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MATRIC : 15/ENG02/059
COURSE : General Mathematics 104

1 find dy/dx if $y = \frac{(2\cos 3x)}{x^3}$

solution

first find for x

$\therefore 2\cos(3x)$ with respect to x

$2\frac{d}{dx}(\cos(3x))$

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differentiate using the chain rule

$\frac{d}{dx}(f(g(x))$

is $f(g(x))g(x)$ where

$f(x) = \cos(x)$ and $g(x) = 3x$

$= 2\left(\frac{d}{du}(\cos(u))\frac{d}{dx}(3x)\right)$

$= 2\left(-\sin(u)\frac{d}{dx}(3x)\right)$

$-2\left(\sin 3x \frac{d}{dx}(3x)\right)$

since 3 is constant with respect to x, the derivative of $3x$ with respect to x is $3\frac{d}{dx}(x)$

$-2\sin(3x)\left(3\frac{d}{dx}(x)\right)$

multiply 3 by -2

$= -6\sin(3x)\frac{d}{dx}(x)$

differentiate to respect of y

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

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

$y = e^{m_1 x}$

$\frac{dy}{dx} = m_1 e^{m_1 x}$

$\frac{d^2y}{dx^2} = m_1^2 e^{m_1 x}$

$m_1^2 e^{m_1 x} - 4m_1 e^{m_1 x} + 4e^{m_1 x} = 0$

$e^{m_1 x}\left(m_1^2 - 4m_1 + 4\right) = 0$

$y = e^x$

$\Rightarrow$

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4. $e^x \sin 2x \, dx$

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

making

$u_1 = \sin 2x$

$\frac{dv_1}{dx} = e^x$

$\frac{du_1}{dx} = 2\cos 2x$

$v_1 = e^x$

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

$= e^x \sin 2x - 2$ ------ (1)

$I_2 = \int e^x \cos 2x \, dx$

$u_2 = \cos 2x \quad \frac{dv_2}{dx} = e^x$

$\frac{du_2}{dx} = -2\sin 2x \cdot v_2 = e^x$

$I_2 = \int e^x \cos 2x \, dx = e^x \cos 2x - -2 \int e^x \sin 2x \, dx$

$= e^x \cos 2x + 2$ ------ (2)

substitute (2) into (1)

$\therefore e^x \sin 2x - 2(e^x \cos 2x + 2)$

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

$5 = e^x \sin 2x - 2e^x \cos 2x + K$

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