

Name: _____ Partners: _____

_____**INSTRUCTIONS:**

1. Write the names of you and your partners.
2. Write all intermediate steps, and circle the answers.
3. Answers given without sufficient work to support them may NOT receive credit.
4. Every member of a group should turn in the lab report stapled with this paper on top.

1. Do the following problems

- (i) # 20 on page 15. (ii) # 21 on page 15. (iii) # 13 on page 24.

2. Consider the following IVP,

$$\frac{dy}{dx} = (y - 1)^2(2 - y)(y - 3), \quad y(0) = \alpha.$$

- (a) Draw the graph of $z = (y - 1)^2(2 - y)(y - 3)$ in the yz -plane.
- (b) Plot the phase line and direction field of the DE, using the result of (a).
- (c) Find $\lim_{x \rightarrow \infty} y(x)$, when $\alpha = 0, 1, 1.5, 2, 2.5, 3, 4$.

3. Consider the following differential equation,

$$\frac{dy}{dx} = y^2 - 1.$$

- (a) Show that $y = \frac{1+ce^{2x}}{1-ce^{2x}}$ is a one-parameter family of solutions to the DE.
- (b) Find another solution to the DE, which can NOT be obtained from those in part (a).

4. Find a solution to the following IVP and show that it is the only solution, using the existence and uniqueness Theorem in Section 1.2.

$$\frac{dy}{dx} + (\sin x)y^3 = e^{x^2}y + \frac{y^2}{x^2 + 1}, \quad y(0) = 0.$$