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Matric No.: 19/ENG04/003
Course Code: MAT 104

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

Use the quotient rule.

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

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

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

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

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

2.) $y = xe^{2x}$ $\quad u = x\,,\ v = e^{2x}$

$\frac{dy}{dx} = u^{dv}/dx + v^{du}/dx$

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

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

$2e^{2x} + e^{2x}.$

$d^2y/dx^2 = 2x\,de^{2x}/dx + (e^{2x}\,d\,2x)/dx + de^{2x}/d$

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

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

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

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

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

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

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

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

let $u = \sin 2x$ and $dv = e^x$

$du = 2\cos 2x \, dx$, $\int dv = \cancel{ex}\ e^x \quad \therefore \quad v = e^x$

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

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

~~Integral~~ Solving $\int (e^x)(2\cos 2x)$ the second time.

= let $u = 2\cos 2x$ and $dv = e^x$

$du/dx = -4\sin 2x$ and $\int dv = e^x \therefore v = e^x$

Using $uv - \int v\,du$

$(2\cos 2x)(e^x) - \int (e^x)(-4\sin 2x)\,dx.$

$\therefore \sin 2x (e^x) - (2\cos 2x)(e^x) - \int (e^x)(-4\sin 2x)\,dx$

$\therefore e^x \sin(2x) - (2e^x \cos(2x) + 4 \int e^x \sin(2x)\,dx.$

~~Since~~.

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

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