Okunlola Olaniyi Oladayo
Mechanical Engineering 100lvl
19/ENG06/040
MAT 101
serial no: 205

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

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

$u = 2\cos 3x \qquad v = x^3$

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

$v^2 = (x^3)^2 = x^6$

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

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

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

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

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

i. $\frac{dy}{dx} = u\,dv/dx + v\,du/dx$

$u = x \qquad v = e^{2x}$

$du/dx = 1 \qquad dv/dx = 2e^{2x}$

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

$= 2xe^{2x} + e^{2x}$

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

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

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

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

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

$Ly = L(xe^{2x})$

$xy = 4xe^{2x}$

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

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

$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 12xe^{2x} - 8xe^{2x} + 4xe^{2x} + 8e^{2x} - 8e^{2x}$

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

3. Oduntan Oluwaseyi Oladayo

19/ENG06/040

Mechanical Engineering.

4. $\int e^x \sin 2x$

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

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

$du/dx = 2\cos 2x \qquad dv/dx = e^x$

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

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

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

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

$u = 2\cos 2x \qquad v = e^x$

$du/dx = -4\sin 2x\,dx \qquad dv/dx = e^x$

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

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

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

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

$5\int \sin 2x\, e^x dx = e^x(\sin 2x - 2\cos 2x)$

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