

## Sample Problems for the Midterm

- The exam is on Thursday, 02/11, 2.10 pm – 3:30 pm.

1. Find the solutions of the given problem:

- (1)  $y' - 2y = 0$ .
- (2)  $y' = \frac{xy}{x^2-1}$ .
- (3)  $3y' + 2xy^2 = 0$ ,  $y(0) = 1$ .
- (4)  $xyy' = (y^2 - 1)^2$ .

2. Solve the following first order linear equations:

- (1)  $y' - 2y = 0$ .
- (2)  $xy' + y - 2x = 0$ .
- (3)  $y' \sin x + y \cos x = 1$ .
- (4)  $y' + 2xy = x$ ,  $y(0) = 1$ .

3. Solve the following equations whenever it is exact:

- (1)  $(x^2 + y^2)dx + 2xydy = 0$ .
- (2)  $(3x + 2y^2)dx + 2xydy = 0$ .
- (3)  $(x^2 + 2xy)dx + x^2dy = 0$ .
- (4)  $ydx + xy^2dy = 0$ .

4. Solve the following Bernoulli equations:

- (1)  $y' + y = xy^2$ .
- (2)  $2yy' \sin x + y^2 \cos x = 1$ ,  $y(\pi/2) = 0$ .
- (3)  $y' + y = y^2 e^x$ .
- (4)  $y' + \frac{2y}{x} = -x^9 y^5$ ,  $y(-1) = 2$ .

5. Solve following homogeneous equations:

- (1)  $y' = \frac{x^2+2xy+y^2}{x^2}$ .
- (2)  $y' = \frac{y-x}{x}$ .
- (3)  $y' = \frac{x^2+y^2}{2xy}$ .

6. Use integrating factor method to solve following equations:

- (1)  $(3x + 2y^2)dx + 2xydy = 0$ ,  $y(0) = 1$ .
- (2)  $(y + 1)dx - xdy = 0$ .
- (3)  $ydx + 3xdy = 0$ .
- (4)  $3x^2y^2dx + (2x^3y + x^3y^4)dy$ .