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Mechanical Engineering

MAT 104

SIN: 37.

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

$$u = 3t \quad dv = e^{2t}$$
$$\frac{du}{dt} = 3 \quad v = \frac{1}{2}e^{2t}$$
$$uv - \int v du$$
$$3t \times \frac{1}{2}e^{2t} - \int \frac{1}{2}e^{2t} 3 dt$$
$$\frac{3}{2}te^{2t} - \frac{3}{2} \int e^{2t} dt$$
$$\frac{3}{2}te^{2t} - \frac{3}{2} \left[\frac{1}{2}e^{2t} \right]$$
$$\left[\frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} \right] + c$$

2) $x^2 \sin x$

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

$$3.) \int \sin 7x \cos 2x$$

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

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

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

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

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

$$= \frac{-\cos 9x}{18} - \frac{\cos 5x}{10} + C$$

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

$$= - \int \frac{x(3x-2)}{x-1} dx$$

$u = x-1$; $\frac{du}{dx} = 1$; $du = dx$
 $x = u+1$; $x^2 = (u+1)^2$

$$= \int \frac{(u+1)(3u+1)}{u} du$$

$$= \int \frac{3u^2 + 4u + 1}{u} du$$

$$= 3 \int u du + \int \frac{1}{u} du + 4 \int du$$

$$= 3 \left(\frac{u^2}{2} \right) + \ln u + 4u$$

$$= \ln u + \frac{3u^2}{2} + 4u$$

$$= \ln(x-1) + \frac{3(x-1)^2}{2} + 4(x-1)$$

$$\int \frac{(2x-3x^2)}{1-x} dx = -4(x-1) - \frac{3(x-1)^2}{2} - \ln(x-1) + C$$