First Name:_____ **Last Name:**_____

OSU Number:_____ **Signature:**_____

OKLAHOMA STATE UNIVERSITY
Department of Mathematics

MATH 2233 (Differential Equations)
Instructor: Dr. Mathias Schulze

PRACTICE MIDTERM 1
February 3, 2012

Duration: 50 minutes

No aids allowed.

This examination paper consists of **7** pages and **6** questions. Please bring any discrepancy to the attention of an invigilator. The number in brackets at the start of each question is the number of points the question is worth.

Answer **3** questions.

You must show all steps in your calculations or give explanations of your answers in order to receive full credit.

For graders' use:

	Score
1 (5)	
2 (15)	
3 (9)	
4 (10)	
5 (5)	
6 (5)	
Total (49)	

1. [5] Sketch the direction field. Identify equilibrium solutions and whether they are stable, unstable or semistable. Sketch one of each type of other solutions and describe their behavior as $t \to \pm\infty$.

   (a) $y' = y^2 - 3y + 2$

   (b) $y' = y^2 + 2y + 1$

2. [15] Identify each of the following differential equations as linear, separable, or exact. Find the general solution. If an initial condition is given, find the specific solutions of the initial value problem. If possible, find the solutions in explicit form.

   (a) $y' - y = 2te^{2t}, \quad y(0) = 1$

   (b) $ty' + 2y = t^2 - t + 1, \quad y(1) = \frac{1}{2}, \quad t > 0$

   (c) $y' + y^2 \sin x = 0$

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

   (e) $2xy^2 + 2y + (2x^2y + 2x)y' = 0$

   (f) $(e^x \sin y - 2y \sin x)dx + (e^x \cos y + 2\cos x)dy = 0$

3. [9] For each of the following differential equations, determine the order, whether it is ordinary or partial, and whether it is linear.

   (a) $\frac{\partial y}{\partial s}\frac{\partial y}{\partial t} = 0$

   (b) $y_{xxx} + \tan(t)y_x = 0$

   (c) $e^{t^2}(y'')^3 - y^5 = 1$

4. [10] Find an integrating factor, or use the given one, to solve the given differential equation.

   (a) $ydx + (2x - ye^y)dy = 0, \quad \mu(x, y) = y$

   (b) $dx + (\frac{x}{y} - \sin y)dy = 0$

5. [5] Without solving, determine an interval in which the solution of the given initial value problem is certain to exist.

   (a) $(t-3)y' + \ln(t)y = 2t, \quad y(1) = 2$

   (b) $\ln(t)y' + y = \cot t, \quad y(2) = 3$

6. [5] Solve the following word problems in your textbook: 2.3.1-3,7-9.

End of examination
Total pages: 7
Total marks: 49