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DEPARTMENT: ~~19/ENG04/015~~ ELECTRICAL ENGINEERING
MATRIC NO: 19/ENG04/015 SERIAL NUMBER: 19
MATHS ASSIGNMENT

(1) $y = (2\cos 3x)/x^3$

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

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

$du/dx = -6\sin 3x \qquad dv/dx = 3x^2$

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

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

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

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

$\frac{dy}{dx} \quad u = x \qquad v = e^{2x}$

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

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

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

$\frac{d^2y}{dx^2} \quad [2xe^{2x} + e^{2x}]$

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

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

$d/dx[2xe^{2x}] = 4xe^{2x} + 2e^{2x}$

$d/dx[e^{2x}] = 2e^{2x}$

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

$d^2y/dx^2 - 4\,dy/dx + 4y = 0$

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

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

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

$= 0$

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(4.) $e^x \sin 2x$

$dy/dx = u \cdot dv/dx + v \cdot du/dx$

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

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

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

$= 2e^x \sin 2x + e^x \sin 2x$

$= 3e^x \sin 2x$

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

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

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

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

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

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

$du/dx = -2\sin 2x \qquad v = 2e^x$

$= e^x \sin 2x - [2e^x \cos 2x + \int 2e^x (2\sin 2x)]$

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

~~Let $I = \int 4e^x \sin 2x$~~

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

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

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

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

$$\therefore \int e^x \sin 2x = \frac{1}{5}\left[e^x \sin 2x - 2e^x \cos 2x\right] + C$$