

Evaluate the following integrals using the appropriate technique.

1. Basic techniques

a. $\int (9x - 2)^{-3} dx$

b. $\int \frac{1}{x^2 - 2x + 10} dx$

c. $\int \frac{e^x}{e^x - e^{-x}} dx$

d. $\int \frac{1}{\sqrt{27 - 6x - x^2}} dx$

e. $\int_2^4 \frac{x^2 + 2}{x - 1} dx$

2. Integration by Parts

a. $\int xe^x dx$

b. $\int \frac{x}{\sqrt{x+1}} dx$

c. $\int x^2 \ln x dx$

d. $\int x \tan^{-1}(x) dx$

e. $\int e^{3x} \cos(2x) dx$

f. $\int x^2 e^{4x} dx$

g. $\int_0^{\ln 2} x \cosh(2x) dx$

h. $\int_1^e \ln(2x) dx$

3. Trig. Integrals

a. $\int \sin^3 x dx$

b. $\int \sin^3 x \cos^2 x dx$

c. $\int \sin^2 x \cos^4 x dx$

d. $\int \tan^3 x dx$

e. $\int \tan^{-5} x \sec^2 x dx$

f. $\int \tan x \sec^3 x dx$

g. $\int_0^{\pi/4} \sec^4 x dx$

4. Trig. Substitutions

a. $\int_0^{\sqrt{2}} \frac{x^2}{\sqrt{4-x^2}} dx$

b. $\int \sqrt{36-x^2} dx$

c. $\int \frac{1}{x^2 \sqrt{x^2+9}} dx$

d. $\int \frac{1}{\sqrt{16+4x^2}} dx$

e. $\int \frac{\sqrt{x^2-4}}{x} dx$

f. $\int \frac{1}{(x^2-25)^{3/2}} dx$

5. Partial Fractions

a. $\int \frac{10x}{x^2 - 2x - 24} dx$

b. $\int \frac{21x^2}{x^3 - x^2 - 12x} dx$

c. $\int \frac{2}{x^3 + x^2} dx$

d. $\int \frac{x^2 - 4}{x^3 - 2x^2 + x} dx$

e. $\int \frac{x^2 + 3x + 2}{x(x^2 + 2x + 2)} dx$

f. $\int \frac{x + 1}{x(x^2 + 4)} dx$

6. Improper Integrals

a. $\int_0^{\infty} \frac{1}{(x + 1)^3} dx$

b. $\int_{-\infty}^1 2^x dx$

c. $\int_2^{\infty} \frac{1}{\sqrt{x}} dx$

d. $\int_{-3}^1 \frac{1}{(2x + 6)^{2/3}} dx$

e. $\int_0^1 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$

f. $\int_{-1}^1 \ln x^2 dx$

7. Differential Equations

Find the solution to the following differential equations. If an initial condition is given, determine the arbitrary constant in the solution. Otherwise, find the general solution.

a. $y'(x) = -2y - 4$

b. $e^{-t} \frac{dy}{dt} = \frac{1}{2y}, \quad y(\ln 2) = 1$

c. $y'(t) = \frac{e^y}{t}$

d. $y'(t) = y(4t^3 + 1), \quad y(0) = 2$

For additional problems, check out the review problems for Chapter 7. Note the questions above are simply a sample of questions possible for the exam; it is possible that other types of questions may appear on your exam.