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19/ENG04/006

S/N: 12 MAT 104

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

Solution

Quotient rule:

$$\frac{V\,du/dx - u\,dv/dx}{V^2}$$

$V = x^3$ ; $dv/dx = 3x^2$ ; $u = 2\cos x$

$du/dx = -2\sin x$

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

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

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

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

2.) If $y = xe^{2x}$ Show the differential equation $d^2y/dx^2 - 4dy/dx + 4y = 0$

Solution

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

$d^2y/dx^2\ xe^{2x} = dy/dx\ 2x^2e^{2x} = 4x^3e^{2x}$

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

is

$4x^3e^{2x} - 4(2x^2e^{2x}) + 4(xe^{2x}) = 0$

or

$4x^3e^{2x} - 8x^2e^{2x} + 4xe^{2x} = 0$

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4.) Integral of $e^x \sin 2x$ with respect to $x$

$\int e^x \sin 2x$

Solution

$U = e^x$ $\quad dv = \sin 2x$

$dU/dx = xe^x$ $\quad V = -\cos 2x$

$du = xe^x dx$

$$UV \mp \int V\,du$$

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

Then, $\int \cos 2x \cdot xe^x\,dx$

$= U = \cos 2x \;;\quad dv/dx = x.e^x$

$du/dx = -\sin 2x \qquad V = xe^x$

$\cos 2x(xe^x) + \int xe^x \sin 2x\,dx$

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

Therefore :-

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

$\int e^x \sin 2x = -e^x \cos 2x$ //