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Computer Engineering 19/ENG02/059

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

let $u = 2\cos 3x$

$v = x^3$

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

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

$\frac{dy}{dx}$

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

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

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

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

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

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

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

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

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

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

$= 0$ //

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

$u = \sin 2x \qquad dv = e^{2x}$

$\frac{du}{dx} = 2\cos 2x \qquad v = e^{2x}$

$du = 2\cos 2x \, dx$

$$\int e^x \sin x \, dx = e^{2x} \sin 2x - \int e^x 2\cos 2x \, dx$$
$$= e^x \sin 2x - \int 2e^2 \cos 2x$$
$$= e^x \sin 2x - (2e^x \cos x - \int 2e^x \cdot -2\sin 2x \, dx$$
$$= e^x \sin dx = 2e^x \cos dx - 4\int e^2 \sin 2x \, dx$$

Let $I = \int e^x \sin 2x \, dx$

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

$5I = e^x \sin 2x - 2e^x \cos 2x$

$I = \frac{e^x \sin 2x - 2e^{2x} \cos 2x}{5}$ //