Classroom Voting Questions: Calculus II

Section 5.1: How Do We Measure Distance Traveled?

1. **True or False** The left-sum always underestimates the area under the curve.

2. **True or False** Averaging the left- and right-sums always improves your estimate.

3. **True or False** Small rectangles will always result in a better estimation.

4. Consider the graph in Figure 5.1. On which interval is the left-sum approximation of the area under the curve on that interval an overestimate?

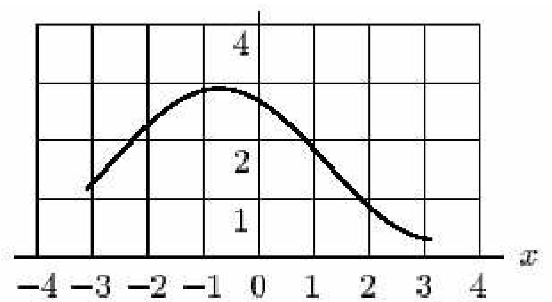


Figure 5.1

   (a) $[-3, -1]$
   (b) $[-2, 0]$
   (c) $[0, 3]$

5. The velocities of two cars are given in Figure 5.2. Assuming that the cars start at the same place, when does Car 2 overtake Car 1?

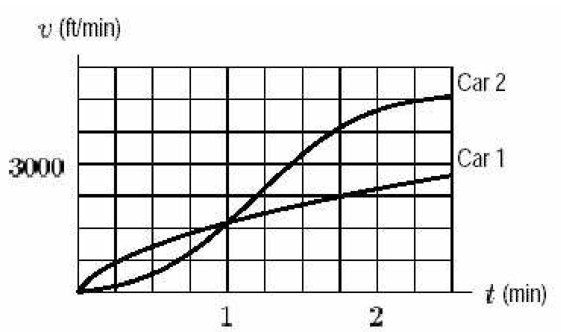


Figure 5.2

(a) Between 0.75 and 1.25 minutes

(b) Between 1.25 and 1.75 minutes

(c) Between 1.75 and 2.25 minutes

6. You are taking a long road trip, and you look down to check your speed every 15 minutes. At 2:00 you are going 60 mph, at 2:15 you are going up a hill at 45 mph, at 2:30 you are going 65 mph, at 2:45 you are going through a canyon at 50 mph, and at 3:00 you are going 70 mph. Assume that in each 15-minute interval you are either always speeding up or always slowing down.

   Using left-hand sums, how far would you estimate that you went between 2:00 and 3:00?

   (a) $(1/4)60 + (1/4)45 + (1/4)65 + (1/4)50 + (1/4)70$

   (b) $(1/4)60 + (1/4)45 + (1/4)65 + (1/4)50$

   (c) $(1/4)45 + (1/4)65 + (1/4)50 + (1/4)70$

   (d) $(1/4)60 + (1/4)65 + (1/4)65 + (1/4)70$

   (e) $(1/5)60 + (1/5)45 + (1/5)65 + (1/5)50 + (1/5)70$

7. You are taking a long road trip, and you look down to check your speed every 15 minutes. At 2:00 you are going 60 mph, at 2:15 you are going up a hill at 45 mph, at 2:30 you are going 65 mph, at 2:45 you are going through a canyon at 50 mph, and at 3:00 you are going 70 mph. Assume that in each 15-minute interval you are either always speeding up or always slowing down.

   Using right-hand sums, how far would you estimate that you went between 2:00 and 3:00?

   (a) $(1/4)60 + (1/4)45 + (1/4)65 + (1/4)50 + (1/4)70$

   (b) $(1/4)60 + (1/4)45 + (1/4)65 + (1/4)50$

   (c) $(1/4)45 + (1/4)65 + (1/4)50 + (1/4)70$

   (d) $(1/4)60 + (1/4)65 + (1/4)65 + (1/4)70$

8. You are taking a long road trip, and you look down to check your speed every 15 minutes. At 2:00 you are going 60 mph, at 2:15 you are going up a hill at 45 mph, at 2:30 you are going 65 mph, at 2:45 you are going through a canyon at 50 mph, and at 3:00 you are going 70 mph. Assume that in each 15-minute interval you are either always speeding up or always slowing down.

   What would be your estimate of the maximum possible distance that you could have traveled between 2:00 and 3:00?

   (a) $(1/4)60 + (1/4)45 + (1/4)65 + (1/4)50 + (1/4)70$

(b) 1/4)60 + (1/4)45 + (1/4)65 + (1/4)50

(c) (1/4)45 + (1/4)65 + (1/4)50 + (1/4)70

(d) (1/4)60 + (1/4)65 + (1/4)65 + (1/4)70

9. The table below gives a cars velocity, v, in miles per hour, with time, t, in minutes. In each of the four fifteen-minute intervals, the car is either always speeding up or always slowing down. The cars route is a straight line with four towns on it. Town A is 60 miles from the starting point, town B is 70 miles from the starting point, town C is 73 miles from the starting point, and town D is 80 miles from the starting point.

t (minutes)	0	15	30	45	60
v (miles per hour)	60	75	72	78	65

We know the car is

(a) between towns A and B.

(b) between towns B and C.

(c) between towns C and D.

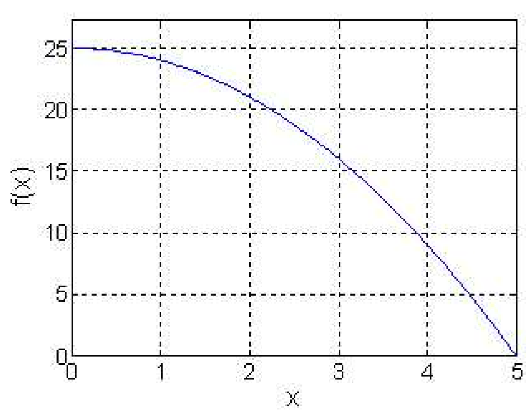
(d) between towns A and D, but cant define more clearly.

(e) past town D.

(f) None of the above.

Section 5.2 The Definite Integral

10. Which of the following is the best estimate of $\int_0^3 f(x)dx$, where $f(x)$ is given in the figure below?

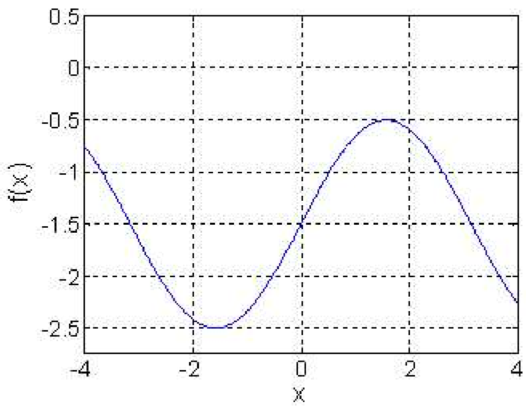


(a) 13

(b) 17

(c) 65
(d) 85

11. Which of the following is the best estimate of $\int_{-2}^{2} f(x)dx$, where $f(x)$ is given in the figure below?



(a) -4
(b) -6
(c) 3
(d) 6
(e) 12

12. Make a sketch of the function $f(x) = \cos x$ and decide whether $\int_{-1.5}^{0} f(x)dx$ is:

(a) Positive
(b) Negative
(c) Zero

13. Make a sketch of the function $f(x) = -x^3$ and decide whether $\int_{-5}^{5} f(x)dx$ is:

(a) Positive
(b) Negative
(c) Zero

14. **True or False:** If a piece of string has been chopped into n small pieces and the i^{th} piece is Δx_i inches long, then the total length of the string is exactly $\sum_{i=1}^{n} \Delta x_i$.

