PIANICK TISE ORITSETSERUNDEDE
CHEMICAL ENGINEERING
19/ENG01/013
SERIAL NUMBER: 48.
MAT 104 Assignment

Question 1

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

Solution

$y = 2\cos 3x \cdot x^{-3}$

$y = 2x^{-3} \cdot \cos 3x$

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

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

Where $u = 2\cos 3x$; $v = x^3$; $V^2 = x^6$

$\frac{du}{dx} = -6\sin 3x$; $\frac{dv}{dx} = 3x^2$

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

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

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

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

Question 3

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

Solution

$$dy/dx = U\,dv/dx + V\,du/dx$$

where $u = x$; $v = e^{2x}$

$\frac{du}{dx} = 1$; $\frac{dv}{du} = 2e^{2x}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Question 3

Write your name, MATRIC number and department

Solution

NAME: PINNICK ITSE ORITSETSERUNDEDE

Matric Number: 19/ENG101/013

department: Chemical ENGINEERING

Question 4,

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

Solution

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

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

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

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

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

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

$$\int \sin 2x e^x dx = e^x \sin 2x - \left[u = 2\cos 2x \quad dv = e^x \right.$$

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

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

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

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

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

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

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

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

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