QUIZ #2

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(Q3) $u = e^{x^2/y}$

$$\frac{d e^{x^2/y}}{dx} = e^{x^2/y} \frac{2x}{y}$$

$$\frac{d e^{x^2/y}}{dy} = e^{x^2/y}\left(-\frac{x^2}{y^2}\right)$$

$$\frac{du}{dx} \cdot dx + \frac{du}{dy} \cdot dy = 0$$

$$\frac{2x}{y} e^{x^2/y}\, dx - \frac{x^2}{y^2} e^{x^2/y}\, dy = 0$$

$$\Rightarrow \frac{2xy e^{x^2/y} dx - x^2 e^{x^2/y} dy}{y^2} = 0$$

$$\Rightarrow x\left(2y e^{x^2/y} dx - x e^{x^2/y} dy\right) = 0$$

$$= 2y e^{x^2/y} dx - x e^{x^2/y} dy = 0$$

$$= e^{x^2/y}(2y\,dx - x\,dy) = 0$$

$$\Rightarrow \boxed{2y\,dx - x\,dy = 0}$$

This is the exact DE for $u = e^{x^2/y}$

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(Q10) $e^{3\theta}(dr + 3r\,d\theta) = 0$

Solution:

$$e^{3\theta}dr + 3re^{3\theta}d\theta = 0$$

Here $M = e^{3\theta}$, $N = 3re^{3\theta}$

$$\frac{dM}{d\theta} = 3e^{3\theta}$$

$$\frac{dN}{dr} = 3e^{3\theta}$$

$\frac{dM}{d\theta} = \frac{dN}{dr}$, so the given equation is exact Differential equation.

$$\int M = \int e^{3\theta}dr$$
$$= re^{3\theta} + C$$

* Terms in $N(r, \theta)$ free of $r = 0$

$$re^{3\theta} + 0 = C$$

$re^{3\theta} = C$ is the General solution.

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(Q.14) $2y^{-1}\cos 2x\,dx = y^{-2}\sin 2x\,dy$, $y(\pi/4) = 3.8$

solution:

$$\frac{2}{y}\cos 2x\,dx - \frac{\sin 2x\,dy}{y^2} = 0$$

$$M(x,y) = \frac{2\cos 2x}{y}, \quad N(x,y) = -\frac{\sin 2x}{y^2}$$

$$M_y = -\frac{2\cos 2x}{y^2}$$

$$N_x = -\frac{2\cos 2x}{y^2}$$

$M_y = N_x$ so the give equation is EDE.

$$\int M(x,y) = \int \frac{2\cos 2x}{y}\,dx$$

$$= \frac{\sin 2x}{y}$$

Terms free of x in $N(x,y) = 0$

so $\int 0\,dy = C_1$

$$\frac{\sin 2x}{y} + C_1 = C$$

$$\frac{\sin 2x}{y} = C \qquad \therefore C = C - C_1$$

$y(\pi/4) = 3.8$

$$\frac{\sin 2(\pi/4)}{3.8} = C \Rightarrow C = \frac{1}{3.8}$$

$$\boxed{y = 3.8\sin 2x}$$

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