15. You want to estimate the area underneath the graph of a positive function by using four rectangles of equal width. The rectangles that must give the best estimate of this area are those with height obtained from the:

    (a) Left endpoints

    (b) Midpoints

    (c) Right endpoints

    (d) Not enough information

16. Suppose you are slicing an 11-inch long carrot REALLY thin from the greens end to the tip of the root. If each slice has a circular cross section $f(x) = \pi[r(x)]^2$ for each x between 0 and 11, and we make our cuts at $x_1, x_2, x_3, \ldots, x_n$ then a good approximation for the volume of the carrot is

    (a) $\sum_{i=1}^{n} f(x_i)x_i$

    (b) $\sum_{i=1}^{n}[f(x_{i+1} - f(x_i)]x_i$

    (c) $\sum_{i=1}^{n} f(x_i)[x_{i+1} - x_i]$

    (d) None of the above.

17. Let f be a continuous function on the interval $[a, b]$.

    True or False: $\lim_{n\to\infty} \sum_{i=1}^{n} f(x_i^*)\Delta x_i$ may lead to different limits if we choose the x_i^* to be the left-endpoints instead of midpoints.

Section 5.3 The Fundamental Theorem and Interpretations

18. On what interval is the average value of $\sin x$ the smallest?

    (a) $0 \leq x \leq \frac{\pi}{2}$

    (b) $\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}$

    (c) $0 \leq x \leq \pi$

    (d) $0 \leq x \leq \frac{3\pi}{2}$

19. Water is pouring out of a pipe at the rate of $f(t)$ gallons/minute. You collect the water that flows from the pipe between $t = 2$ minutes and $t = 4$ minutes. The amount of water you collect can be represented by:

(a) $\int_2^4 f(x)dx$

(b) $f(4) - f(2)$

(c) $(4-2)f(4)$

(d) the average of $f(4)$ and $f(2)$ times the amountof time that elapsed

20. If $f(t)$ is measured in gallons/minute and t is measured in minutes, what are the units of $\int_2^4 f(t)dt$?

(a) gallons/minute

(b) gallons

(c) minutes

(d) gallons/minute/minute

21. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity is as shown in the graph, where positive velocities indicate travel toward the east, and negative velocities indicate travel toward the west. On what time intervals is she stopped?

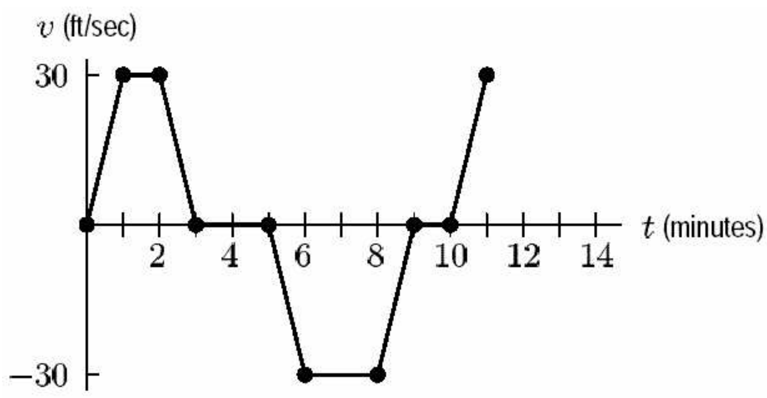


Figure 5.6

(a) $[1, 2]$, $[3, 5]$, $[6, 8]$, and $[9, 10]$

(b) $[3, 5]$ and $[9, 10]$

22. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity is as shown in the graph, where positive velocities indicate travel toward the east, and negative velocities indicate travel toward the west. How far from home is she the first time she stops, and in what direction?

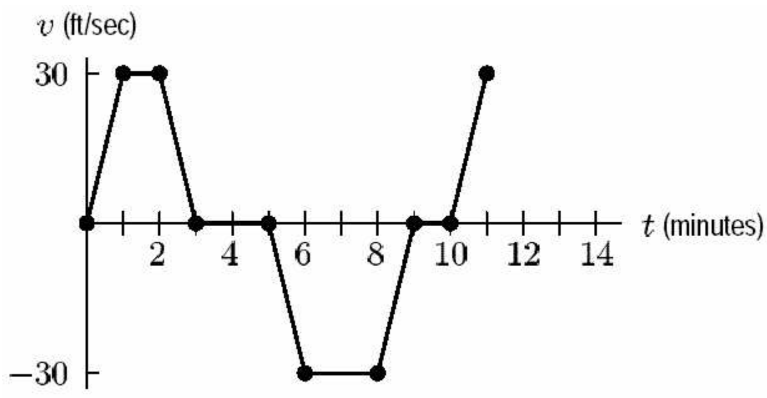


Figure 5.6

(a) 3 feet east

(b) 3 feet west

(c) 60 feet east

(d) 60 feet west

(e) 90 feet east

(f) 90 feet west

(g) 3600 feet east

(h) 3600 feet west

23. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity is as shown in the graph, where positive velocities indicate travel toward the east, and negative velocities indicate travel toward the west. At what time does she bike past her house?

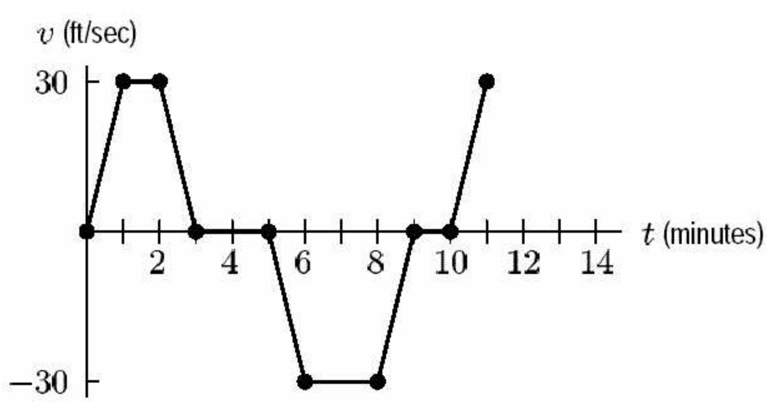


Figure 5.6

(a) 3 minutes

(b) 7.5 minutes

(c) 9 minutes

(d) never

24. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity as a function of time is given by $v(t)$. What does $\int_0^{11} v(t)dt$ represent?

(a) The total distance the bicyclist rode in eleven minutes

(b) The bicyclists average velocity over eleven minutes

(c) The bicyclist's distance from the home after eleven minutes

(d) None of the above

25. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity as a function of time is given by $v(t)$. What does $\int_0^{11} |v(t)|dt$ represent?

(a) The total distance the bicyclist rode in eleven minutes

(b) The bicyclist's average velocity over eleven minutes

(c) The bicyclist's distance from the home after eleven minutes

(d) None of the above.

26. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity as a function of time is given by $v(t)$. What does $\frac{1}{11}\int_0^{1} 1v(t)dt$ represent?

(a) The total distance the bicyclist rode in eleven minutes

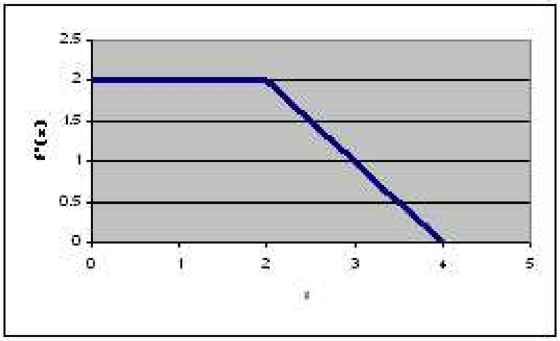
(b) The bicyclists average velocity over eleven minutes

(c) The bicyclist's distance from the home after eleven minutes

(d) None of the above.

