408D Course Guide

Adrian Melendez Relli

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1 Derivatives

$$\frac{d}{dx}\sin(x) = \cos(x)$$

$$\frac{d}{dx}\cos(x) = -\sin(x)$$

$$\frac{d}{dx}\tan(x) = \sec^2(x)$$

$$\frac{d}{dx}\sec(x) = \sec(x)\tan(x)$$

$$\frac{d}{dx}\cot(x) = -\csc^2(x)$$

$$\frac{d}{dx}\csc(x) = -\csc(x)\cot(x)$$

2 Integration

$$\int \sin(x)\,dx = -\cos(x) + C$$

$$\int \cos(x)\,dx = \sin(x) + C$$

$$\int \tan(x)\,dx = -\ln|\cos(x)| + C$$

$$\int \cot(x))\,dx = \ln|\sin(x)| + C$$

$$\int \sec(x))\,dx = \ln|\sec(x) + \tan(x)| + C$$

$$\int \csc(x))\,dx = -\ln|\csc(x) + \cot(x)| + C$$

Integrate by Parts $\int u\,dv - \int v\,du$

3 Product of sines and cosines

$$\int sin^n(x)cos^m(x)$$

Case 1 : m = 1 $\frac{sin^{n+1}(x)}{n+1} + C$

Case 2 : m = odd

Use $\cos^2(x) = 1 - \sin^2(x)$ to convert all but one power of cosine to sine.

Case 3 : n = 1 $-\frac{cos^{m+1}(x)}{m+1} + C$

Case 4 : n = odd

Use $\cos^2(x) = 1 - \sin^2(x)$ to convert all but one power of sine to cosine.

Case 5: Both are even, Use Double Angle Formulas

$$sin^n(x)cos^m(x) = (\frac{1}{2}(1 - cos(2x)))^{\frac{n}{2}}(\frac{1}{2}(1 + cos(2x)))^{\frac{m}{2}}$$

4 Product of secants and tangents

$$\int sec^n(x)tan^m(x)$$

Case 1 : n = 2 $u = tan(x), \int u^m du$

Case 2: n = even Convert all but two secants to tangents

Case 3 : m = 1 $u = sec(x), \int u^{n-1} du$

Case 4: m = odd Convert all but one power of tangent into secants

Be sure to factor out any coefficient inside trig function, e.g. $cos(3x)$ becomes $\frac{1}{3}\int$ (u − sub)

5 Trigonometric Formulas

Double Angle Formulas:

$$sin(2x) = 2sin(x)cos(x)$$

$$cos(2x) = cos^2(x) - sin^2(x)$$

$$cos(2x) = 1 - 2sin^2(x)$$

$$cos(2x) = 2cos^2(x) - 1$$

Products of Trig Functions with Different Angles

$$sin(A)sin(B) = \frac{cos(A-B) - cos(A+B)}{2}$$

$$cos(A)cos(B) = \frac{cos(A-B) + cos(A+B)}{2}$$

$$sin(A)cos(B) = \frac{sin(A+B) + sin(A-B)}{2}$$

6 Trig Substitution