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COURSE TITLE: GENERAL MATHEMATICS II
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1) $\int 2x^2 \ln x \, dx$

Let $u = \ln x$ $\quad dv = 2x^2$

$\frac{du}{dx} = \frac{1}{x}$ $\quad v = \frac{2x^3}{3}$

$du = \frac{1}{x} dx$

$\int u \, dv = uv - \int v \, du$

$\int 2x^2 \ln x \, dx = \ln x \cdot \frac{2x^3}{3} - \int \frac{2x^3}{3} \cdot \frac{1}{x} \, dx$

$\int 2x^2 \ln x \, dx = \frac{2x^3}{3} \ln x - \frac{2}{3} \int x^3 \cdot \frac{1}{x} \, dx$

$\int 2x^2 \ln x \, dx = \frac{2x^3}{3} \ln x - \frac{2}{3} \left[\frac{x^3}{3} \right] + c$

$\int 2x^2 \ln x \, dx = \frac{2x^3}{3} \left[\ln x - \frac{1}{3} \right] + c$

2) $\int 3te^{2t} dt$

Let $u = 3t$ $\quad dv = e^{2t}$

$\frac{du}{dt} = 3$ $\quad v = \frac{1}{2} e^{2t}$

$du = 3 \, dt$

$\int 3te^{2t} dt = 3t \cdot \frac{1}{2} e^{2t} - \int \frac{1}{2} e^{2t} \cdot 3 \, dt$

$\int 3te^{2t} dt = \frac{3}{2} te^{2t} - 3 \int \frac{1}{2} e^{2t} dt$

$\int 3te^{2t} dt = \left[\frac{3}{2} te^{2t} - \frac{3}{4} e^{2t} \right] + c$

3 $\int x^2 \sin x \, dx$

Let $u = x^2$ $\quad du = \sin x$

$\frac{dy}{dx} = 2x$ $\quad v = -\cos x$

$dy = 2x\,dx$

$\int x^2 \sin x \, dx = -x^2 \cos x - \int -\cos x \cdot 2x \, dx$

$\int x^2 \sin x \, dx = -x^2 \cos x + 2 \int \cos x \cdot x \, dx$ ... eq(i)

$\int \cos x \cdot x \, dx$

Let $u = x$, $dv = \cos x$

$\frac{du}{dx} = 1$ $\quad v = \sin x$

$du = dx$

$\int \cos x \cdot x \, dx = x \sin x - \int \sin x \, dx$ eq(ii)

Putting eq(ii) into eq(i)

$\int x^2 \sin x \, dx = -x^2 \cos x + 2 [x \sin x - \int \sin x \, dx]$

$\int x^2 \sin x \, dx = -x^2 \cos x + 2 [x \sin x - [-\cos x]] + c$

$\int x^2 \sin x \, dx = -x^2 \cos x + 2 [x \sin x + \cos x] + c$

$\int x^2 \sin x \, dx = -x^2 \cos x + 2x \sin x + 2 \cos x + c$

4 $\int \cos 5x \cos 6x \, dx$

Let $A = 5x$ $\quad B = 6x$

$\cos A \cos B = \frac{1}{2} [\cos(A+B) + \cos(A-B)]$

$\int \cos 5x \cos 6x \, dx = \frac{1}{2} \int \cos(5x+6x) + \cos(5x-6x)$

$\int \cos 5x \cos 6x \, dx = \frac{1}{2} \int \cos 11x + \cos x$

$\int \cos 5x \cos 6x \, dx = \frac{1}{2} \left[\frac{\sin 11x}{11} + \sin x\right] + c$

$\int \cos 5x \cos 6x \, dx = \frac{\sin 11x}{22} + \frac{\sin x}{2} + c$

6) $\int \sin 7x \cos 2x \, dx$

$\sin A \cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}[\sin(7x+2x) + \sin(7x-2x)]$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}[\sin 9x + \sin 5x]$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\int [\sin 9x + \sin 5x]$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\left[\frac{-\cos 9x}{9} - \frac{\cos 5x}{5}\right] + c$

$\int \sin 7x \cos 2x \, dx = \frac{-\cos 9x}{18} - \frac{\cos 5x}{10} + c$