Section 5.4 Theorems About Definite Integrals

27. The graph shows the *derivative* of a function f. If $f(0) = 3$, what is $f(2)$?



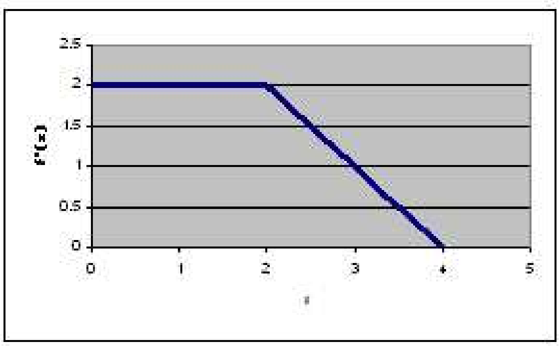
(a) 2

(b) 4

(c) 7

(d) None of the above

28. The graph shows the *derivative* of a function f. Which is greater?



(a) $f(2) - f(0)$

(b) $f(3) - f(1)$

(c) $f(4) - f(2)$

29. Suppose f is a differentiable function. Then $\int_0^5 f'(t)dt = f(5)$

(a) Always

(b) Sometimes

(c) Never

30. If f is continuous and $f(x) < 0$ for all x in $[a, b]$, then $\int_a^b f(x)dx$

(a) must be negative

(b) might be 0

(c) not enough information

31. Let f be a continuous function on the interval $[a, b]$. **True or False:** There exist two constants m and M, such that

$$m(b-a) \leq \int_a^b f(x)dx \leq M(b-a).$$

32. You are traveling with velocity $v(t)$ that varies continuously over the interval $[a, b]$ and your position at time t is given by $s(t)$. Which of the following represent your average velocity for that time interval:

I.

$$\frac{\int_a^b v(t)dt}{b-a}$$

II.

$$\frac{s(b)-s(a)}{b-a}$$

III. $v(c)$ for at least one c between a and b

(a) I, II, and III

(b) I only

(c) I and II only

(d) II only

(e) II and III only

33. **True or False:** $\int_0^2 f(x)dx = \int_0^2 f(t)dt$

34. **True or False:** If $a = b$ then $\int_a^b f(x)dx = 0$.

35. **True or False:** If $a \neq b$ then $\int_a^b f(x)dx \neq 0$.

36. **True or False:** If $a \neq b$ and if $\int_a^b f(x)dx = 0$.then $f(x) = 0$.

37. **True or False:** If $a \neq b$ and if $\int_a^b |f(x)|dx = 0$.then $f(x) = 0$.

38. **True or False:** If $\int_0^2 f(x)dx = 3$ and $\int_2^4 f(x)dx = 5$, then $\int_0^4 f(x)dx = 8$.

39. Given that $\int_0^2 f(x)dx = 3$ and $\int_2^4 f(x)dx = 5$, what is $\int_0^2 f(2x)dx$?

    (a) 3/2
    (b) 3
    (c) 4
    (d) 6
    (e) 8
    (f) Cannot be determined

40. **True or False:** If $\int_0^2 (f(x) + g(x))dx = 10$ and $\int_0^2 f(x)dx = 3$, then $\int_0^2 g(x)dx = 7$.

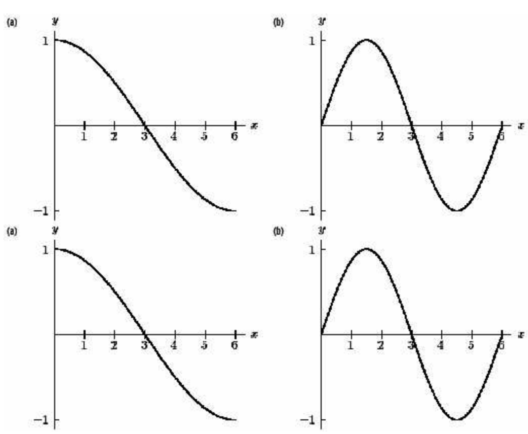
41. **True or False:** $\int_1^2 f(x)dx + \int_2^3 g(x)dx = \int_1^3 (f(x) + g(x))dx$.

42. **True or False:** If $f(x) \leq g(x)$ for $2 \leq x \leq 6$, then $\int_2^6 f(x)dx \leq \int_2^6 g(x)dx$.

43. **True or False:** If $\int_2^6 f(x)dx \leq \int_2^6 g(x)dx$, then $f(x) \leq g(x)$ for $2 \leq x \leq 6$.

Section 6.1 Antiderivatives Graphically and Numerically

44. Which of the graphs (a-d) could represent an antiderivative of the function shown in Figure 6.1.



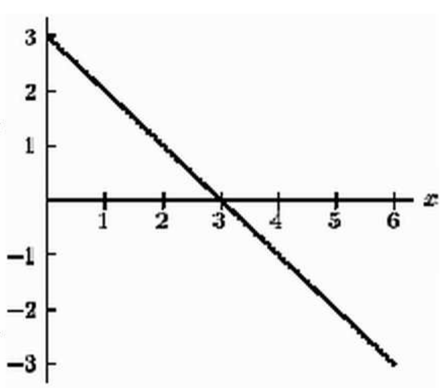
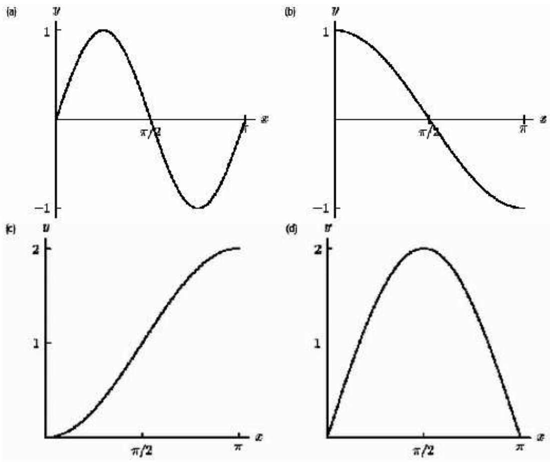


Figure 6.1

45. Which of the graphs (a-d) could represent an antiderivative of the function shown in Figure 6.2.



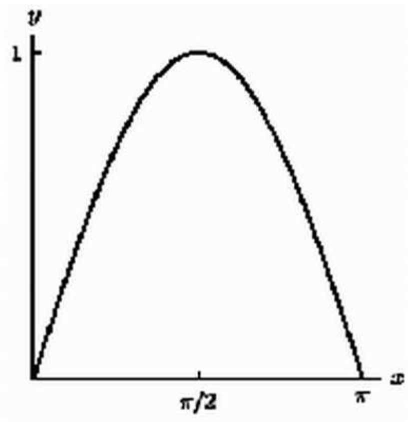


Figure 6.2

46. Consider the graph of $f'(x)$ shown below. Which of the functions with values from the table could represent $f(x)$?

Table 6.1

	x	0	2	4	6
(a)	$g(x)$	1	3	4	3
(b)	$h(x)$	5	7	8	7
(c)	$j(x)$	32	34	35	34
(d)	$k(x)$	−9	−7	−6	−7

