1. Determine for which values of $m$ the function $y = x^m$ is a solution of the ODE $3x^2y'' + 11xy' - 3y = 0$.

2. Use Euler’s method with step size .2 to estimate the solution of the IVP $y' = \frac{x}{y}$, $y(0) = -1$ at .4.

3. Find the orthogonal family to the family of curves $y^2 = kx$.

4. Find the general solution to the first order linear equation $xy' - y = x^2e^x$.

5. Is the equation $(2xy^2 + 1)dx + 2x^2ydy = 0$ exact? If so, find the general solution.

**Part B. Do Two.**

i. If $p(x, y)$ is a polynomial, what can one say about the number and domains of solutions to the IVP $y' = p(x, y)$, $y(0) = 0$?

ii. Does the IVP $y' = (2 + x^2 \cos(y))^\frac{1}{2}$, $y(0) = 0$ have a solution?

iii. What is an isocline and what is its relation to a direction field? Explain carefully.