5(x+1)\ln(x+1) + 40$
E) $3x + 5(x+1)\ln(x+1) + 100$
Ans: C

136. Suppose that the profit from a machine's production can be considered as a continuous income stream with annual rate of flow at time t given by $f(t) = 11{,}000 - 500t$ (dollars per year). If money is worth 20%, compounded continuously, find the present value of this stream over the next 5 years. Round your answer to the nearest dollar.
A) $26,874
B) $39,367
C) $31,464
D) $27,785
E) $34,548
Ans: C

137. Suppose the Lorenz curve for the distribution of income of a certain country is given by $y = 7xe^{x-2.94591}$. Find the Gini coefficient of income. Round your answer to three decimal places.
A) 2.632
B) 2.896
C) 4.264
D) 5.632
E) 0.264
Ans: E

138. Suppose the income from an Internet access business is a continuous income stream with annual rate of flow given by $f(t) = 150te^{-0.5t}$ in thousands of dollars per year. Find the total income over the next 20 years.

A) $600 - \frac{7,600}{e^{11}}$ thousand dollars

B) $600 + \frac{6,600}{e^{12}}$ thousand dollars

C) $600 - \frac{6,600}{e^{10}}$ thousand dollars

D) $1,600 - \frac{7,600}{e^{10}}$ thousand dollars

E) $1,600 + \frac{6,600}{e^{11}}$ thousand dollars

Ans: C

139. With data for 1990 to 2002, the total receipts for world tourism (in billions of dollars per year) can be modeled by the function $R(t) = -53.846 + 194.7 \ln t$ where t = 0 represents 1985. Find the predicted total receipts for world tourism for the decade from 2013 to 2023. Round your answer to one decimal place.

A) $4002.3 billion
B) $18,479.5 billion
C) $6261.7 billion
D) $11,463.6 billion
E) $14,938.3 billion
Ans: C

140. With the data for selected years from 1920 to 2007, the life span of individuals in a country can be modeled by $L(x) = 13.96 + 15.32 \ln x$ where x = 0 represents 1900. Find the predicted average life span from 2040 to 2055. Round your answer to the nearest year.

A) 128.58 years
B) 146.66 years
C) 90.46 years
D) 289.42 years
E) 50.19 years
Ans: C

141. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_1^{\infty} \frac{1}{x^3}\, dx$$

A) $\frac{1}{4}$
B) 4
C) 3
D) $\frac{1}{2}$
E) diverges
Ans: D

142. Evaluate the integral $\int_{13}^{\infty} \frac{dx}{(x-9)^3}$.

A) $-\frac{3}{256}$
B) $\frac{3}{256}$
C) $\frac{1}{32}$
D) $-\frac{1}{32}$
E) integral diverges
Ans: C

143. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_1^{\infty} \frac{1}{\sqrt[4]{x}}\, dx$$

A) $\sqrt[4]{5}$
B) 1
C) 4
D) 5
E) diverges
Ans: E

144. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_1^{\infty} x^6 e^{x^7}\, dx$$

A) e^7
B) $\frac{e^7}{6}$
C) e^6
D) $\frac{e^7}{7}$
E) diverges
Ans: E

145. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_{-\infty}^{-2} \frac{x}{\sqrt[11]{x^2-1}}\, dx$$

A) $\sqrt[11]{5}$
B) $11\ln(5)$
C) $11\ln(3)$
D) $\sqrt[11]{3}$
E) diverges
Ans: E

146. Evaluate the integral $\int_{-\infty}^{2} 4x^2 e^{-x^3}\, dx$.

A) 0
B) $-\frac{1}{3}$
C) $\frac{1}{3}$
D) $\frac{e^{-2}}{3}$
E) integral diverges
Ans: E

147. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_{-\infty}^{0} \frac{x}{(x^2+1)^{12}}dx$$

A) $\frac{1}{11}$
B) $-\frac{1}{22}$
C) $-\frac{1}{33}$
D) $-\frac{1}{11}$
E) diverges
Ans: B

148. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_{-\infty}^{-2} \frac{9x^7}{x^8+1}dx$$

