Sample Problems for the Midterm

- *The exam is on Thursday, 05/07, 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) $3x^2y^2dx + (2x^3y + x^3y^4)dy$.