AFINIKI JOHN MHYA
Computer Engineering
Serial No: 50
MAT 104

Assignment

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

$$\frac{dy}{dx} = \frac{V\frac{dy}{du} - U\frac{dv}{du}}{V^2}$$

$U = 2\cos 3x$ $\quad V^2 = x^6$

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

$\frac{dv}{dx}$

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

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

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

$$\frac{dy}{dx} = \frac{-6(x\sin 3x + \cos 3x)}{x^4}$$

2 If $y = xe^{2x}$, show that the differential equation

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

$$\frac{dy}{dx} = U\frac{dv}{dx} + V\frac{du}{dx}$$

$U = x$ $\quad \frac{du}{dx} = 1$, $\quad \frac{dv}{dx} = 2e^{2x}$

$V = e^{2x}$

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

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

$$4\frac{dy}{dx} = 4\left(2xe^{2x} + e^{2x}\right)$$

$$\cancel{4\frac{dy}{dx} = 4\left(2xe^{2x} + e^{2x}\right)}$$

$$\frac{4dy}{dx} = \left(8xe^{2x} + 4e^{2x}\right)$$

$$\frac{d^2y}{dx^2} = \left(2e^{2x} + \cancel{4x}e^{2} \; 4xe^{2x}\right) + 2e^{2x}$$

$$= 4xe^{2x} + 2e^{2x} + \cancel{4}\,2e^{2x}$$

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

$$4y = 4\left(xe^{2x}\right)$$

$$4y = 4\left(xe^{2x}\right)$$

$$4y = 4xe^{2x}$$

$$\frac{d^2y}{dx^2} - \frac{4dy}{dx} + 4y = \left(4xe^{2x} + 4e^{2x}\right) - \left(8xe^{2x} + 4e^{2x}\right) + 4xe^{2x}$$

$$\frac{d^2y}{dx^2} - \frac{4dy}{dx} + 4y = 4xe^{2x} + 4e^{2x} - 8xe^{2x} - 4e^{2x} + 4xe^{2x}$$

$$\frac{d^2y}{dx^2} - \frac{4dy}{dx} + 4y = \cancel{8xe^{2x}} - \cancel{8xe^{2x}} + \cancel{4e^{2x}} - \cancel{4e^{2x}}$$

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

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

3 Name: AFINIKI JOHN MHYA
Matric number: 19/ENG02/028
Department: COMPUTER ENGINEERING

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

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

$u = \sin 2x$

$dv = e^x$

$\frac{du}{dx} = 2\cos 2x$

$v = e^x$

$$du = 2\cos 2x \, dx$$

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

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

solve for $\int e^x \, 2\cos 2x \, dx$

$u = 2\cos 2x$

$\frac{du}{dx} = -4\sin 2x$

$dv = e^x$

$v = e^x$

$$du = -4\sin 2x \, dx$$

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

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

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

$$-3\int \sin 2x \, e^x \, dx = e^x (\sin 2x - 2\cos 2x)$$

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