MA205

Board Sheet - 5 September 2007, Substitution Rule, Lesson 11

Admin: Engineering Expo - Bonus Points for Attendance - Friday 7 September 1800-2000, Eisenhower Hall. Bring back something from the math table!

How to use Substitution to solve Integrals

An example to help you understand before the definitions

- Find $\int x^3 \cos(x^4+2)dx$.
- We start with the substitution $u = x^4 + 2$.
- We take the derivative of u which is $du = 4x^3 dx$.
- We solve for dx which gives us $dx = \frac{du}{4x^3}$
- We substitute in our new variables:

$$\begin{aligned}
\int x^3 \cos(x^4+2)dx &= \int x^3 \cos u \frac{du}{4x^3} \\
&= \frac{1}{4}\int \cos u du \\
&= \frac{1}{4}\sin u + C \\
&= \frac{1}{4}\sin(x^4+2) + C
\end{aligned}$$

Definition

- **Indefinite Substitution** If $u = g(x)$ is a differentiable function whose range is an interval I and f is continuous on I, then

$$\int f(g(x))g'(x)dx = \int f(u)du$$

Do these problems to help

1. $\int x^2\sqrt{x^3+1}dx, \quad u = x^3 + 1$

2. $\int e^{\sin\theta}\cos\theta d\theta, \quad u = \sin\theta$