

Problem 1 Evaluate each integral.

a)  $\int xe^{2x} dx$

b)  $\int \ln x dx$

c)  $\int \tan^3 x \sec^3 x dx$

d)  $\int \frac{x^3 - 2}{x^3 + x} dx$

$$e) \int \frac{dx}{x^2 - 2x - 3}$$

$$f) \int x \tan^{-1} x dx$$

$$g) \int \frac{1}{x^2 \sqrt{4x^2 - 9}} dx$$

Problem 2 Find the improper integrals, or determine that they diverge.

a)  $\int_{-\infty}^{\infty} \frac{x}{x^2 + 4} dx$

b)  $\int_0^{\infty} xe^{-2x} dx$

c)  $\int_2^4 \frac{1}{(x-2)^2} dx$

Problem 3 Use the Comparison test to determine whether the integral converges or diverges.

a.  $\int_2^{\infty} \frac{dx}{\sqrt[4]{x^3 - 2}}$

b.  $\int_1^{\infty} \frac{dx}{x + e^x}$ .

Problem 4 Solve the following differential equation:

$$y'(t) = -3y(t) : y(0) = 2$$