Basic Integration
7.3 – Integration With Trigonometry

Anti-Derivatives of the Six Trigonometric Functions

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

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

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

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

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

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

More Anti-Derivatives

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

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

$$\int \sec^2(x)\,dx = \tan(x) + C$$

$$\int csc\,^2(x)\,dx = -cot\,(x) + C$$

Reciprocal Identities

$$\sin(x) = \frac{1}{\csc(x)}$$
$$\cos(x) = \frac{1}{\sec(x)}$$
$$\tan(x) = \frac{1}{\cot(x)}$$

$$\csc(x) = \frac{1}{\sin(x)}$$
$$\sec(x) = \frac{1}{\cos(x)}$$
$$\cot(x) = \frac{1}{\tan(x)}$$

Quotient Identities

$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$
$$\cot(x) = \frac{\cos(x)}{\sin(x)}$$

Pythagorean Identities:

$$\sin^2(x) + \cos^2(x) = 1$$
$$\tan^2(x) + 1 = \sec^2(x)$$
$$1 + \cot^2(x) = \csc^2(x)$$

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Ex A: Integrate each function

#1) $\int [2\sin(x) + \cos(x)]dx$

$= -2\cos(x) + \sin(x) + C$

#2) $\int [\csc(x)(\cot(x) - \csc(x))]dx$

$= \int [\csc(x)\cot(x) - \csc^2(x)]dx$

$= -\csc(x) - (-\cot(x)) + C$

$= -\csc(x) + \cot(x) + C$

#3) $\int \sqrt{\pi \cos^2(x)}\, dx$

$= \int \sqrt{\pi}\cos(x)\, dx$

$= \sqrt{\pi}\sin(x) + C$

#4) $\int \sqrt{1 - \cos^2(x)}\, dx$

$= \int \sqrt{\sin^2(x)}\, dx$

$= \int \sin(x)\, dx$

$= -\cos(x) + C$

#5) $\int \cos(x)\sec(x)\, dx$

$= \int 1\, dx$

$= x + C$

#6) $\int \sec^2(x)\cot^2(x)\, dx$

$= \int \frac{1}{\cos^2(x)} \cdot \frac{\cos^2(x)}{\sin^2(x)}\, dx$

$= \int \frac{1}{\sin^2(x)}\, dx$

$= \int \csc^2(x)\, dx$

$= -\cot(x) + C$