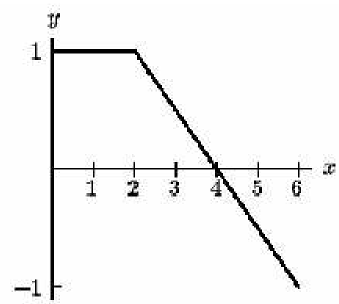


Figure 6.4

1. (a) only
2. (a), (b), and (c) only
3. All of them
4. None of them

47. Figure 6.4 shows $f'(x)$. If $f(2) = 5$, what is $f(0)$?

Table 6.1

	x	0	2	4	6
(a)	$g(x)$	1	3	4	3
(b)	$h(x)$	5	7	8	7
(c)	$j(x)$	32	34	35	34
(d)	$k(x)$	−9	−7	−6	−7

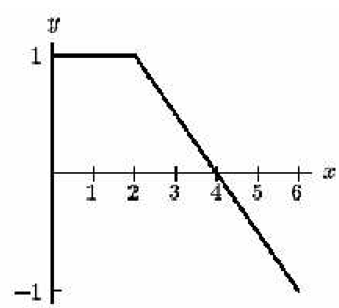


Figure 6.4

(a) 0
(b) 3
(c) 7
(d) Cant tell

48. The graph of f is given below. Let $F'(x) = f(x)$. Where does F have critical points?

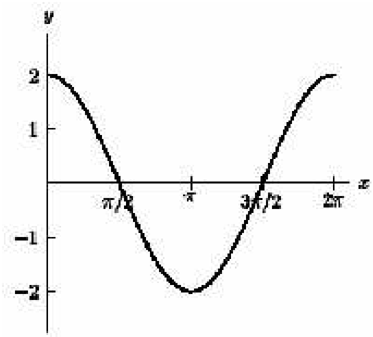


Figure 2.9

(a) $x = 0, \pi, 2\pi$
(b) $x = \pi$
(c) $x = \pi/2, 3\pi/2$
(d) None of the above

49. The graph of f is given below. Let $F'(x) = f(x)$. Where does F have a global max on $[0, 2\pi]$?

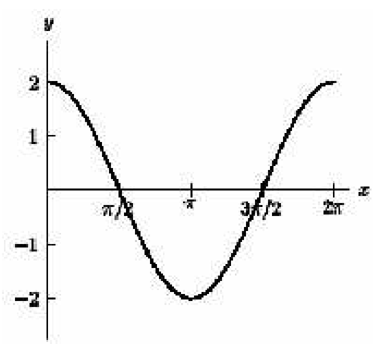
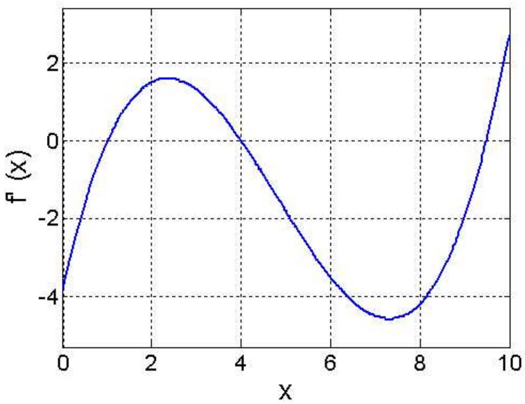


Figure 2.9

(a) $x = 0$
(b) $x = \pi/2$
(c) $x = \pi$
(d) $x = 3\pi/2$

(e) $x = 2\pi$

50. The derivative, f', of a function f is plotted below. At approximately what value of x does f reach a maximum, on the range $[0, 10]$?



(a) 1

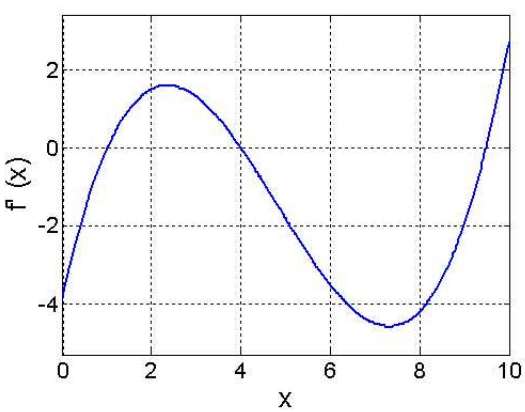
(b) 2.5

(c) 4

(d) 7

(e) 9.5

51. The derivative, f', of a function f is plotted below. If we know that the maximum value of f on this range is 20, what is $f(9.5)$?



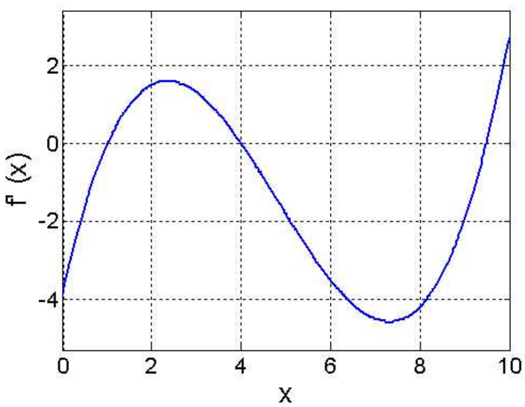
(a) $f(9.5) \approx 6$

(b) $f(9.5) \approx 14$

(c) $f(9.5) \approx -14$

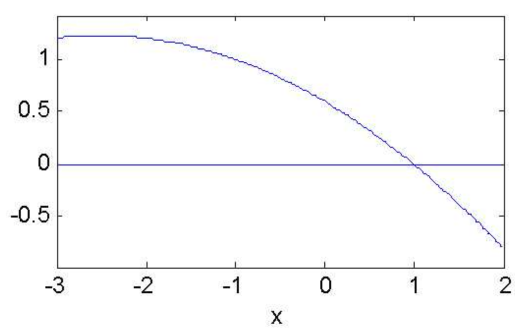
(d) $f(9.5) \approx 34$

52. The derivative, f', of a function f is plotted below. When is f concave up?



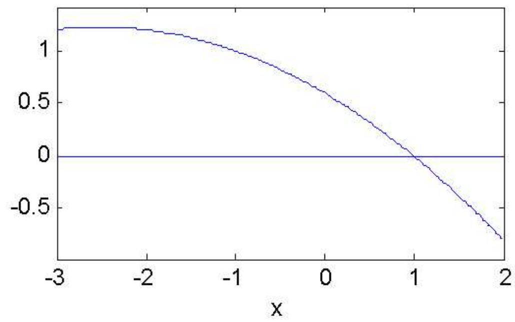
(a) $x > 5$
(b) $x < 5$
(c) $x < 2.5$ and $x > 7.5$
(d) $2.5 < x < 7.5$
(e) $1 < x < 4$ and $x > 9.5$

53. The graph below shows the second derivative, f'' of a function, and we know $f(1) = 3$ and $f'(1) = 0$. Is $f'(2)$ positive or negative?



(a) $f'(2) > 0$
(b) $f'(2) < 0$
(c) It is impossible to tell without further information.

54. The graph below shows the second derivative, f'' of a function, and we know $f(1) = 3$ and $f'(1) = 0$. Is $f(-3)$ bigger than 3 or smaller than 3?

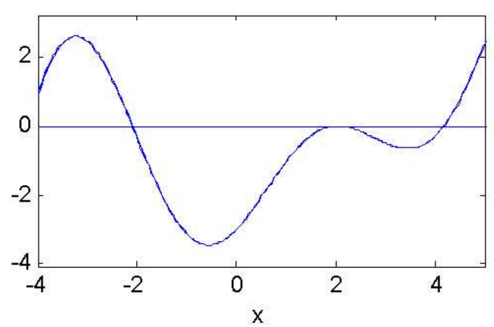


(a) $f(-3) > 3$

(b) $f(-3) < 3$

(c) It is impossible to tell without further information.