A) $\ln 257$
B) $\ln 8$
C) $9\ln 8$
D) $9\ln 257$
E) diverges
Ans: E

149. Evaluate the improper integral if it converges, or state that it diverges.

$$\int_{-\infty}^{\infty} \frac{7x}{(x^2+1)^8}dx$$

A) 1
B) 0
C) $-\frac{7}{15}$
D) $\frac{7}{17}$
E) diverges
Ans: B

150. Evaluate the integral $\int_{-\infty}^{\infty} 4x^3 e^{-x^4}\,dx$.

A) 0
B) $-\frac{1}{4}$
C) $\frac{1}{4}$
D) $\frac{e^{-3}}{4}$
E) integral diverges
Ans: A

151. For what value of c does $\int_3^{\infty} \frac{c}{x^2}dx = 1$?

A) 6
B) 81
C) –3
D) 3
E) –81
Ans: D

152. Find the area, if it exists, of the region under the graph of $y = \frac{x}{e^{x^2}}$ and to the right of $x = 2$.

A) $\frac{2}{e^4}$
B) $\frac{1}{2e^4}$
C) $-\frac{1}{2e^4}$
D) $-\frac{2}{e^4}$
E) does not exist
Ans: B

153. Find the area, if it exists, of the region under the graph of $y = f(x)$ and to the right of $x = 1$.

$f(x) = \dfrac{1}{x\sqrt[2]{x}}$

A) 4
B) 5
C) 3
D) 2
E) does not exist
Ans: D

154. For what value of a is $f(x) = \begin{cases} ae^{-9t} & \text{if } t \geq 0 \\ 0 & \text{if } t < 0 \end{cases}$ a probability density function?

A) 1
B) 9
C) –9
D) $\dfrac{1}{9}$
E) $-\dfrac{1}{9}$
Ans: B

155. For what value of c is the function $f(x) = \begin{cases} c/x^3 & \text{if } x \geq 50 \\ 0 & \text{otherwise} \end{cases}$ a probability density function?

A) 500
B) 250
C) 10,000
D) 1,000
E) 5,000
Ans: E

156. Find the mean of the probability distribution if the probability density function is $f(x) = \begin{cases} \dfrac{450}{x^3} & \text{if } x \geq 15 \\ 0 & \text{otherwise} \end{cases}$.

A) 6,750
B) 2
C) 30
D) 15
E) 45
Ans: C

157. In a manufacturing process involving several machines, the average down time t (in hours) for a machine that needs repair has the probability density function $f(t) = 0.8e^{-0.8t}$, $t \geq 0$. Find the probability that a failed machine's down time is 4 hours or more. Round your answer to three decimal places.
A) 0.959
B) 0.999
C) 0.051
D) 0.041
E) 0.001
Ans: D

158. The probability density function for the life span of an electronics part is $f(t) = 0.09e^{-0.09t}$, where t is the number of months in service. Find the probability that any given part of this type lasts longer than 20 months. Round your answer to three decimal places.
A) 0.1653
B) 0.8347
C) 0.1511
D) 0.8489
E) 0.1753
Ans: A

159. Suppose that the output of the machinery in a factory can be considered as a continuous income stream with an annual rate of flow at time t given by $f(t) = 530e^{-0.12t}$ in thousands of dollars per year. If the annual interest rate is 4% compounded continuously, find the capital value of the machinery.
A) $\$4,968,750$
B) $\$1,325,000$
C) $\$2,208,333$
D) $\$7,287,500$
E) $\$3,312,500$
Ans: E

160. A transmission repair firm that wants to offer a lifetime warranty on its repairs has determined that the probability density function for transmission failure after repair is $f(t) = 0.25e^{-0.25t}$, where t is the number of months after repair. What is the probability that a transmission chosen at random will last more than 4 months? Round to 3 decimal places.
A) 0.258
B) 0.184
C) 0.368
D) 0.405
E) 0.331
Ans: C

161. Suppose that the rate at which a nuclear power plant produces radioactive waste is proportional to the number of years it has been operating, according to $f(t) = 257.64t$, in pounds per year. Suppose also that the waste decays exponentially at a rate of 6% per year. Then the amount of radioactive waste that will accumulate in *b* years is given by $\int_0^b 257.64te^{-0.06(b-t)}dt$. Evaluate this integral.

