

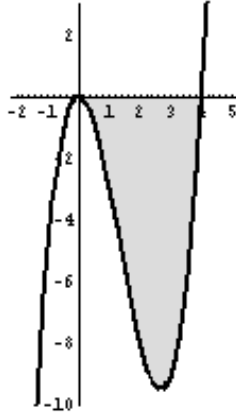
## Chapter 6 ■ Integration

1. Find the indefinite integral  $\int 3dx$ . **Answer:**  $3x + C$
2. Find the indefinite integral  $\int \sqrt{5}dx$ . **Answer:**  $\sqrt{5}x + C$
3. Find the indefinite integral  $\int 2x^3 dx$ . **Answer:**  $\frac{1}{2}x^4 + C$
4. Find the indefinite integral  $\int 4t^{-6} dt$ . **Answer:**  $-\frac{4}{5}t^{-5} + C$
5. Find the indefinite integral  $\int e\sqrt{t} dt$ . **Answer:**  $\frac{2}{3}et^{3/2} + C$
6. Find the indefinite integral  $\int (1 + 2x + 4x^2)dx$ . **Answer:**  $x + x^2 + \frac{4}{3}x^3 + C$
7. Find the indefinite integral  $\int 3e^x dx$ . **Answer:**  $3e^x + C$
8. Find the indefinite integral  $\int (2 + \sqrt{x} + 2x + e^x)dx$ . **Answer:**  $2x + \frac{2}{3}x^{3/2} + x^2 + e^x + C$
9. Find the indefinite integral  $\int (u^{7/2} + 2u^{5/2} - u)du$ . **Answer:**  $\frac{2}{9}u^{9/2} + \frac{4}{7}u^{7/2} - \frac{1}{2}u^2 + C$
10. Find the indefinite integral  $\int (2y + 3)(3y - 2)dy$ . **Answer:**  $2y^3 + \frac{5}{2}y^2 - 6y + C$
11. Find the indefinite integral  $\int \sqrt{y}(y^2 - y + 1)dy$ . **Answer:**  $\frac{2}{7}y^{7/2} - \frac{2}{5}y^{5/2} + \frac{2}{3}y^{3/2} + C$
12. Find the indefinite integral  $\int \frac{x^5 + \sqrt[5]{x}}{x^2} dx$ . **Answer:**  $\frac{1}{4}x^4 - \frac{5}{4}x^{-4/5} + C$
13. Find the indefinite integral  $\int \frac{y^3 - 5y^2 - y}{y} dy$ . **Answer:**  $\frac{y^3}{3} - \frac{5}{2}y^2 - y + C$
14. Find the function  $f(x)$  if  $f'(x) = 6x^2 - 4x + 7$  and  $f(1) = 3$ . **Answer:**  $2x^3 - 2x^2 + 7x - 4$
15. Find the function  $f(x)$  if  $f'(x) = 3x^2 + e^x$  and  $f(0) = 3$ . **Answer:**  $x^3 + e^x + 2$
16. A study conducted by Mega-Byte Ltd. estimates that the number of online service subscribers will grow at a rate of  $250 + 200t^{5/6}$  new subscribers per month  $t$  months from the start date of the service. If 4000 customers signed up for the service initially, how many subscribers will there be 18 months from the start date? **Answer:** **30,333**
17. The rate of growth of a particular type of pest can be approximated by the function  $20 + 20t^{2/3}$  pests/month. If there are initially 20 pests present, how many will there be 8 months from beginning? **Answer:** 584

18. Find the indefinite integral  $\int 2x\sqrt{x^2 + 3} dx$ . **Answer:**  $\frac{2}{3}(x^2 + 3)^{3/2} + C$
19. Find the indefinite integral  $\int 6(6x + 4)^3 dx$ . **Answer:**  $\frac{1}{4}(6x + 4)^4 + C$
20. Find the indefinite integral  $\int (x^3 + 7x)^4 (3x^2 + 7) dx$ . **Answer:**  $\frac{1}{5}(x^3 + 7x)^5 + C$
21. Find the indefinite integral  $\int \frac{3x^2}{(x^3 + 3)^4} dx$ . **Answer:**  $\frac{-1}{3(x^3 + 3)^3} + C$
22. Find the indefinite integral  $\int \frac{3x}{3x^2 + 5} dx$ . **Answer:**  $\frac{1}{2} \ln(3x^2 + 5) + C$
23. Find the indefinite integral  $\int \frac{3x^2 + 3}{(x^3 + 3x)^4} dx$ . **Answer:**  $\frac{-1}{3(x^3 + 3)^3} + C$
24. Find the indefinite integral  $\int \frac{x^3}{\sqrt{x^4 + 4}} dx$ . **Answer:**  $\frac{1}{2} \sqrt{x^4 + 4} + C$
25. Find the indefinite integral  $\int \frac{2x + 2}{x^2 + 2x + 3} dx$ . **Answer:**  $\ln|x^2 + 2x + 3| + C$
26. Find the indefinite integral  $\int e^{3x} dx$ . **Answer:**  $\frac{1}{3} e^{3x} + C$
27. Find the indefinite integral  $\int x^4 e^{x^5 - 2} dx$ . **Answer:**  $\frac{1}{5} e^{x^5 - 2} + C$
28. Let  $f(x) = x^2$  and compute the Riemann sum of  $f$  over the interval  $[1, 3]$  using four subintervals of equal length ( $n = 4$ ). Choose the representative point in each subinterval to be the midpoint of the subinterval. **Answer: 8.625**
29. Let  $f(x) = x^2$  and compute the Riemann sum of  $f$  over the interval  $[1, 3]$  using four subintervals of equal length ( $n = 4$ ). Choose the representative point in each subinterval to be the left endpoint of the subinterval. **Answer: 6.75**

