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MATRIC NUMBER: 18/ENG02/095
DEPARTMENT: COMPUTER ENGINEERING
COURSE CODE & TITLE: MATHS 104

Pract

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

Solution

find the derivative of the equation using implicit differentiation.

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

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

using chain Rule,

$$\frac{d}{dx}(y) = \frac{dy(u)}{du}\frac{du}{dx}, \text{ where } u = x$$

and

$$\frac{d}{du}(y(u)) = y'(u)$$

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

$$= 2 \cdot \frac{d}{dx}\left[\frac{\cos(3x)}{x^3}\right]$$

$$= 2 \cdot \frac{\frac{d}{dx}[\cos(3x)] \cdot x^3 - \cos(3x) \cdot \frac{d}{dx}[x^3]}{(x^3)^2}$$

$$= \frac{2((-\sin(3x)) \cdot \frac{d}{dx}[3x] \cdot x^3 - 3x^2\cos(3x))}{x^6}$$

$$= \frac{2(-3 \cdot \frac{d}{dx}[x] \cdot x^3\sin(3x) - 3x^2\cos(3x))}{x^6}$$

$$= \frac{2(-3 \cdot \frac{d}{dx}[x] \cdot x^3\sin(3x) - 3x^2\cos(3x))}{x^6}$$

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

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

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

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

2. If $y = xe^{2x}$, show that the differential equation $d^2y/dx^2 - 4dy/dx + 4y = 0$

Solution.

$y = xe^{2x}$, show $d^2y/dx^2 - 4dy/dx + 4y = 0$

$$\frac{dx(e)}{de} = \frac{1 - 4x + 2x^2}{4e - 4ex}$$

$$\frac{\partial e(x)}{\partial x} = -\frac{4e(-1+x)}{1 - 4x + 2x^2}$$

$$\frac{\partial^2 x(e)}{\partial e^2} = \frac{7 - 40x + 68x^2 - 48x^3 + 12x^4}{8e^2 - (-1 + x)}$$

$$\frac{d^2e(x)}{dx^2} = \frac{16e}{(1 - 4x + 2x^2)^2}$$

3. Write your name, Matric NOS & department:

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MATRIC NOS: 18/ENG/02/095

DEPT: Computer engineering.

4. Find the Integral of $e^x \sin 2x$ with respect to $x$

Solution.

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

Integration by parts

$$f' = 1,\quad g = e^x \sin(2x)$$

$$= f' = 1,\quad g = \frac{e^x \sin(2x) - 2e^x \cos(2x)}{5}$$

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

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

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

Apply linearity.

$$= \frac{1}{5}\int e^x \sin(2x)\,dx - \frac{2}{5}\int e^x \cos(2x)\,dx$$

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

$$= e^x \sin(2x) - \left(2e^x \cos(2x) - \int -4e^x \sin(2x)\,dx\right)$$

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

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

$$= \frac{2(2e^x \sin(2x) + e^x \cos(2x))}{25} + \frac{x(e^x \sin(2x)}{5}$$

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

$$= \frac{2(2e^x \sin(2x) + e^x \cos(2x))}{25} 25 + \frac{x(e^x \sin(2x) - 2e^x \cos(2x))}{5}$$

$$- \frac{e^x \sin(2x) - 2e^x \cos(2x)}{25} + C$$

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

$$\frac{e^x((5x+3)\sin(2x) + (4 - 10x)\cos(2x))}{25} + C$$