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

$$y = (2)(3\sin 3x)$$

$$y = \frac{(6\sin 3x)}{x^3}$$

$$\frac{dy}{dx} = \frac{6\sin 3x}{x^3}$$

multiply x^3 into y

$$\frac{g(x)\frac{d}{dx}(f(x)) - f(x)\frac{d}{dx}(g(x))}{g(x)^2}$$

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

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

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

$y = xe^{2x}$

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

$y = 1xe^{2x}$

Hence $\frac{dy}{dx} = (x)(2e^{2x}) +$

$(e^{2x})(1)$

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

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

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

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

$\frac{d^2y}{dx} = 4xe^{2x} + 8e^{2x}$

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

Substituting value

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

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

thus when $y = xe^{3x}$,

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

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

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$

$u_1 = \sin 2x$

$\frac{dv}{dx} = e^x$

$v_1 = e^x$

$\frac{du_1}{dx} = 2\cos 2x$

$I_1 = \int e^x \sin 2x \, dx = e^x \sin 2x - 2 \int e^x \cos 2x \, dx$

$= e^x \sin 2x - 2 I_2$

$I_2 = \int e^x \cos 2x \, dx$

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

$= e^x \cos 2x + 2 I_1$

sub 2 in 1.

$I_1 = e^x \sin 2x - 2 (e^x \cos 2x + 2 I_1)$

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

$5 I_1 = e^x \sin 2x - 2e^x \cos 2x + k$

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

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

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