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MAT 104 19/MHS01/263

8/N-029

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

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

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

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

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

b).  $\int 3t + e^{2t} \, dt$

$u = 3t$   $du = 3 dt$

$v = \frac{1}{2} e^{2t}$   $dv = e^{2t} dt$

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

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

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

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

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

$$c) \int x^2 \sin x \, dx$$

$$u = x^2$$

$$du = 2x \, dx$$

$$v = -\cos x$$

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

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

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

$$u = 2x, \, du = 2 \, dx$$

$$v = \sin x$$

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

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

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

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

$$d) \int \cos 5x \cos 6x \, dx$$

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

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

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

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

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

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

$$e) \int \sin 7x \cos 2x dx$$

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

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

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

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

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

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