UDIT THAKKAR

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(3) $(1-\ln x)\frac{dy}{dx} + \ln x = -(1+ z(x,y))$

$\Rightarrow (1-\ln x)dy + [1+\ln x + z(x,y)]dx = 0$

$M = 1+\ln x + z(x,y)$, $N = 1-\ln x$

For soln. to be exact $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$

$\therefore \frac{\partial M}{\partial y} = \frac{\partial}{\partial y}(1+\ln x + z(x,y))$

$= \frac{\partial}{\partial y}(z(x,y))$

$\therefore \frac{\partial}{\partial y}(z(x,y)) = \frac{-1}{x}$

$\partial(z(x,y)) = \frac{-1}{x}\partial y$

Integrating on both sides;

$z(x,y) = \frac{-y}{x}$ —(1)

$\frac{\partial F}{\partial x} = M$

$\frac{\partial F}{\partial x} = 1+\ln x - \frac{y}{x}$ —(2)

$\frac{\partial F}{\partial y} = N = 1-\ln x$

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$\partial F = (1-\ln x)\,\partial y$

$F = (1-\ln x)y + R(x)$

$\frac{\partial F}{\partial x} = \frac{-y}{x} + R'(x)$ —— 3

From 2 & 3;

$\therefore \frac{-y}{x} + R'(x) = \frac{-y}{x} + 1 + \ln x$

$\therefore R'(x) = 1 + \ln x$

$R = \int (1+\ln x)\,dx$

$= x + x\ln x - x$

$= x\ln x$

$(1-\ln x)y + x\ln x = c$ is the solution.