S/N=97 Arwoseikpaye Ogheneuwede Michael

19/ENG06/010

Maths 104 Mechanical Engineering

① $y = \frac{2\cos 3x}{x^3}$

$\ln y = \ln(2\cos 3x) - \ln(x^3)$

$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{2\cos 3x} \times -6\sin 3x - \frac{1}{x^3} \times 3x^2$

$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{-6\sin 3x}{2\cos 3x} - \frac{3x^2}{x^3}$

$\frac{1}{y}\frac{dy}{dx} = -3\tan 3x - 3x^{-1}$

$\frac{dy}{dx} = y\left[-3\tan 3x - 3x^{-1}\right]$

$\frac{dy}{dx} = \frac{2\cos 3x}{x^3}\left[-3\tan 3x - \frac{3}{x}\right]$ ///

② $y = xe^{2x}$

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

$e^{2x}(1+2x)$ //

$\begin{cases} U = x, V = e^{2x} \\ \frac{dy}{dx} = 1, \frac{dV}{dx} = 2e^{2x} \end{cases}$

$\frac{d^2y}{dx^2} = U = e^{2x}, V = (1+2x)$

$\frac{dy}{dx} = 2e^{2x}, \frac{dV}{dx} = 2$

$2e^{2x}(1+2x) + 2e^{2x}$

$2e^{2x}[(1+2x)+1] \rightarrow$

$4y \Rightarrow 4xe^{2x}$

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

$(2e^{2x}(1+2x) + 2e^{2x}) - 4(e^{2x}(1+2x) + 4(xe^{2x})$

$\Rightarrow 2e^{2x} + 4xe^{2x} + 2e^{2x} - 4(e^{2x} + 2xe^{2x}) + 4xe^{2x}$

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

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

$= 8xe^{2x} - 8xe^{2x} = 0$ /// Proved

(3) NAME: AYWOSEKPAYE Oghenevwede Michael
MATRIC NO: 19/ENG06/010
DEPT: Mechanical Engineering. // S/N: 97

(4) $\int e^x \sin 2x\,dx$, $\quad u = \sin 2x,\ dv = e^x$

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

$= e^x \sin 2x - 2\int e^x \cos 2x\,dx \quad \begin{cases} u = \cos 2x \\ dv = e^x \\ \frac{du}{dx} = -2\sin 2x \;//\; v = e^x \end{cases}$

$= e^x \sin 2x - 2\left[e^x \cos 2x + 2\int e^x \sin 2x\,dx\right.$.

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

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

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

$5I = e^x(\sin 2x - 2\cos 2x) + C$

$I = \frac{e^x}{5}(\sin 2x - 2\cos 2x) + C$ //

OR

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

$\Rightarrow x = 1, a = 1, b = 2$

$\int e^x \sin 2x\,dx = \left[\frac{e^x}{1^2+2^2}(1\sin 2x - 2\cos 2x)\right]$

$= \frac{e^x}{5}(\sin 2x - 2\cos 2x) + C$ //