55. The figure below is the graph of $f'(x)$. Where is the global maximum of f on $[-4, 4]$?



(a) $x = -3.2$

(b) $x = -2$

(c) $x = -0.8$

(d) $x = 2$

(e) $x = 4$

Section 6.2 Constructing Antiderivatives Analytically

56. **True or False:** If f is continuous on the interval $[a, b]$, then $\int_a^b f(x)dx$ is a number (rather than a function).

57. $\int(x^3+5)dx =$

(a) $3x^2$

(b) $3x^2+5$

(c) $\frac{x^4}{4}+5$

(d) $\frac{1}{4}x^4+5x$

(e) None of the above

58. $\int \sin x \, dx =$

(a) $\sin x + C$

(b) $\cos x + C$

(c) $\sin x + C$

(d) $\cos x + C$

(e) None of the above

59. $\int x \sin x \, dx =$

(a) $\cos x + C$

(b) $\frac{1}{2}x^2(-\cos x) + C$

(c) $x \cos x + C$

(d) $\frac{1}{2}x^2 \sin x + C$

(e) Cant do with what we know right now

60. $\int 5e^x \, dx =$

(a) $5e^x + C$

(b) $e^x + C$

(c) $5xe^x + C$

(d) $\frac{5e^{x+1}}{x+1} + C$

(e) None of the above

61. $\int \sqrt{x} \, dx =$

(a) $\frac{1}{2}x^{-1/2} + C$

(b) $\frac{2}{3}x^{3/2} + C$

(c) $\frac{3}{2}x^{3/2} + C$

(d) $\frac{3}{2}x^{2/3} + C$

(e) Cant do with what we know right now

62. $\int \sqrt{x^3}\, dx =$

(a) $x^{3/2} + C$

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

(c) $\frac{3}{2}x^{1/2} + C$

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

(e) $\frac{3}{5}x^{5/3} + C$

(f) None of the above

63. $\int \frac{7}{x^5}\, dx =$

(a) $-\frac{7}{4}x^{-4} + C$

(b) $7x^{-5} + C$

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

(d) $\frac{7}{4x^4} + C$

(e) None of the above

64. What is $\int_1^5 3\, dt$?

(a) 3

(b) 4

(c) 12

(d) 15

(e) 16

65. What is $\int \frac{5}{x^2}\, dx$?

(a) $-\frac{5}{x} + C$

(b) $\frac{5}{x^2} + C$

(c) $-\frac{10}{x^3} + C$

(d) $\frac{30}{x^4} + C$

66. $\int \frac{3}{x}\,dx =$

(a) $-\frac{3}{2}x^{-2} + C$
(b) $3\ln x + C$
(c) $\frac{3}{x^2} + C$
(d) $3x^{-1} + C$
(e) None of the above

67. An antiderivative of $6x^2$ is

(a) $2x^3$
(b) $2x^3 + 5$
(c) $2x^3 + 18$
(d) $2x^3 - 6$
(e) All of the above

68. Which of the following is an antiderivative of $y(x) = 3\sin(x) + 7$?

(a) $g(x) = 3\cos(x)$
(b) $g(x) = 3\cos(x) + 7$
(c) $g(x) = 3\cos(x) + 7x$
(d) $g(x) = -3\cos(x) + 7x$

69. **True or False:** If $F(x)$ is an antiderivative of $f(x)$ and $G(x) = F(x) + 2$, then $G(x)$ is an antiderivative of $f(x)$.

70. Water is flowing out of a reservoir at a rate given by $f(t) = 5000 + 50t + 5t^2$, where t is in days and f is in gallons per day. How much water flows out of the reservoir during the first week?

(a) 572 gallons
(b) 5,000 gallons
(c) 5,595 gallons
(d) 35,000 gallons
(e) 36,797 gallons

71. Trucks are driving over a bridge at a rate given by the function $b(t) = 30\cos(t) + 70$, where t is in hours from noon and b is in trucks per hour. How many trucks drive across the bridge between 3pm and 6pm?

(a) 13 trucks
(b) 210 trucks
(c) 197 trucks
(d) 269 trucks

Section 6.3 Differential Equations

72. Find the solution to the differential equation $\frac{dy}{dx} = 6x^2$ if $y(0) = 5$.

(a) $y(x) = 12x + 5$
(b) $y(x) = 6x^2 + 5$
(c) $y(x) = 2x^3 + 5$
(d) None of the above

73. Suppose you are told that the acceleration function of an object is a continuous function $a(t)$. Let's say you are given that $v(0) = 1$. **True or False:** You can find the position of the object at any time t.

74. We know that $\frac{d^2 f}{dt^2} = 8e^x + 12$, that $f'(0) = 4$, and $f(0) = 10$. What is$f(x)$?

(a) $f(x) = 8e^x + 6x^2 + 4x + 10$
(b) $f(x) = 8e^x + 6x^2 - 4x + 2$
(c) $f(x) = 8e^x + 12x^2 + 4x + 10$
(d) $f(x) = 8e^x + 12x^2 - 4x + 2$

75. **True or False:** If $F(x)$ is an antiderivative of $f(x)$, then $y = F(x)$ is a solution to the differential equation $\frac{dy}{dx} = f(x)$.

76. **True or False:** If $y = F(x)$ is a solution to the differential equation $\frac{dy}{dx} = f(x)$, then $F(x)$ is an antiderivative of $f(x)$.

77. **True or False:** If an object has constant nonzero acceleration, then the position of the object as a function of time is a quadratic polynomial.

78. **True or False:** If an object's position as a function of time is a quadratic polynomial, then its acceleration is constant.

79. **True or False:** If $F(x)$ and $G(x)$ are two antiderivatives of $f(x)$ for $-\infty < x < \infty$ and $F(5) > G(5)$, then $F(10) > G(10)$.

80. **True or False:** If two solutions of a differential equation $\frac{dy}{dx} = f(x)$ have different values at $x = 3$ then they have different values at every x.

81. **True or False:** If the function $y = f(x)$ is a solution of the differential equation $\frac{dy}{dx} = \frac{\sin x}{x}$, then the function $y = f(x) + 5$ is also a solution.

82. A car is traveling at a speed of 40 mph. How fast is this speed in feet per second?

    (a) 211,200 ft/s
    (b) 58.67 ft/s
    (c) 3,520 ft/s
    (d) 586.7 ft/s

83. A car goes from zero to 80 ft/s in 4 seconds. What is its acceleration?

    (a) 10 ft/s^2
    (b) 20 ft/s^2
    (c) 30 ft/s^2
    (d) 40 ft/s^2

84. An acrobat is tossed into the air at an upward speed of 40 ft/s. What is the acrobats velocity after 2 seconds?

    (a) 40 ft/s
    (b) -24 ft/s
    (c) -32 ft/s
    (d) -64 ft/s

85. An acrobat is tossed into the air at an upward speed of 40 ft/s. How high is the acrobat after 2 seconds?

    (a) 80 ft
    (b) 64 ft
    (c) 16 ft
    (d) −48 ft

86. A car is traveling at a speed of 72 ft/s when the driver slams on the brakes, giving it a deceleration of 12 ft/s2. How long does it take for the car to reach a stop?

