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Department ⟹ Computer Engineering
Course ⟹ Mat 104
Mat. No ⟹ 19/ENG02/061
Date ⟹ 6/05/2020
Serial No ⟹ 220

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

Solution

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

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

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

$\frac{dy}{dx} = y\left[\frac{-3\sin 3x}{\cos 3x} - \frac{3}{x}\right]$

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

(2) If $y = x\cdot e^{2x}$, show that the differential equation $d^2y/dx^2 - 4dy/dx + 4y = 0$

Solution

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

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

$= x\,de^{2x}/dx + e^{2x}\,dx/dx$

$= x\cdot e^{2x}\cdot 2 + e^{2x}\times 1$

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

$d^2y/dx^2 = 2x\frac{de^{2x}}{dx} + e^{2x}\frac{d2x}{dx} + \frac{de^{2x}}{dx}$

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

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

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

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

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

$8xe^{2x} - 8xe^{2x} + 4e^{2x} - 4e^{2x} = 0$

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

(3) Write your name, Matric Number and department.

Solution

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(4) Find the integral of $e^x \sin 2x$ With respect to x.

Solution

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

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

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

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

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

$e^x \sin 2x - \int e^x 2\cos 2x \cdot dx$

$\int u = 2\cos 2x \quad dv = e^x$

$du = -2\sin 2x \quad v = e^x$

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

$e^x 2\cos 2x + 2\sin 2x\, e^x \cdot dx$

$e^x \sin 2x - e^x 2\cos 2x - \int e^x 2\sin 2 \cdot dx$

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

let $J = \int e^x 2\sin 2x \cdot dx$

$J = e^x \cdot 2\sin 2x - e^x 2\cos 2x - J$

$2J = e^x \cdot 2\sin 2x - e^x 2\cos 2x$

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

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