

# Basic Integration

## 9.2 – Integration by Substitution & Trig

Using a u-substitution and trig functions.

#1)  $\int \cot(4x) dx$

$$\begin{aligned} &= \int \cot(u) \frac{du}{4} \\ &= \frac{1}{4} \int \cot(u) du \\ &= \frac{1}{4} \ln |\sin(u)| + C \\ &= \frac{1}{4} \ln |\sin(4x)| + C \end{aligned}$$

$$\begin{aligned} u &= 4x \\ \frac{du}{dx} &= 4 \\ du &= 4 dx \\ \frac{du}{4} &= dx \end{aligned}$$

#2)  $\int \sec(4x) dx$

$$\begin{aligned} &= \int \sec(u) \frac{du}{4} \\ &= \frac{1}{4} \int \sec(u) du \\ &= \frac{1}{4} \ln |\sec(u) + \tan(u)| + C \\ &= \frac{1}{4} \ln |\sec(4x) + \tan(4x)| + C \end{aligned}$$

$$\begin{aligned} u &= 4x \\ \frac{du}{dx} &= 4 \\ du &= 4 dx \\ \frac{du}{4} &= dx \end{aligned}$$

#3)  $\int \cos(x) e^{\sin(x)} dx$

$$\begin{aligned} &= \int \cancel{\cos(x)} e^u \frac{du}{\cancel{\cos(x)}} \\ &= \int e^u du \\ &= e^u + C \\ &= e^{\sin(x)} + C \end{aligned}$$

$$\begin{aligned} u &= \sin(x) \\ \frac{du}{dx} &= \cos(x) \\ du &= \cos(x) dx \\ \frac{du}{\cos(x)} &= dx \end{aligned}$$

#4)  $\int \cos(x) \sin(x) dx$

$$\begin{aligned} &= \int \cancel{\cos(x)} u \left( \frac{du}{\cancel{\cos(x)}} \right) \\ &= \int u du \\ &= \frac{1}{2} u^2 + C \\ &= \frac{1}{2} \sin^2(x) + C \end{aligned}$$

$$\begin{aligned} u &= \sin(x) \\ \frac{du}{dx} &= \cos(x) \\ du &= \cos(x) dx \\ \frac{du}{\cos(x)} &= dx \end{aligned}$$

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