Math 308 (sections 517 and 518), Midterm 1 (SAMPLE)  
The actual exam is on Tuesday, October 9, 2018 (your class time)  
The solutions to the sample exam will not be provided.  
The actual exam will be 6 problems.  
You can use your books and notes.  
Bring your own paper.  
No calculators.

1. Find all solutions:  
   \[
   \frac{dy}{dx} = \frac{4x + y}{x + 4y}, \quad x > 0.
   \]

2. Find all solutions:  
   \[
   \frac{dy}{dx} - \frac{y}{x} = x^3 y^2, \quad x > 0.
   \]

3. Find the solution:  
   \[
   \frac{dy}{dx} = \frac{\sin x - \sin y}{e^y + x \cos y}, \quad y(1) = 1
   \]

4. Determine the integrating factor \( m(x) \) or \( m(y) \) to find all the solutions:  
   \[
   y^2 \, dx + (3xy + \sin y) \, dy = 0
   \]

5. Find the solution to the initial value problem:  
   \[
   y'' + 3y' + 2y = e^t \sin t, \quad y(0) = 1, \quad y'(0) = -1.
   \]

6. Find the solution to the initial value problem:  
   \[
   y'' + 7y' = t^2, \quad y(0) = 1, \quad y'(0) = 0.
   \]

7. Determine the form of a particular solution; do not evaluate the coefficients!  
   \[
   y'' + 6y' + 9y = e^{-t} + (t^2 + 1)e^{-3t} + 7e^{-t} \sin t
   \]