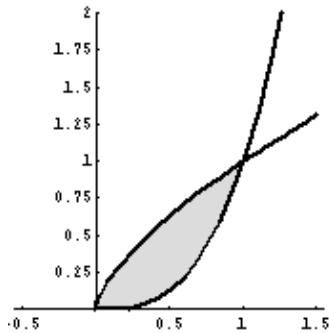
30. Let  $f(x) = 4x + 1$  and compute the Riemann sum of  $f$  over the interval  $[0, 3]$  using four subintervals of equal length ( $n = 6$ ). Choose the representative point in each subinterval to be the left endpoint of the subinterval. **Answer: 18**
31. Let  $f(x) = 4x + 1$  and compute the Riemann sum of  $f$  over the interval  $[0, 3]$  using four subintervals of equal length ( $n = 6$ ). Choose the representative point in each subinterval to be the right endpoint of the subinterval. **Answer: 24**
32. Find the area of the region under the graph of the function  $f(x) = 4x + 5$  on the interval  $[-1, 2]$ . **Answer: 21**
33. Find the area of the region under the graph of the function  $f(x) = 11$  on the interval  $[-2, 4]$ . **Answer: 66**
34. Find the area of the region under the graph of the function  $f(x) = x^2$  on the interval  $[-1, 2]$ . **Answer: 3**
35. Find the area of the region under the graph of the function  $f(x) = \frac{1}{x}$  on the interval  $[2, 8]$ . **Answer: 2 (ln2)**
36. Evaluate the definite integral  $\int_1^2 4dx$ . **Answer: 4**
37. Evaluate the definite integral  $\int_1^2 2xdx$ . **Answer: 3**
38. Evaluate the definite integral  $\int_{-2}^3 (4x + 3)dx$ . **Answer: 25**
39. Evaluate the definite integral  $\int_4^9 \frac{3}{\sqrt{x}} dx$ . **Answer: 6**
40. Evaluate the definite integral  $\int_1^4 \left(1 + \frac{1}{x^2} + \frac{1}{x^4}\right) dx$ . **Answer:  $\frac{261}{64}$**
41. Evaluate the definite integral  $\int_1^8 \left(\sqrt[3]{x} - \frac{1}{\sqrt[3]{x}}\right) dx$ . **Answer:  $\frac{27}{4}$**
42. Evaluate the definite integral  $\int_0^4 2x\sqrt{x^2 + 9} dx$ . **Answer:  $\frac{196}{3}$**
43. Evaluate the definite integral  $\int_0^1 \frac{3e^x}{e^x + 2} dx$ . **Answer:  $3 \ln(e + 2) - 3 \ln 3$**

44. Find the average value of the function  $f(x) = x^2 + 3$  over the interval  $[1,5]$ . **Answer:**  $\frac{40}{3}$
45. Find the average value of the function  $f(x) = 10 - 2x$  over the interval  $[1,3]$ . **Answer:** 6
46. Find the area of the region bounded by the graphs of the functions  $f(x) = x^2$  and  $g(x) = 10$  and the vertical lines  $x = 0$  and  $x = 2$ . **Answer:**  $\frac{52}{3}$
47. Find the area of the shaded region below where  $y = f(x) = x^3 - 4x^2$ .



**Answer:**  $\frac{64}{3}$

48. Find the area of the region bounded by the graphs of the functions  $f(x) = x^3$  and  $g(x) = x^{2/3}$  (shaded below).



**Answer:**  $\frac{7}{20}$

49. Find the area of the region bounded by the graphs of the functions  $f(x) = 2 + x^2$  and  $g(x) = 1$  and the vertical lines  $x = 1$  and  $x = 3$ . **Answer:**  $\frac{32}{3}$
50. Find the area of the region bounded by the graphs of the functions  $f(x) = e^{x-2}$  and  $g(x) = 0$  and the vertical lines  $x = -2$  and  $x = 2$ . **Answer:**  $1 - e^{-4}$