

MAT 104 ASSIGNMENT.

a)  $\int 2x^2 \ln x \, dx$

let  $u = \ln x$ ,  $dv = 2x^2$ ,  
 $du = \frac{1}{x} dx$   $v = \frac{2x^3}{3}$

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

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

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

$$\int \ln x \cdot 2x^2 \, dx = \frac{2x^3}{3} (\ln x) - \frac{2}{3} \left( \frac{x^3}{3} \right) + C$$

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

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

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

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

$$\text{recall: } \int u dv = uv - \int v du.$$

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

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

$$\int 3te^{2t} dt = \frac{3}{2} te^{2t} - \frac{3}{2} \left( \frac{1}{2} e^{2t} \right) + C.$$

$$\int 3te^{2t} dt = \frac{3}{2} te^{2t} - \frac{3}{4} e^{2t} + C.$$

$$c. \int x^2 \sin x dx.$$

$$u = x^2$$

$$du = 2x dx$$

$$dv = \sin x$$

$$v = -\cos x$$

recall:

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

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

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

$$u = 2x, \quad dv = \cos x.$$

$$du = 2 dx, \quad v = \sin x.$$

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

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

$$\int 2x \cos x dx = 2x \sin x + 2 \cos x + C$$

$$\int x^2 \sin x dx = -x^2 \cos x + 2x \sin x + 2 \cos x + C.$$

$$d. \int \cos 5x \cos 6x dx.$$

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

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

$$\Rightarrow \frac{1}{2} \therefore \cos 5x \cos 6x = \frac{1}{2} [\cos 11x - \cos x]$$

$$\int \cos 5x \cos 6x dx = \frac{1}{2} \int (\cos 11x - \cos x)$$

$$\int \cos 5x \cos 6x dx = \frac{1}{2} \left( \frac{\sin 11x}{11} - \sin x \right) + C$$

$$\int \cos 5x \cos 6x dx = \frac{\sin 11x}{22} - \frac{\sin x}{2} + C.$$

$$\int \sin 7x \cos 2x \, dx.$$

$$A = 7x, \quad B = 2x.$$

recall:

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

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

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

$$\int \sin 7x \cos 2x \, dx = \frac{1}{2} \left( -\frac{\cos 9x}{9} - \frac{\cos 5x}{5} \right)$$

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