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Matric No: 19/ENG06/043
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Course: MAT104

Assignment

1) $y = \frac{2\cos 3x}{x^3}$

$u = 2\cos 3x$

$\frac{du}{dx} = -6\sin 3x$

$v = x^3$

$\frac{dv}{dx} = 3x^2$

$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

$= \frac{x^3(-6\sin 3x) - 2\cos 3x\,(3x^2)}{x^6}$

$= \frac{-6x^3\sin 3x - 6x^2\cos 3x}{x^6}$

$= x^2\left(\frac{-6x\sin 3x - 6\cos 3x}{x^6}\right)$

$= \frac{-6x\sin 3x - 6\cos 3x}{x^4}$

2) $y = xe^{2x}$

$u = x$

$\frac{du}{dx} = 1$

$v = e^{2x}$

$\frac{dv}{dx} = 2e^{2x}$

$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$

$\frac{dy}{dx} = x(2e^{2x}) + e^{2x}(1)$

$\frac{dy}{dx} = 2xe^{2x} + e^{2x}$

$\frac{d^2y}{dx^2} = 2(2xe^{2x} + e^{2x}) + 2e^{2x}$

$\frac{d^2y}{dx^2} = 4xe^{2x} + 2e^{2x} + 2e^{2x}$

$\therefore \frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$

$= 4xe^{2x} + 4e^{2x} - 4(2xe^{2x} + e^{2x}) + 4(xe^{2x})$

$= 4xe^{2x} + 4e^{2x} - 8xe^{2x} - 4e^{2x} + 4xe^{2x}$

$= 4xe^{2x} - 8xe^{2x} + 4xe^{2x} + 4e^{2x} - 4e^{2x}$

$= 0$

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4) $\int e^x \sin 2x\, dx$

$u = \sin 2x \qquad dv = e^x$

$\frac{du}{dx} = 2\cos 2x \qquad v = e^x$

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

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

$-\int u = 2\cos 2x \quad dv = e^x$

$\frac{du}{dx} = -4\sin 2x \quad v = e^x$

$e^x \cdot 2\cos 2x - \int e^x \cdot -4\sin 2x\, dx$

$= e^x \sin 2x - 2e^x \cos 2x - \int 4e^x \sin 2x\, dx$

$\int e^x \sin 2x\, dx = e^x \sin 2x - 2e^x \cos x - 4\int e^x \sin 2x\, dx$

Let $\int e^x \sin 2x\, dx = I$

$I = e^x \sin 2x - 2e^x \cos x - 4I$

$5I = e^x \sin 2x - 2e^x \cos x$

$$I = e^x \frac{\sin 2x - 2e^x \cos x}{5}$$

$$\therefore \int e^x \sin 2x = \frac{e^x \sin 2x - 2e^x \cos x}{5}$$