Math 307 A - Fall 2011 Pactice Mid-Term Exam October 31, 2011

Name:	Student number:
rvanic.	Student number.

1	12	
2	9	
3	10	
4	9	
5	10	
Total	50	

- Complete all questions.
- You may use a scientific calculator during this examination. Other electronic devices (e.g. cell phones) are not allowed, and should be turned off for the duration of the exam.
- You may use one hand-written 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 60 minutes to complete the exam.

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- 1. Match each differential equation with the most immediately effective method for solving it. You do not need to find the solutions.
- 1) Separate Variables 2) Substitute $u=\frac{y}{x}$ 3) Find an integrating factor 4) Find the potential function 5) Substitue u=x+y 6) None of the these

$$y' = \frac{\ln(y) + 1 - \ln(x)}{y/x + 1}$$

Ans:____

(b) (2 points)
$$(y^2 - xye^{xy}) + (2xy - x^2e^{x^2y})y' = 0$$

Ans:____

(c) (2 points)
$$y' = \frac{y}{x^2}$$

$$y' = \frac{y}{x^2}$$

Ans:____

(d) (2 points)
$$y' = e^{x-1} \cdot e^y - 1$$

Ans:

(e) (2 points)
$$(y^2 - 2xye^{x^2y}) + (2xy - x^2e^{x^2y})y' = 0$$

Ans:____

(f) (2 points)
$$y' = \frac{y}{x} - x$$

Ans:____

2. (a) (3 points) Find the general solution to the linear equation by finding an integrating factor

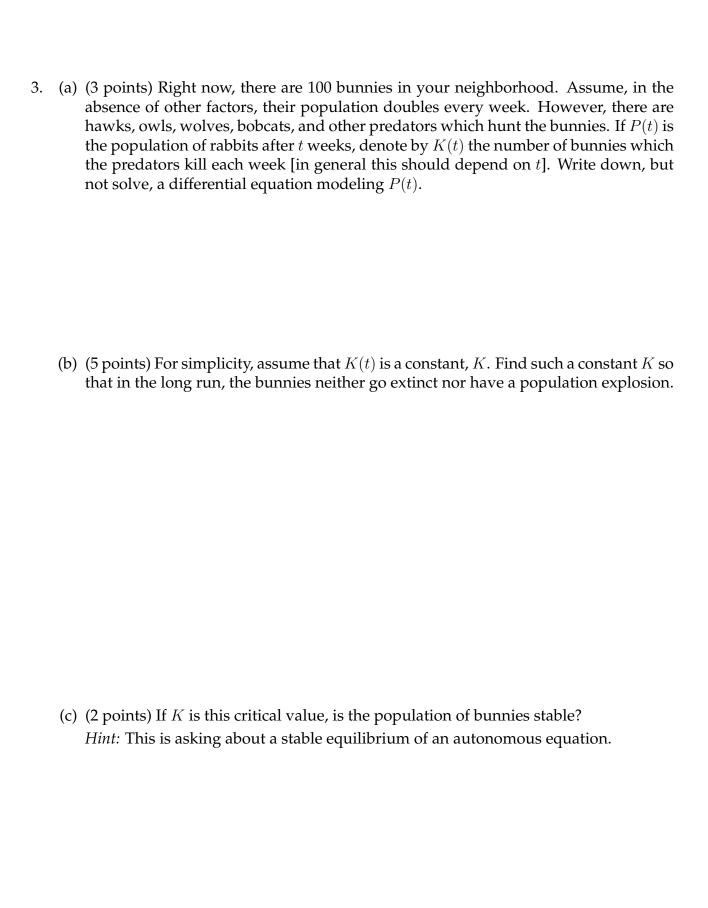
$$\frac{dy}{dx} = \frac{1}{x}y - xe^x.$$

(b) (3 points) Find the general solution to the homogeneous equation using the substitution u=y/x

$$xy\frac{dy}{dx} = (y+x)^2, \quad x, y > 0.$$

(c) (3 points) Find the general solution to the exact equation by finding the potential function

$$y(y+1) + x(2y+1)y' = 0.$$



4. Solve the following second-order differential equations:

(a) (3 points)
$$y'' - 2y' = 0$$
.

(b) (3 points)
$$\frac{1}{4}y'' + 3y' + 9y = 0$$
.

(c) (3 points)
$$y'' - y' + \frac{5}{4}y = 0$$
,

5. (10 points) Consider the linear homogeneous differential equation

$$y'' - \frac{t}{t^2 \ln(t) - t^2} y' + \frac{1}{t^2 \ln(t) - t^2} y = 0, \qquad t > 0.$$

(a) (2 points) Verify directly that $y_1(t) = t$ is a solution.

(b) (8 points) Find another independent solution using the method of reduction of order, and write down the general solution to the differential equation.