    (a) 2 s
    (b) 4 s
    (c) 6 s
    (d) 8 s
    (e) 12 s

87. A ball is thrown up into the air at a speed of 64 ft/s. How high will the ball get?

    (a) 2 ft
    (b) 32 ft
    (c) 64 ft
    (d) 128 ft

88. A plane can accelerate from zero to 200 ft/s in 10 seconds. What distance will it cover before it reaches 200 ft/s?

    (a) 10 ft
    (b) 100 ft
    (c) 1,000 ft
    (d) 10,000 ft

89. Looking over the edge of a canyon, we throw down a stone at a speed of 12 ft/s. When it hits the floor of the canyon, it is going at a speed of 140 ft/s. How deep is the canyon?

    (a) 304 ft

(b) 259 ft
(c) 122 ft
(d) 76 ft

90. A car goes from zero to 80 ft/s at a constant acceleration. When the car reaches 80 ft/s, it has traveled a distance of 200 ft. What was its acceleration?

(a) 4 ft/s^2
(b) 8 ft/s^2
(c) 16 ft/s^2
(d) 32 ft/s^2
(e) 200 ft/s^2

91. A car is driving at 100 ft/s when the driver suddenly slams on the brakes, slowing down at a constant deceleration to 20 ft/s, when the driver takes his foot off the brakes. The distance the car traveled while the brakes were on is 240 ft. What was the cars rate of decceleration?

(a) 6.7 ft/s^2
(b) 13.3 ft/s^2
(c) 20 ft/s^2
(d) 40 ft/s^2

Section 6.4 Second Fundamental Theorem of Calculus

92. If $f(x) = \int_1^x t^4 dt$, then

(a) $f'(x) = t^4$
(b) $f'(x) = x^4$
(c) $f'(x) = \frac{1}{5}x^5 - \frac{1}{5}$
(d) $f'(x) = x^4 - 1$

93. If $f(t) = \int_t^7 \cos x dx$, then

(a) $f'(t) = \cos t$

(b) $f'(t) = \sin t$
(c) $f'(t) = \sin 7 - \sin t$
(d) $f'(t) = -\cos t$
(e) $f'(t) = -\sin t$

94. If $f(x) = \int_2^x e^{2x} dx$, then

(a) $f'(x) = 2xe^{2x^2}$
(b) $f'(x) = e^{2x}$
(c) $f'(x) = e^{2x^2}$
(d) $f'(x) = 2e^{2x^2}$
(e) $f'(x) = \frac{1}{2}e^{2x^2} - \frac{1}{2}e^8$

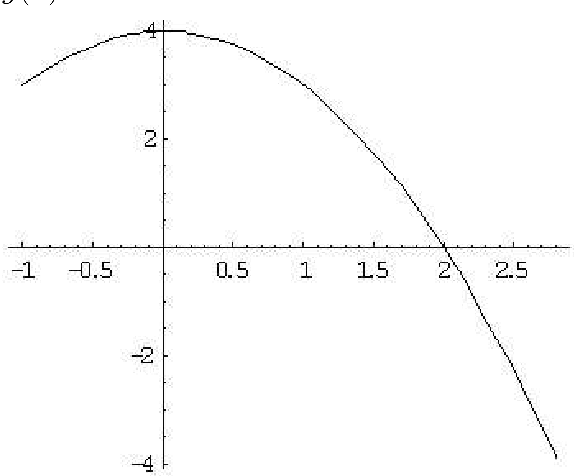
95. **True or False:** If f is continuous on the interval $[a, b]$, then $\frac{d}{dx}\int_a^b f(x)dx = f(x)$.

96. If f is continuous on the interval $[a, b]$, then $\frac{d}{dx}\int_a^b f(x)dx =$

(a) 0
(b) $f(b)$
(c) $f(x)$
(d) None of the above.

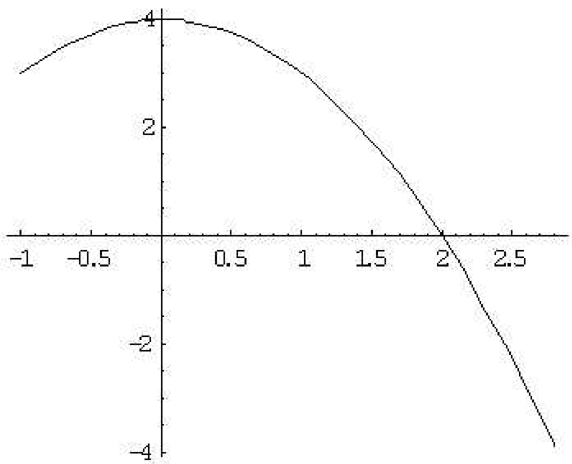
97. **True or False:** $\int_0^x \sin(t^2)dt$ is an antiderivative of $\sin(x^2)$.

98. The graph of function f is given below. Let $g(x) = \int_0^x f(t)dt$.. Then for $0 < x < 2$, $g(x)$ is



(a) increasing and concave up.
(b) increasing and concave down.
(c) decreasing and concave up.
(d) decreasing and concave down.

99. The graph of function f is given below. Let $g(x) = \int_0^x f(t)dt$. Then

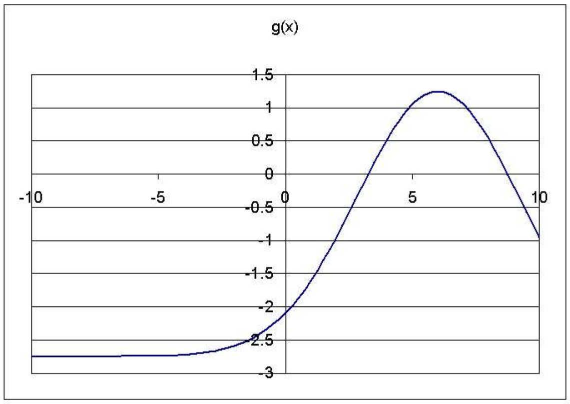


(a) $g(0) = 0$, $g'(0) = 0$ and $g'(2) = 0$
(b) $g(0) = 0$, $g'(0) = 4$ and $g'(2) = 0$
(c) $g(0) = 1$, $g'(0) = 0$ and $g'(2) = 1$
(d) $g(0) = 0$, $g'(0) = 0$ and $g'(2) = 1$

100. The speed of a car is given by the function $s(t) = 15t^2$, where t is in seconds, and s is in feet per second. If the car starts out a distance of 20 ft from the starting line, how far from the starting line will the car be at $t = 4$ seconds?

(a) 240 ft
(b) 260 ft
(c) 320 ft
(d) 340 ft
(e) 6,000 ft

101. The function $g(x)$ is related to the function $f(x)$ by the equation $g(x) = \int_3^x f(x)dx$, and $g(x)$ is plotted below. Where is $f(x)$ positive?



(a) $3 < x < 8$

(b) $x < 6$

(c) $2.5 < x$

(d) $x < 2.5$

Section 7.1 Integration by Substitution

102. If we are trying to evaluate the integral $\int e^{\cos\theta} \sin\theta \, d\theta$, which substitution would be most helpful?

    (a) $u = \cos\theta$

    (b) $u = \sin\theta$

    (c) $u = e^{\cos\theta}$

103. If we are trying to evaluate the integral $\int x^2\sqrt{x^3+5}\, dx$, which substitution would be most helpful?

    (a) $u = x^2$

    (b) $u = x^3$

    (c) $u = x^3 + 5$

    (d) $u = \sqrt{x^3+5}$

104. Would a substitution be useful in evaluating this integral? $\int x\sin(x^2)\, dx$

    (a) Yes, substitution would be useful.

    (b) No, substitution would not be useful.

