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19/ENG04/002

MAT 104

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

Let $U = 2\cos 3x$

$V = x^3$

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

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

$\frac{dy}{dx} = \frac{V\,du/dx - U\,dv/dx}{V^2}$

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

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

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

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

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

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

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

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

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

$= 0$

//

3 $\Rightarrow d^2y/dx^2 - 4\,dy/dx + 4y = 0$

//

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

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

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

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

$\int e^x \sin 2x\,dx = e^x \sin 2x - \int e^x \cdot 2\cos 2x\,dx$ | $u = \sin 2x \quad \cos 2x$

$du/dx = -2\sin 2x$

$dv = 2e^x \quad v = 2e^x$

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

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

$= e^x \sin 2x - \left(2e^x \cos 2x - \int -4e^x \sin 2x\,dx \right)$

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

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

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

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

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

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