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19/ENG02/039

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

let $u = 2\cos 3x$ $v = x^3$

$\frac{du}{dx} = -6\sin 3x$ $\frac{dv}{dx} = 3x^2$

$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

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

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

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

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

let $u = x$, $v = e^{2x}$

$\frac{du}{dx} = 1$, $\frac{dv}{dx} = 2e^{2x}$

$\frac{dy}{dx} \Rightarrow e^{2x} + 2xe^{2x}$

let u =

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

$\frac{d^2y}{dx^2} = 2e^{2x} + \frac{d}{dx}(2xe^{2x})$

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

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

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

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

$4\frac{dy}{dx} = 4(e^{2x} + 2xe^{2x}) \Rightarrow 4e^{2x} + 8xe^{2x}$

$4y = 4(xe^{2x}) \Rightarrow 4xe^{2x}$

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

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

is correct

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

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

$v = e^x$ and $du = \sin 2x$

$dv = e^x dx$ $\quad u = \frac{-\cos 2x}{2}$

~~$\int v du = uv -$~~

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

$\int e^x \sin 2x = -\frac{e^x \cos 2x}{2} + \int \frac{e^x \cos 2x}{2}$

$\int \frac{e^x \cos 2x}{2} = \frac{1}{2} \int e^x \cos 2x$

$\int e^x \cos 2x = \left(\frac{e^x \sin 2x}{2} - \int \frac{e^x \sin 2x}{2} \right) \frac{1}{2}$

$\int e^x \sin 2x = \frac{e^x \sin 2x}{4} - \frac{e^x \cos 2x}{2} - \int \frac{e^x \sin 2x}{4}$

let $\int e^x \sin 2x$ be y

$y = \frac{e^x \sin 2x}{4} - \frac{e^x \cos 2x}{2} - \frac{y}{4} + c$

$\frac{5y}{4} = \frac{e^x \sin 2x}{4} - \frac{e^x \cos 2x}{2} + c$

$$5y = e^{x}\sin 2x - 2e^{x}\cos 2x + c$$

$$y = \frac{e^{x}\sin 2x - 2e^{x}\cos 2x}{5} + c$$

putting the value of y back

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