105. Would a substitution be useful in evaluating this integral? $\int x \sin x \, dx$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

106. Would a substitution be useful in evaluating this integral? $\int (3x+2)(x^3+5x)^7 dx$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

107. Would a substitution be useful in evaluating this integral? $\int \frac{1}{x \ln x} dx$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

108. Would a substitution be useful in evaluating this integral? $\int e^{\sin\theta} \cos\theta d\theta$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

109. Would a substitution be useful in evaluating this integral? $\int e^x \sqrt{1+e^x} dx$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

110. Would a substitution be useful in evaluating this integral? $\int \frac{\sin x}{x} dx$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

111. Would a substitution be useful in evaluating this integral? $\int \frac{e^x - e^{-x}}{(e^x+e^{-x})^3} dx$

(a) Yes, substitution would be useful.
(b) No, substitution would not be useful.

112. Would a substitution be useful in evaluating this integral? $\int x^{16}(x^{17}+16x)^{16} dx$

(a) Yes, substitution would be useful.

(b) No, substitution would not be useful.

113. What is $\int_0^{1/2} \cos(\pi x) dx$?

(a) 0

(b) π

(c) $1/\pi$

(d) 1

(e) This integral cannot be done with substitution.

114. A companys sales are growing at an exponential rate, so that the sales rate is $R = R_0 e^{0.2t}$ widgets per year, where t is in years, starting now. Right now the company is selling widgets at a rate of 1000 widgets per year. If this model holds, how many widgets will they sell over the next ten years?

(a) 1,278

(b) 6,389

(c) 7,389

(d) 31,945

(e) 32,945

(f) 36,945

115. What is $\int \frac{1}{\sqrt{4-x}} dx$?

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

(b) $2\sqrt{4-x} + C$

(c) $-2\sqrt{4-x} + C$

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

(e) This integral cannot be done with substitution.

116. What is $\int \frac{1}{5x} dx$?

(a) $\ln(5x) + C$

(b) $\frac{1}{5} \ln x + C$

(c) $\frac{1}{5} \ln(5x) + C$

(d) This integral cannot be done with substitution.

117. What is $\int xe^{x^2} dx$?

(a) $-\frac{1}{2}e^u + C$
(b) $-\frac{1}{2}e^{-x^2} + C$
(c) $-2e^{-x^2} + C$
(d) $e^{-x^2} - 4x^2e^{-x^2} + C$
(e) This integral cannot be done with substitution.

118. What is $\int \cos x \sin^6 x dx$?

(a) $\frac{1}{7}x^7 + C$
(b) $\frac{1}{7}\sin^7 x + C$
(c) $\frac{1}{7}\cos^7 x + C$
(d) This integral cannot be done with substitution.

119. What is $\int \cos x \sin x dx$?

(a) $\frac{1}{2}\sin^2 x + C$
(b) $-\frac{1}{2}\cos^2 x + C$
(c) $\frac{1}{2}\sin^2 x \cos^2 x + C$
(d) This integral cannot be done with substitution.

120. What is $\int \frac{\sin x}{\cos x} dx$?

(a) $-\ln(\cos x) + C$
(b) $\ln(\sin x) + C$
(c) $-\ln\left(\frac{\sin x}{\cos x}\right) + C$
(d) $\ln(\cos x) + C$
(e) This integral cannot be done with substitution.

Section 7.2 Integration by Parts

121. What is the derivative of $f(x) = \frac{1}{3}xe^{3x} - \frac{1}{9}e^{3x} + 25$?

   (a) $f'(x) = xe^{3x}$
   (b) $f'(x) = \frac{2}{3}e^{3x}$
   (c) $f'(x) = \frac{1}{3}e^{3x} + xe^{3x}$
   (d) $f'(x) = e^{3x}$

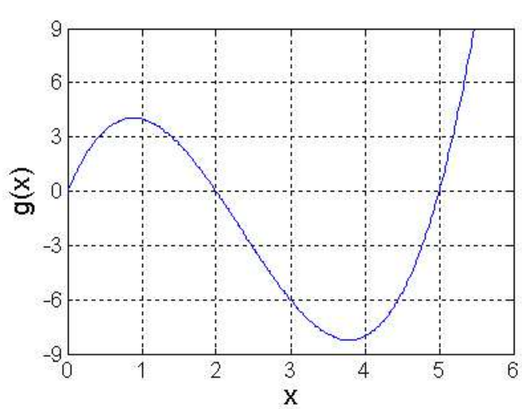
122. What is $\int xe^{4x}dx$?

   (a) $\frac{1}{8}x^2e^{4x} + C$
   (b) $\frac{1}{4}xe^{4x} - \frac{1}{16}e^{4x} + C$
   (c) $\frac{1}{4}xe^{4x} - \frac{1}{4}e^{4x} + C$
   (d) $\frac{1}{16}e^{4x} - \frac{1}{4}xe^{4x} + C$

123. Find $\int_1^4 \ln(t)\sqrt{(}t)dt$.

   (a) 4.28
   (b) 3.83
   (c) -1
   (d) 0.444
   (e) 5.33
   (f) This integral cannot be done with integration by parts.

124. Estimate $\int_0^5 f(x)g'(x)dx$ if $f(x) = 2x$ and $g(x)$ is given in the figure below.



(a) 40
(b) 20
(c) 10
(d) -10
(e) This integral cannot be done with integration by parts.

125. Find an antiderivative of x^2e^x.

(a) $x^2e^x - 2xe^x + 2e^x$
(b) $x^2e^x - 2xe^x$
(c) $\frac{1}{3}x^3e^x - x^2e^x + 2e^x$
(d) $x^2e^x - 2xe^x - 2e^x$
(e) This integral cannot be done with integration by parts.

Section 7.7/7.8 Improper Integrals

126. **True or False:** If f is continuous for all x and $\int_0^\infty f(x)dx$ converges, then so does $\int_a^\infty f(x)dx$ for all positive a.

127. **True or False:** If f is continuous for all x and $\int_0^\infty f(x)dx$ diverges, then so does $\int_a^\infty f(x)dx$ for all positive a.

128. Does $\int_1^\infty \frac{dx}{1+x^2}$

(a) Converge
(b) Diverge
(c) Can't tell with what we know

129. Does $\int_1^\infty \frac{dx}{\sqrt{x^4+x^2+1}}$

(a) Converge
(b) Diverge
(c) Can't tell with what we know

130. Does $\int_2^\infty \frac{dx}{x^2-1}$

(a) Converge by direct comparison with $\int_2^\infty (1/x^2)dx$

(b) Diverge by direct comparison with $\int_2^\infty (1/x^2)dx$

(c) Can't tell by direct comparison with $\int_2^\infty (1/x^2)dx$

131. Is this an improper integral?

$$\int_1^\infty \frac{\sin x}{x} dx$$

(a) Yes, it is improper.

(b) No, it is proper.

132. Is this an improper integral?

$$\int_4^5 \frac{1}{x} dx$$

(a) Yes, it is improper.

(b) No, it is proper.

133. Is this an improper integral?

$$\int_0^1 \frac{1}{2-3x} dx$$

(a) Yes, it is improper.

(b) No, it is proper.

134. Is this an improper integral?

$$\int_3^4 \frac{1}{\sin x} dx$$

(a) Yes, it is improper.

(b) No, it is proper.

135. Is this an improper integral?

$$\int_{-3}^3 x^{-1/3} dx$$

(a) Yes, it is improper.

(b) No, it is proper.

136. Is this an improper integral?

$$\int_1^2 \frac{1}{2x-1}dx$$

(a) Yes, it is improper.
(b) No, it is proper.