A) $\frac{257.64}{0.0036}\left(0.06b - 1 + e^{-0.06b}\right)$

B) $\frac{257.64}{0.0036}\left(0.06b - 1 + e^{0.06b}\right)$

C) $\frac{0.06}{257.64}\left(0.06b - 1 + e^{-0.06b}\right)$

D) $\frac{257.64}{0.06}\left(0.06b + e^{0.06b}\right)$

E) $\frac{0.0036}{257.64}\left(0.06b + e^{-0.06b}\right)$

Ans: A

162. Suppose that the rate at which a nuclear power plant produces radioactive waste is proportional to the number of years it has been operating, according to $f(t) = 601.4t$, in pounds per year. Suppose also that the waste decays exponentially at a rate of 4% per year. Then the amount of radioactive waste that will accumulate in *b* years is given by $\int_0^b 601.4te^{-0.04(b-t)}dt$ and this integral evaluates to $\frac{601.4}{0.0016}\left(0.04b - 1 + e^{-0.04b}\right)$. How much waste will accumulate in the long run? Take the limit as $b \to \infty$ in the integral evaluated. Round your answer to the nearest pound, if it exists.

A) Approximately 375,875 pounds of waste will accumulate in the long run.

B) Approximately 15,035 pounds of waste will accumulate in the long run.

C) Approximately 360,840 pounds of waste will accumulate in the long run.

D) 0 (No waste will accumulate in the long run.)

E) ∞ (Waste is produced more rapidly than existing waste decays.)

Ans: E

163. For the interval $[-5, 2]$ and for $n = 4$, find *h*.

A) $-\frac{3}{4}$

B) $\frac{7}{4}$

C) $\frac{1}{4}$

D) $-\frac{5}{4}$

E) $\frac{1}{2}$

Ans: B

164. For the interval $[-7, 5]$ and $n = 4$, find the values of $x_0, x_1, \ldots x_n$.

A) $x_0 = -7,\ x_1 = -4,\ x_2 = -1,\ x_3 = 2$

B) $x_0 = -4,\ x_1 = -1,\ x_2 = 2,\ x_3 = 5$

C) $x_0 = -7,\ x_1 = -3,\ x_2 = 1,\ x_3 = 5$

D) $x_0 = -7,\ x_1 = -3,\ x_2 = -1,\ x_3 = 1,\ x_4 = 5$

E) $x_0 = -7,\ x_1 = -4,\ x_2 = -1,\ x_3 = 2,\ x_4 = 5$

Ans: E

165. Use the Trapezoidal Rule to approximate $\int_4^7 3x^3 dx$ with $n = 10$. Round your answer to two decimal places.

A) 1794.13
B) 2413.13
C) 1610.98
D) 3038.81
E) 1491.11
Ans: C

166. Use Simpson's Rule to approximate $\int_4^8 4x^4 dx$ with $n = 8$. Round your answer to two decimal places.

A) 29,896.50
B) 25,395.33
C) 25,544.50
D) 46,737.00
E) 22,792.33
Ans: B

167. Evaluate the integral $\int_1^8 2x^3 dx$ by integration. Round your answer to two decimal places.

A) 63.00
B) 2,047.50
C) 378.00
D) 24,570.00
E) 1,200.50
Ans: B

168. Use the Trapezoidal Rule to approximate $\int_4^6 x^{\frac{1}{4}} dx$ with $n = 6$. Round your answer to two decimal places.

A) 3.48
B) 2.66
C) 4.48
D) 5.48
E) 2.99
Ans: E

169. Use Simpson's Rule to approximate $\int_{2}^{7} 3x^{\frac{1}{4}} dx$ with $n = 10$. Round your answer to two decimal places.
A) 23.72
B) 21.62
C) 21.61
D) 41.11
E) 20.20
Ans: B

170. Evaluate the integral $\int_{4}^{7} 5x^{\frac{1}{3}}$ by integration. Round your answer to two decimal places.
A) 82.50
B) 26.40
C) 0.80
D) 11.73
E) 16.23
Ans: B

171. Approximate the given integral by using the Trapezoidal Rule with $n = 4$. Round your answer to 3 decimal places.

$$\int_{2}^{4} \frac{dx}{\sqrt{4x^3+1}}$$

A) 0.208
B) 0.314
C) 0.831
D) 0.416
E) 0.157
Ans: A

172. Use Simpson's Rule to approximate $\int_{0}^{2} e^{-x^2} dx$ with $n = 6$. Round your answer to three decimal places.
A) 1.051
B) 0.882
C) 0.881
D) 1.593
E) 0.768
Ans: B

173. Use the Trapezoidal Rule to approximate $\int_0^7 \ln\left(5x^2 - 2x + 1\right) dx$ with $n = 10$. Round your answer to three decimal places.

