

ODE - Test1

Srikanth Pai, Asst. Prof, MSE

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Each problem carries 3 marks. Problem 1 is compulsory.
Solve any one of the remaining two.

1. (Compulsory) Solve

$$(xy + y - 1)dx + xdy = 0.$$

2. Let $y : (\frac{9}{10}, 3) \rightarrow \mathbb{R}$ be a differentiable function satisfying

$$(x - 2y)\frac{dy}{dx} + (2x + y) = 0, \quad x \in \left(\frac{9}{10}, 3\right),$$

and

$$y(1) = 1.$$

Find the value of $y(2)$. [Note: There is a unique answer.]

3. Show that $y(x) = 0$ (i.e. identically zero) is the unique solution to

$$x^2 y' + y = 0$$

on a interval containing 0. [Hint: If y is a solution, what is $y(0)$ forced to be?]