

1. 10 pts. each Evaluate the integral by integrating by parts.

(a) $\int \ln \sqrt{x} \, dx$

(b) $\int_0^{\pi/3} (\sin x) \ln(\cos x) \, dx$

2. 10 pts. each Evaluate the trigonometric integral.

(a) $\int \sin^5(6t) \cos^2(6t) \, dt$

(b) $\int \tan^2 \theta \sec^4 \theta \, d\theta$

(c) $\int_0^{\pi/6} \sqrt{1 + \cos 2x} \, dx$

3. 10 pts. each Evaluate using trigonometric substitution.

(a) $\int_0^1 \frac{dx}{(x^2 + 1)^2}$

(b) $\int \frac{dt}{t^2 \sqrt{t^2 - 16}}, \quad t > 4$

4. 10 pts. each Evaluate using partial fractions.

(a) $\int_1^2 \frac{4y^2 - 7y - 12}{y(y+2)(y-3)} \, dy$

(b) $\int \frac{x^2 - x + 6}{x^3 + 3x} \, dx$

(c) $\int_0^1 \frac{1}{1 + \sqrt[3]{x}} \, dx$ (Make a substitution first)

5. 10 pts. each Evaluate using any strategy.

(a) $\int e^{x+e^x} \, dx$

(b) $\int \arctan \sqrt{x} \, dx$

(c) $\int \sqrt{3 - 2x - x^2} \, dx$

6. 10 pts. each Determine whether the integral is convergent or divergent, and evaluate if convergent.

(a) $\int_0^{\infty} \frac{x^2}{\sqrt{1+x^3}} dx$

(b) $\int_{-2}^{14} \frac{dx}{\sqrt[4]{x+2}}$

(c) $\int_{-\infty}^0 ze^{2z} dz$

7. 10 pts. Use the Comparison Theorem to determine whether

$$\int_0^1 \frac{\sec^2 x}{x\sqrt{x}} dx$$

is convergent or divergent.

FORMULAS & DEFINITIONS

- $(\sin^{-1} x)' = \frac{1}{\sqrt{1-x^2}}$
- $(\tan^{-1} x)' = \frac{1}{1+x^2}$
- $(\sec^{-1} x)' = \frac{1}{|x|\sqrt{x^2-1}}$
- $\int \frac{1}{\sqrt{a^2-x^2}} dx = \sin^{-1}\left(\frac{x}{a}\right) + c$
- $\int \frac{1}{a^2+x^2} dx = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + c$
- $\int \frac{1}{x\sqrt{x^2-a^2}} dx = \frac{1}{a} \sec^{-1}\left|\frac{x}{a}\right| + c$
- $\int \sin^n x dx = -\frac{\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x dx$
- $\int \cos^n x dx = \frac{\cos^{n-1} x \sin x}{n} + \frac{n-1}{n} \int \cos^{n-2} x dx$
- $\int \tan^n x dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x dx$
- $\int \sec^n x dx = \frac{\sec^{n-2} x \tan x}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2} x dx$
- $\int \tan x dx = \ln |\sec x| + c$
- $\int \cot x dx = \ln |\sin x| + c$
- $\int \sec x dx = \ln |\sec x + \tan x| + c$
- $\int \csc x dx = -\ln |\csc x + \cot x| + c$