A) 26.641
B) 24.707
C) 23.491
D) 47.562
E) 24.734
Ans: E

174. Use Simpson's Rule to approximate $\int_0^4 \ln\left(x^2 - 2x + 2\right) dx$ with $n = 4$. Round your answer to three decimal places.

A) 3.607
B) 3.800
C) 2.996
D) 6.103
E) 5.298
Ans: A

175. Approximate the given integral by Simpson's Rule with n=4. Round your answer to 3 decimal places.

$\int_6^{10} \ln\,(x^2 + x + 2) dx$

A) 34.275
B) 17.147
C) 12.86
D) 25.72
E) 8.569
Ans: B

176. Use the table values and apply the Simpson's Rule to approximate $\int_{1.0}^{8.2} f(x)\, dx$ to one decimal place.

x	*f(x)*
1.0	1.9
2.2	0.3
3.4	0.5
4.6	0.7
5.8	0.1
7.0	0.1
8.2	0.2

A) 2.5
B) 2.2
C) 1.8
D) 2.6
E) 3.0
Ans: D

177. Use the table of values to approximate $\int_0^{1.8} f(x)\,dx$. Use Simpson's Rule and round your answers to one decimal place.

x	$f(x)$
0	8.5
0.3	4.6
0.6	3.9
0.9	0
1.2	4.2
1.5	7.4
1.8	9.4

A) 49.3
B) 24.6
C) 16.4
D) 8.2
E) 2.7
Ans: D

178. The production from a particular assembly line is considered a continuous income stream with annual rate of flow given by $f(t) = 90\frac{e^{0.05t}}{t+1}$ (in thousands of dollars per year). Use Simpson's Rule with $n = 4$ to approximate the total income to 2 decimal places over the first 2 years, given by $\text{Total income} = \int_0^2 90\frac{e^{0.05t}}{t+1}\,dt$.

A) $\$103,176.75$
B) $\$237,306.51$
C) $\$60,692.20$
D) $\$319,847.91$
E) $\$144,447.44$
Ans: A

179. Suppose that the demand for q units of a certain product at $\$p$ per unit is given by $p = 940 + \frac{200}{q^2+1}$. Use Simpson's Rule with $n = 4$ to approximate the average price as demand ranges from 2 to 7 items to the nearest cent.
A) $\$952.96$
B) $\$953.65$
C) $\$4,764.79$
D) $\$4,768.23$
E) $\$3,969.99$
Ans: A

180. Consider the following supply and demand schedules, with p in dollars and x as the number of units.

Supply Schedule		Demand Schedule	
x	p	x	p
0	120	0	900
10	250	10	800
20	310	20	700
30	440	30	580
40	490	40	490
50	590	50	410

Use Simpson's Rule to approximate the producer's surplus at market equilibrium to 2 decimal places. Note that market equilibrium can be found from the tables.

A) $6,300.00

B) $23,766.67

C) $15,800.00

D) $27,700.00

E) $13,300.00

Ans: A

181. Suppose the following table gives the supply and demand schedules, with p in dollars and x as the number of units. Use Simpson's Rule to approximate the consumer's surplus at market equilibrium. Note that market equilibrium can be found from the tables.

Supply	Schedule	Demand	Schedule
x	p	x	p
0	120	0	2400
10	260	10	1550
20	380	20	1200
30	450	30	940
40	540	40	805
50	630	50	731
60	680	60	680
70	720	70	650

A) $32,438

B) $25,780

C) $28,413

D) $12,460

E) $30,213

Ans: B

182. Suppose that the rate of production of a product (in units per week) is measured at the end of each of the first 5 weeks after start-up, and the following data are obtained. Use the Trapezoidal Rule to approximate the total number of units produced in the first 5 weeks. Round your answer to two decimal places.

