

## Examples Chapter 5

### 5.5 The Substitution Rule

Ex 1 Find the following:

a.)  $\int \sec^2(3x)dx$

b.)  $\int x^2\sqrt{x^3+9}dx$

c.)  $\int 2\sin^3 x \cos x dx$

Ex 2 Evaluate  $\int_1^2 \frac{dt}{(1+t)^3}$ .

Ex 3 For  $f(x) = x^4 + 2$ , use the symmetry of the function to evaluate  $\int_{-1}^1 (x^4 + 2)dx$ .

Ex 4 Evaluate the following:

a.)  $\int_0^1 x(x^2+1)^5 dx$

b.)  $\int \frac{(\ln x)^3}{x} dx$

c.)  $\int \frac{e^t}{3+e^t} dt$

### 5.6 Integration by Parts

Ex 1 Find the following:

a.)  $\int x \cos x dx$

b.)  $\int \ln x dx$

c.)  $\int_0^1 xe^x dx$

d.)  $\int e^x \sin x dx$

## 5.7 Additional Techniques of Integration

Ex 1 Evaluate the following.

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

b.)  $\int \tan^3 x \sec x dx$

c.)  $\int \sin^5 x \cos^2 x dx$

## Appendix G Integration of Rational Functions by Partial Fractions

Ex 1 Find the partial fraction decomposition for the following.

a.)  $\frac{x - 8}{x^2 - x - 2}$

b.)  $\frac{2x^2 + 3x - 3}{x^2 - 1}$

Ex 2 Evaluate the following

a.)  $\int \frac{5 - 2x}{(x - 1)^2} dx$

b.)  $\int \frac{dx}{x^2 + 25}$

c.)  $\int \frac{10}{(x - 1)(x^2 + 9)} dx$

## 5.8 Integration using Tables and Computer Algebra Systems

Ex 1 Evaluate the following using the table of integrals.

a.)  $\int \frac{dx}{x^2 \sqrt{4x^2 + 9}}$

b.)  $\int \frac{\tan^3\left(\frac{1}{x}\right)}{x^2} dx$

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

Ex 2 Evaluate the following using Maple.

a.)  $\int \frac{dx}{x^2\sqrt{4x^2+9}}$

b.)  $\int \frac{\tan^3\left(\frac{1}{x}\right)}{x^2} dx$

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

## 5.9 Approximate Integration

Ex 1 Use (a) Midpoint Rule and (b) Trapezoid Rule with  $n = 6$  to approximate  $\int_1^3 \frac{dx}{x}$ .

Ex 2 Use Simpson's Rule with  $n = 6$  to approximate  $\int_1^3 \frac{dx}{x}$ .

## 5.10 Improper Integrals

Ex 1 Find the following.

a.)  $\int_1^\infty \frac{dx}{x+1}$

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

Ex 2 Find the following.

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

b.)  $\int_1^2 \frac{dx}{(x-2)^2}$

Ex 3 Use the Comparison Theorem to determine whether the integral is convergent or divergent.

a.)  $\int_1^\infty \frac{\cos^2 x}{1+x^2} dx$

b.)  $\int_1^\infty \frac{1+e^{-x}}{x} dx$