Nnaemeka Okonjo
Computer Engineering
14/Eng02/045
Math 102

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

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

$\frac{d(\ln y)}{dx} = \frac{d(\ln 2\cos 3x)}{dx} - \frac{d(\ln x^3)}{dx}$

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

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

$\frac{dy}{dx} = \left(\frac{-3\sin 3x}{\cos 3x} - \frac{3}{x}\right)\cdot y$

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

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

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

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

$\therefore 4xe^{2x} - 4(2xe^{2x}) + 4(xe^{2x}) = 0$

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

$3xe^{2x} - 8xe^{2x} = 0$

3) Nnaemeka Okonjo
14/Eng02/045
Computer Engineering

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$3A = e^x \sin 2x - e^x 2\cos 2x$

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

$\int e^x \sin 2x\,dx = \frac{1}{3}[e^x \sin 2x - e^x 2\cos 2x] + C$