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19/MHS01/002

Medicine and Health sciences

Medicine and surgery

MAT 104 Assignment

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

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

$$\int u \, dv = uv - \int v \, du$$
$$= \ln x \times \frac{2x^3}{3} - \int \frac{2x^3}{3} \cdot \frac{1}{x} dx$$

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

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

$$= \frac{2x^3 \ln x}{3} - \frac{2x^3}{4}$$

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

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

let $u = 3t$ $du = 3$
 $v = \frac{1}{2}e^{2t}$ $dv = e^{2t} dt$

$$\int u \, dv = uv - \int v \, du$$
$$= 3t \times \frac{1}{2}e^{2t} - \int \frac{1}{2}e^{2t} \times 3$$
$$= \frac{3t}{2}e^{2t} - \int \frac{3e^{2t}}{2}$$

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

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

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

$u = x^2$ $du = 2x$

$dv = \sin x \, dx$ $v = -\cos x$

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

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

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

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

Integrate by parts

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

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

$$= -x^2 \cos x + 2x \sin x + \cos x - 2$$

$$= -x^2 \cos x + 2x \sin x + 2 \cos x + C$$

let $u = -2x$

$dv = \cos x \, dx$

$dx = -2$

$v = \sin x$

$$4) \cos 5x \cos 6x = \frac{1}{2} (\cos(5x+6x) + \cos(5x-6x))$$

$$= \frac{1}{2} (\cos 11x - \cos x)$$

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

$$= \frac{1}{2} \left[\frac{\cos 11x}{11} - \frac{\cos x}{2} \right] + C$$

$$= \frac{1}{2} \left[\frac{\cos 11x}{22} - \frac{\cos x}{4} \right] + C$$

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

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

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

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

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