

ILODIBE ANTHONY UDENNA

COMPUTER ENGINEERING

19/ENG02/026

MAT 104 SERIAL NO: 35

1 Find dy/dx if $y = \frac{(2\cos 3x)}{x^3}$

sol

$$u = 2\cos 3x \quad ; \quad \frac{du}{dx} = -6\sin 3x$$

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

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

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

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

$$\therefore \frac{dy}{dx} = \frac{6x^2[-x\sin 3x - \cos 3x]}{x^6}$$

2 If $y = xe^{2x}$, show that the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$.

sol

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

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

$$\frac{d^2y}{dx^2} = 4ne^{2x}$$

$$\therefore 4ne^{2x} - 4(2xe^{2x}) + 4(xe^{2x}) = 0$$

$$4ne^{2x} - 8xe^{2x} + 4xe^{2x} = 0$$

$$-4xe^{2x} + 4xe^{2x} = 0$$

$$0 = 0$$

$$\therefore L.H.S = R.H.S$$

3 Write your name, matric number and department

sol

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4 Find the integral of $e^x \sin 2x$ with respect to x

sol

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

$$\int u \frac{dv}{dx} \, dx = uv - \int v \frac{du}{dx} \, dx$$

$$\therefore \int e^x \sin 2x \, dx ; u = e^x ; \frac{du}{dx} = e^x$$

$$\frac{dv}{dx} = \sin 2x ; v = 2 \cos 2x$$

$$\therefore \int e^x \sin 2x \, dx = e^x (2 \cos 2x) - \int 2 \cos 2x (e^x) \, dx \quad \text{--- (*)}$$

$$\int (e^x) 2 \cos 2x \, dx$$

$$u = e^x ; \frac{du}{dx} = e^x$$

$$\frac{dv}{dx} = 2 \cos 2x ; v = -4 \sin 2x$$

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

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

Substitute $(e^x (-4 \sin 2x) + \int 4 \sin 2x e^x \, dx)$ into equi (*)

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

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

$$\int e^x \sin 2x \, dx + 4 \int \sin 2x e^x \, dx = e^x (2 \cos 2x) + e^x (4 \sin 2x)$$

$$\int e^x \sin 2x \, dx = e^x (2 \cos 2x) + e^x (4 \sin 2x)$$

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$$\therefore \int e^x \sin 2x \, dx = e^x [(2 \cos 2x) + e^x (4 \sin 2x)]$$

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