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Dept: Civil Engineering

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MAT104 Assignment

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

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

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

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

$$du = 3dt$$

$$\begin{aligned} \therefore uv - \int v du \\ = 3t \left( \frac{e^{2t}}{2} \right) - \int e^{2t} 3dt \end{aligned}$$

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

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

$$= \underline{\underline{\frac{3e^{2t}(t-1)}{2} + C}}$$

2)  $\int x^2 \sin x$

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

$$u = x^2 \quad dv = \sin x$$

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

$$du = 2x dx$$

$$\therefore uv - \int v du$$

$$= -x^2 \cos x - \int -\cos x 2x dx$$

$$x^2 \cos x + \begin{cases} \int \cos x 2x dx \\ u = 2x \quad dv = \cos x \\ \frac{du}{dx} = 2 \quad v = \sin x \\ du = 2 dx \\ 2x \sin x - \int \sin x dx \\ 2x \sin x - 2(-\cos x) \\ 2x \sin x + 2 \cos x \end{cases}$$

$$\therefore \int x^2 \sin x = \underline{\underline{x^2 \cos x + 2x \sin x + 2 \cos x + C}}$$

$$3.) \int \sin 7x \cos 2x dx, A=7x, B=2x$$

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

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

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

$$= \frac{1}{2} \left[ -\frac{\cos 9x}{9} - \frac{\cos 5x}{5} \right]$$

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

$$4.) \int \frac{2x-3x^2}{1-x}$$

$$\begin{array}{r} 3x+1 \\ 1-x \overline{) 2x-3x^2} \\ \underline{3x-3x^2} \\ -x \phantom{-3x^2} \\ \underline{+1-x} \\ 1 \end{array}$$

$$\therefore \int \frac{2x-3x^2}{1-x} = \int 3x+1 + \int \frac{1}{1-x}$$

$$= 3 \int x + \int 1 + \ln(1-x) + C$$

$$= \frac{3x^2}{2} + x + \ln(1-x) + C$$