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 DEPARTMENT: BIOMEDICAL ENGINEERING  
 MATRIC NUMBER: 19 EN608/004  
 MAT 104 ASSIGNMENT

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

Solution

$$y = \frac{2 \cos 3x}{x^3}$$

Using quotient rule,

$$u = 2 \cos 3x$$

$$v = x^3$$

$$\frac{du}{dx} = -6 \sin 3x$$

$$\frac{dv}{dx} = 3x^2$$

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

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

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

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

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

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

Solution

$$y = xe^{2x}$$

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

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

solve for,

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

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

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

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

Q.E.D



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

Recall:

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

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

$$du = 2 \cos 2x \quad v = e^x$$

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

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

$$= e^x \sin 2x - 2e^x \cos 2x - 4 \int e^x \sin 2x \, dx$$

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

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

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

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Department: Biomedical Engineering

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