15. $\int_1^{+\infty} \frac{x^2\,dx}{(x^3+2)^2}$

16. $\int_1^{+\infty} \frac{x^2\,dx}{x^3+2}$

17. $\int_1^{+\infty} \frac{x^2\,dx}{\sqrt{x^5+2}}$

18. $\int_0^{+\infty} xe^{-x^2}\,dx$

19. $\int_1^{+\infty} \frac{e^{-\sqrt{x}}}{\sqrt{x}}\,dx$

20. $\int_0^{+\infty} xe^{-x}\,dx$

21. $\int_0^{-\infty} 5xe^{10-x}\,dx$

22. $\int_1^{+\infty} \frac{\ln x\,dx}{x}$

23. $\int_2^{+\infty} \frac{dx}{x\ln x}$

24. $\int_2^{+\infty} \frac{dx}{x\sqrt{\ln x}}$

25. $\int_0^{+\infty} x^2e^{-x}\,dx$

26. $\int_0^{+\infty} x^3e^{-x^2}\,dx$

27. $\int_{-\infty}^{0} \frac{2x\,dx}{x^2+1}$

28. $\int_1^{+\infty} \frac{x\,dx}{(1+x^2)^2}$

29. $\int_{-\infty}^{0} \frac{dx}{\sqrt{2-x}}$

30. $\int_{-\infty}^{4} \frac{dx}{(5-x)^2}$

31. $\int_{-\infty}^{+\infty} xe^{-|x|}\,dx$

32. $\int_{-\infty}^{+\infty} \frac{dx}{x^2+1}$

33. $\int_0^1 \frac{dx}{x^{1/5}}$

34. $\int_0^4 \frac{dx}{x\sqrt{x}}$

35. $\int_0^1 \frac{dx}{(1-x)^{1/2}}$

36. $\int_0^2 \frac{dx}{(1-x)^2}$

37. $\int_{-1}^{1} \frac{e^x}{\sqrt{1-e^x}}\,dx$

38. $\int_{-\infty}^{+\infty} \frac{3x\,dx}{(3x^2+2)^3}$

39. $\int_0^1 \ln x\,dx$

40. $\int_1^{+\infty} \ln x\,dx$

41. $\int_e^{+\infty} \frac{dx}{x(\ln x)^2}$

42. $\int_0^1 \frac{x\,dx}{1-x^2}$

43. $\int_0^1 e^{-(1/2)\ln x}\,dx$

44. $\int_0^{-\infty} \frac{dx}{e^x+e^{-x}}$

45. $\int_0^{\pi/3} \frac{\sec^2 x\,dx}{1-\tan x}$

46. $\int_0^{\pi/2} \frac{\sin x\,dx}{\sqrt{1-2\cos x}}$

47. Find the area of the unbounded region between the x-axis and the curve

$$y = \frac{2}{(x-4)^3} \quad \text{for } x \geq 6$$

48. Find the area of the unbounded region between the x-axis and the curve

$$y = \frac{2}{(x-4)^3} \quad \text{for } x \leq 2$$

49. The total amount of radioactive material present in the atmosphere at time T is modeled by

$$A = \int_0^T Pe^{rt}\,dt$$

where P is a constant and t is the number of years. Suppose a recent United Nations publication indicates that, at the present time, $r = 0.002$ and $P = 200$ millirads. Estimate the total future buildup of radioactive material in the atmosphere if these values remain constant.

50. Suppose that an oil well produces $P(t)$ thousand barrels of crude oil per month according to the formula

$$P(t) = 100e^{-0.02t} - 100e^{-0.04t}$$

where t is the number of months the well has been in production. What is the total amount of oil produced by the oil well?

51. Let $f(x) = \begin{cases} \frac{1}{x^2} & \text{for } x \geq 1 \\ 1 & \text{for } -1 < x < 1 \\ e^{x+1} & \text{for } x \leq -1 \end{cases}$

Sketch the graph of f and evaluate

$$\int_{-\infty}^{+\infty} f(x)\,dx$$

52. Find all values of p for which $\int_2^{+\infty} \frac{dx}{x(\ln x)^p}$ converges, and find the value of the integral when it exists.

53. Find all values of p for which $\int_0^1 \frac{dx}{x^p}$ converges, and find the value of the integral when it exists.

54. Find all values of p for which $\int_0^{1/2} \frac{dx}{x(\ln x)^p}$ converges, and find the value of the integral when it exists.

55. **Counterexample Problem** Discuss the calculation

$$\int_{-1}^{1} \frac{dx}{x^2} = \frac{-1}{x}\Big|_{-1}^{1} = -[1-(-1)] = -2$$

Is the calculation correct? Explain.

56. **Journal Problem** *College Mathematics Journal*[*] ■ Peter Lindstrom of North Lake College in Irving, Texas, had a student who handled an ∞/∞ form as follows:

$$\begin{aligned} \int_1^{+\infty} (x-1)e^{-x}\,dx &= \int_1^{+\infty} \frac{x-1}{e^x}\,dx \\ &= \int_1^{+\infty} \frac{1}{e^x}\,dx \qquad \text{l'Hôpital's rule} \\ &= \frac{1}{e} \end{aligned}$$

What is wrong, if anything, with this student's solution?

57. Find $\int_0^2 f(x)\,dx$, where

$$f(x) = \begin{cases} \frac{1}{\sqrt[4]{x^3}} & \text{for } 0 < x \leq 1 \\ \frac{1}{\sqrt[4]{(x-1)^3}} & \text{for } 1 < x < 2 \end{cases}$$

58. Evaluate the improper polar integral $\int_0^{+\infty} \theta e^{-\theta}\,d\theta$.

59. Find the total area between the spirals $r = e^{-2\theta}$ and $r = e^{-\theta}$ for $\theta \geq 0$.

[*] Vol. 24, No. 4, September 1993, p. 343.