137. Is this an improper integral?

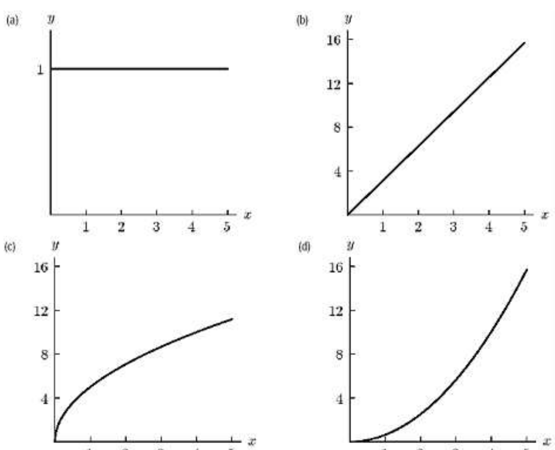
$$\int_1^2 \ln(x-1)dx$$

(a) Yes, it is improper.
(b) No, it is proper.

Section 8.2 Applications to Geometry

138. **True or False** The volume of the solid of revolution is the same whether a region is revolved around the x-axis or the y-axis.

139. Imagine taking the enclosed region in Figure 8.8 and rotating it about the x-axis. Which of the following graphs (a)-(d) represents the resulting volume as a function of x?



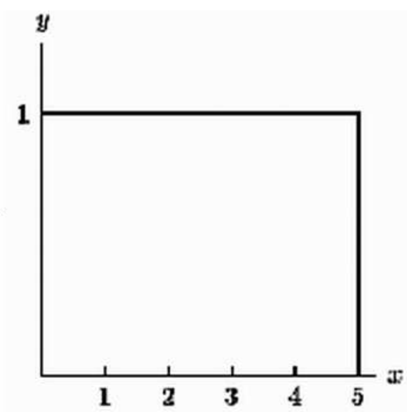
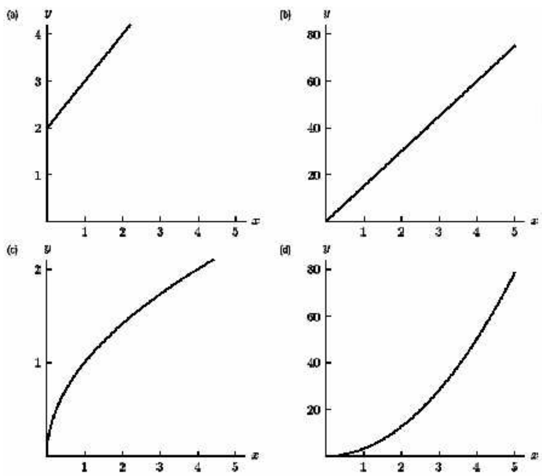


Figure 8.8

140. Imagine taking the enclosed region in Figure 8.9 and rotating it about the y-axis. Which of the following graphs (a)-(d) represents the resulting volume as a function of x?



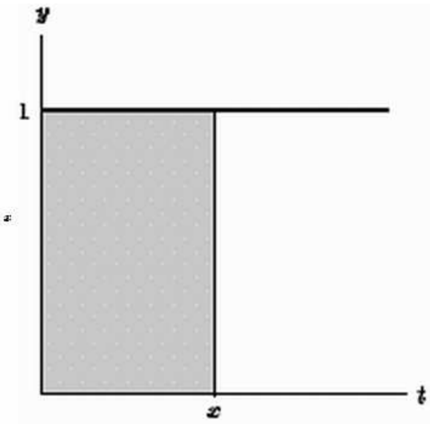


Figure 8.9

141. Imagine that the region between the graphs of f and g in Figure 8.10 is rotated about the x-axis to form a solid. Which of the following represents the volume of this solid?

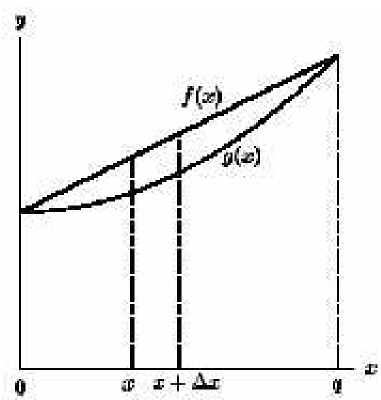


Figure 8.10

(a) $\int_0^q 2\pi x(f(x) - g(x))dx$

(b) $int_0^q(f(x) - g(x))dx$

(c) $\int_-^q \pi(f(x) - g(x))^2 dx$

(d) $\int_0^q(\pi f^2(x) - \pi g^2(x))dx$

(e) $\int_0^q \pi x(f(x) - g(x))dx$

142. Imagine rotating the enclosed region in Figure 8.11 about three lines separately: the x-axis, the y-axis, and the vertical line at $x = 6$. This produces three different volumes. Which of the following lists those volumes in order from largest to smallest?

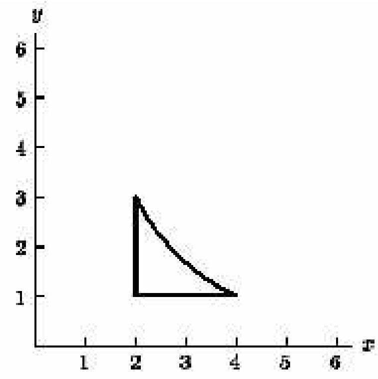


Figure 8.11

(a) x-axis; $x = 6$; y-axis

(b) y-axis; $x = 6$; x-axis

(c) $x = 6$; y-axis; x-axis

(d) $x = 6$; x-axis; y-axis

(e) x-axis; y-axis; $x = 6$

(f) y-axis; x-axis; $x = 6$

Section 8.5 Applications to Physics

143. **True or False** It takes more work to lift a 20-lb weight 10 feet slowly than to lift it the same distance quickly.

144. A constant force of 5.2 lb pushes on an object, moving the object through a distance of 3 feet. Is an integral needed to determine how much work is done?

(a) Yes integral is needed

(b) No just need to multiply force by distance

item A 3-lb book is lifted 5 feet off the floor. Is an integral needed to determine how much work is done?

(a) Yes integral is needed

(b) No just need to multiply force by distance

145. Im carrying my garden hose around my yard, laying down hose to set up a path for a traveling sprinkler. Is an integral needed to determine how much work is done?

(a) Yes integral is needed

(b) No just need to multiply force by distance

146. The average value of the force, $F(x)$, exerted on an object while moving the object over the interval $1 \leq x \leq 4$ is 7 N. Is an integral needed to determine how much work is done?

(a) Yes integral is needed

(b) No just need to multiply force by distance

147. I'm pushing a shopping cart around the grocery store, filling it with my groceries. Is an integral needed to determine how much work is done on the shopping cart?

(a) Yes - integral is needed

(b) No just need to multiply force by distance

148. My boat is floating 20 feet offshore, and I use a rope to pull it in to the beach. I pull on the rope with a constant force, but the boat moves faster and faster as it gets closer to the beach so its distance from the shore is given by the function $d(t) = 20 - 3t^2$, where t is in seconds. Is an integral needed to determine how much work is done on the boat?

(a) Yes - integral is needed

(b) No just need to multiply force by distance

149. You are lifting a 15 kg bucket 3 meters up from the ground to the second floor of a building. The bucket is held by a heavy chain that has a mass of 2 kg per meter, so the farther up you lift it, the easier it becomes, because there is less chain out. Recall that the force of gravity (in Newtons) is equal to mass (in kg) times g (in m/s^2), and assume that $g \approx 10$ m/s^2. How much work does it take to raise the bucket?

(a) 45 Joules

(b) 90 Joules

(c) 450 Joules

(d) 540 Joules

(e) 630 Joules

(f) None of the above