

Evaluate .

1. $\int x e^{2x} dx$
2. $\int x^4 \ln x dx$
3. $\int x \sin 4x dx$
4. $\int \sin^{-1} x dx$
5. $\int x^2 \cos 3x dx$
6. $\int (\ln x)^2 dx$
7. $\int t^3 e^t dt$
8. $\int r^3 \ln r dr$
9. $\int (\sin \ln t) dt$
10. $\int e^{2\theta} \sin 3\theta d\theta$
11. $\int t e^{-t} dt$
12. $\int \sqrt{t} \ln t dt$
13. $\int (x^2 + 1)e^{-x} dx$
14. $\int x \csc^2 x dx$
15. $\int \ln \sqrt{x} dx$
16. $\int x \tan^{-1} x dx$
17. $\int \cos \theta \ln(\sin \theta) d\theta$
18. $\int e^s (t - s) ds$
19. $\int x^5 \cos(x^3) dx$
20. $\int \theta^3 \cos(\theta^2) d\theta$
21. $\int_1^4 e^{\sqrt{x}} dx$
22. $\int \frac{\sqrt{9 - x^2}}{x^2} dx$
23. $\int \frac{dx}{x^2 \sqrt{x^2 + 4}}$
24. $\int \sqrt{x^2 + 1} dx$
25. $\int \frac{dt}{t^3 \sqrt{t^2 - 1}}$
26. $\int \frac{x^3 dx}{\sqrt{16 - x^2}}$
27. $\int \frac{xdx}{\sqrt{3 - 2x - x^2}}$

28. $\int x \sqrt{x^2 + 2x + 4} dx$
29. $\int t \sin^2 2t dt$
30. $\int \frac{dx}{x + x^3}$
31. $\int_0^1 \frac{dx}{\sqrt{1 - x}}$
32. $\int_{-5}^{-3} \frac{xdx}{\sqrt{x^2 - 9}}$
33. $\int_2^4 \frac{dt}{\sqrt{16 - t^2}}$
34. $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \sec \theta d\theta$
35. $\int_0^{+\infty} \frac{dx}{x^3}$
36. $\int_0^{\frac{\pi}{2}} \tan \theta d\theta$
37. $\int_2^{+\infty} \frac{dx}{x \sqrt{x^2 - 4}}$
38. $\int_0^4 \frac{dx}{x^2 - 2x - 3}$
39. $\int_{-1}^1 \frac{dx}{x^2}$
40. $\int_1^{+\infty} \frac{dx}{x^2 - 1}$
41. $\int (\ln x)^2 dx$
42. $\int_0^{\frac{1}{2}} \sin^{-1} x dx$
43. $\int_1^3 \sqrt{x} \tan^{-1} \sqrt{x} dx$
44. $\int e^{\sqrt{x}} dx$
45. $\int \sqrt{\tan t} \sec^4 t dt$
46. $\int \cot^3 x dx$
47. $\int \tan x \sec^{\frac{3}{2}} x dx$
48. $\int \frac{dx}{(9x^2 - 1)^{\frac{3}{2}}}$

49. $\int \frac{\sqrt{1 + t^2}}{t} dt$
50. $\int \frac{dx}{x^2 \sqrt{4x^2 - 9}}$
51. $\int \frac{x^5 + 2x^2 + 1}{x^3 - x} dx$
52. $\int \frac{dx}{x^2 + 3x - 4}$
53. $\int \frac{x^2 dx}{(x + 2)^3}$
54. $\int \frac{3x^2 - x + 1}{x^3 - x^2} dx$
55. $\int \frac{dx}{x^3 + x}$
56. $\int \frac{x^3 + x^2 + x + 2}{(x^2 + 1)(x^2 + 2)} dx$
57. $\int_e^{+\infty} \frac{dx}{x(\ln x)^3}$
58. $\int_{-\infty}^0 e^{3x} dx$
59. $\int_{-\infty}^{+\infty} \frac{xdx}{\sqrt{x^2 + 2}}$
60. $\int_0^8 \frac{dx}{\sqrt[3]{x}}$

61. A cell of the bacterium *E. Coli* divides into two cells every 20 minutes when placed under a nutrient culture. Let $y = y(t)$ be the number of cells that are present t minutes after a single cell is placed in the culture. Assume that the growth of the bacteria is approximated by a continuous exponential growth model. (a.) Find a formula for $y(t)$. (b.) How many cells are present after 2 hours? (c.) How long does it take for the numbers of cells to reach 1,000,000?

62. Radon-222 is a radioactive gas with a half-life of 3.83 days. This gas is a health hazard because it tends to get trapped in the basements of houses, and many health officials suggest that homeowners seal their basements to prevent entry of the gas. Assume that 5.0×10^7 radon atoms are trapped in a basement at the time it is sealed. (a.) Find a formula for the number of atoms present t days later. (b.) How many atoms will be present after 30 days? (c.) How long will it take for 90% of the original quantity of gas to decay?

63. Suppose that the town of Grayrock has a population of 10,000 in 1987 and a population of 12,000 in 1997. Assuming an exponential growth model, in what year will the population reach 20,000?

64. Suppose that 40% of a certain radioactive substance decays in 5 years. (a.) What is the half-life of the substance (in years)? (b.) What percentage will remain after 10 years.