Weeks t	0	1	2	3	4	5
Rate $R(t)$	350.0	297.8	195.6	293.1	291.6	289.5

A) 1423.75 units
B) 2074.05 units
C) 611.75 units
D) 1667.20 units
E) 733.25 units
Ans: A

183. The manufacturer of a medicine wants to test how a new 300-milligram capsule is released into the bloodstream. After a volunteer is given a capsule, blood samples are drawn every half-hour, and the number of milligrams of the drug in the bloodstream is calculated. The results obtained are as follows.

Time t (hr)	**$N(t)$ (mg)**
0	0
.5	246.7
1	267.1
1.5	235.3
2	179
2.5	112.4

Use the trapezoidal rule to approximate the *average* number of milligrams in the bloodstream during the first $2\frac{1}{2}$ hours and round your answer to 2 decimal places.

A) 452.78 mg
B) 196.86 mg
C) 123.04 mg
D) 255.92 mg
E) 334.66 mg
Ans: B

184. The following income distribution data define points on Lorenz curves, where x represents the fraction of a certain country's population and $L(x)$ the cumulative percent of income held by fraction x. Use this data and a numerical method to evaluate $2\int_0^1 [x - L(x)]dx,$ and hence to find the Gini coefficient of income for this country in 1995 and 2003. Round your answers to 3 decimal places.

	x					
	0.0	**0.2**	**0.4**	**0.6**	**0.8**	**1.0**
***L*(*x*) for Americans**						
1995	0	3.8	12.8	29.3	53.5	100
2003	0	2.6	11.2	26.7	50.4	100

A) 1995: 0.523
2003: 0.567

B) 1995: 0.483
2003: 0.524

C) 1995: 0.402
2003: 0.436

D) 1995: 0.287
2003: 0.611

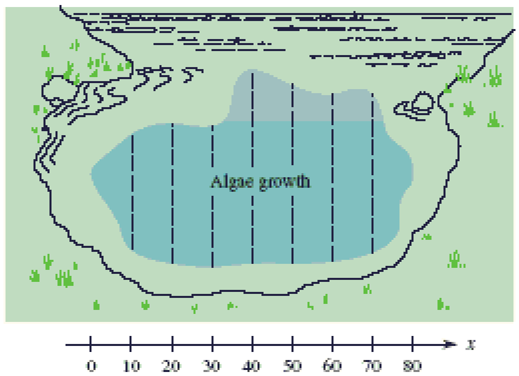
E) 1995: 0.335
2003: 0.364

Ans: C

185. The presence of phosphates in certain waste products dumped into a lake promotes the growth of algae. Rampant growth of algae affects the oxygen supply in the water, so an environmental group wishes to estimate the area of algae growth. Group members measure across the algae growth (see the Figure) and obtain the following data (in feet).

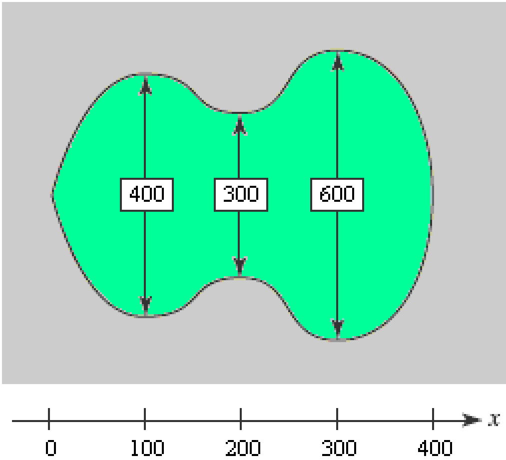
x	**Width** w	x	**Width** w
0	0	50	28
10	14	60	20
20	20	70	22
30	20	80	0
40	32		

Use Simpson's Rule to approximate the area of the algae growth and round your answer to the nearest square foot.



A) 1143 sq ft
B) 1600 sq ft
C) 2720 sq ft
D) 2080 sq ft
E) 3680 sq ft
Ans: B

186. Suppose a land developer is planning to dig a small lake and build a group of homes around it. To estimate the cost of the project, the area of the lake must be calculated from the proposed measurements (in feet) given in the following figure and in the table. Use Simpson's Rule to approximate the area of the lake. Round your answer to two decimal places.



x	0	100	200	300	400
Width $w(x)$	0	400	300	600	0

A) 92,000.00 sq ft
B) 153,333.33 sq ft
C) 73,600.00 sq ft
D) 173,333.33 sq ft
E) 85,333.33 sq ft
Ans: B

