

MATH 251  
Midterm Exam I  
March 1, 2007

Name: \_\_\_\_\_  
Student Number: \_\_\_\_\_  
Instructor: \_\_\_\_\_  
Section: \_\_\_\_\_

This exam has 11 questions for a total of 100 points. There are 2 multiple choice questions. **In order to obtain full credit for partial credit problems, all work must be shown. Credit will not be given for an answer not supported by work.**

**THE USE OF CALCULATORS IS NOT PERMITTED IN THIS EXAMINATION.**  
At the end of the examination, the booklet will be collected.

**Do not write in this box.**

1: _____
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11: _____
Total: _____

1. (6 points) A mass weighing 100kg stretches a spring 5m. If there is no damping, which of the following equations describes the motion of the spring?

(a)  $100y'' + \frac{980}{5}y = 0$ ,

(b)  $100y' + 5y = 0$ ,

(c)  $100y'' + 5y = \sin 9t$ ,

(d)  $y'' = \cos(y)$ ,

(e)  $5y'' + 100y = 0$ .

2. (6 points) which equation below describes a system undergoing resonance?

(a)  $y'' + 4y = 0$ ,

(b)  $y'' + 4y' + 4y = \sin 4t$ ,

(c)  $y'' + 9y = \sin 9t$ ,

(d)  $y'' = \cos(y)$ ,

(e)  $y'' + 9y = 6 \cos 3t$ .

3. (5 points) Consider the initial value problem

$$(t^2 - 1)y' + (t - 2)y = 4, \quad y(0) = 5.$$

State the largest interval in which a unique solution is guaranteed to exist. **Do not solve the equation.**