

Name: _____

1. (32) Find all continuous solutions to each of the initial value problems:

$$(a) \frac{dy}{dx} = 2y^{\frac{2}{3}}, \quad y(1) = 0; \quad (b) y' - y = \begin{cases} 0 & \text{for } x \leq 1 \\ 5 & \text{for } x > 1 \end{cases}, \quad y(0) = 3.$$

2. (18) Test the differential $(2e^x - e^y) dx - xe^y dy$ for exactness and find all functions $F(x, y)$, whose gradient dF is the given differential.
3. (20) Find a 1st order differential equation satisfied by the family of all circles in the plane centered at the point $(1, 1)$. Find the family of all curves orthogonal to all these circles. Sketch a few curves from both families.
4. (30) Find all solutions to each of the following equations:

$$(a) y' = y^2 + 3y + 2; \quad (b) y' = x|y|.$$

(Hint: In part (b) take cases.)

1	2	3	4	total (100)