

Score:

Name: \_\_\_\_\_

Section (circle one): 1 2 3 4 5 6

Team (circle one): a b c d e f

**SM286 –Test #3– Fall 2010**

**Closed book. Calculators and one note sheet allowed. Box your final answer.**

**YOU MUST SHOW WORK FOR CREDIT**

1. (20 pts) Given the Maclaurin series:  $f(t) = \sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!} t^n$  :
- a. Derive the Maclaurin series for  $\sin(t)$ .
  - b. What is the Maclaurin series for  $\sin(t^3)$ ?
  - c. What is the Maclaurin series for  $\sin(3t)$ ?
  - d. What is the Maclaurin series for  $\frac{1}{3}\sin(3t)$ ?

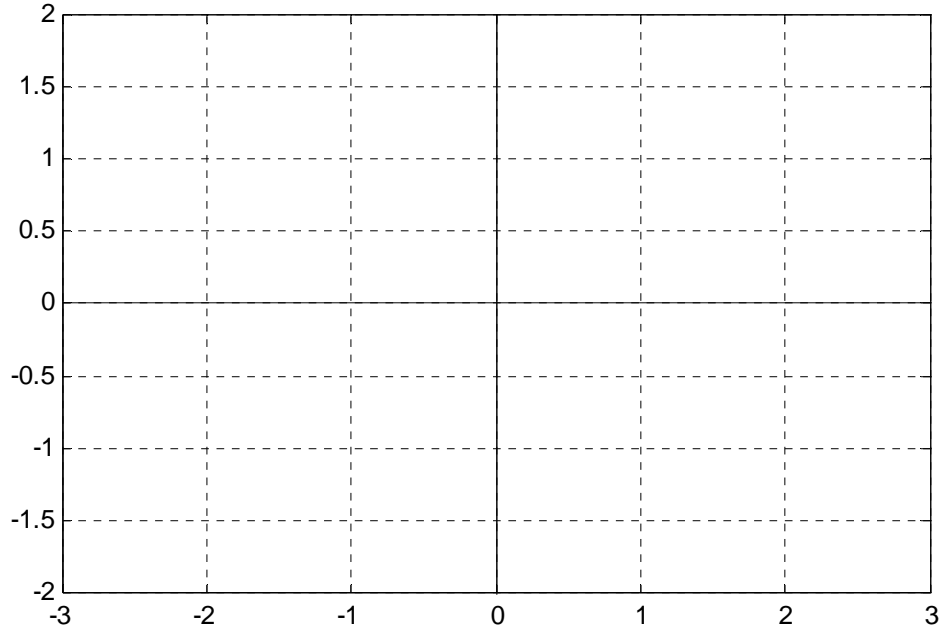
No marks on this table	
<b>1 (20 pts)</b>	
<b>2 (30+5 pts)</b>	
<b>3 (20 pts)</b>	
<b>4 (30 pts)</b>	
<b>cumm.</b>	

2. (30 pts) Given the DE  $x'' + 9x = 0$  with initial value  $x(0) = 0$  and  $x'(0) = 1$ . Starting with  $x = \sum_{n=0}^{\infty} c_n t^n$ ,
- Find the power series solution for the DE.
  - Express the resulting power series as a function (5 points extra credit).

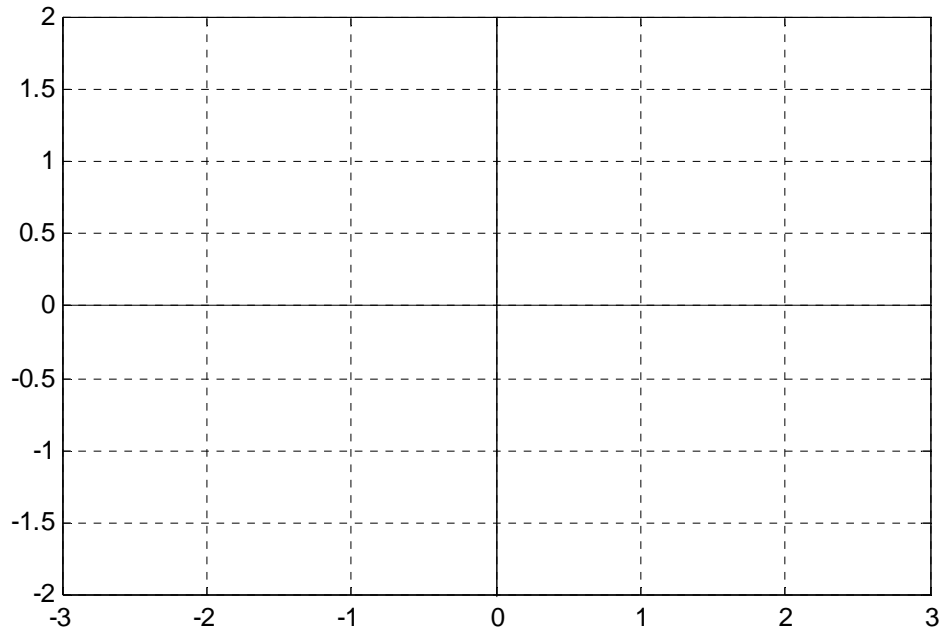
**Caution:** Although you can solve this with other methods, the intent here is that you use the power series method for finding this solution.

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3. (20 pts) Consider the function  $f(x) = \begin{cases} 2x, & 0 \leq x \leq \frac{1}{2} \\ 1, & \frac{1}{2} < x \leq 1 \end{cases}$ . Sketch the sine series for the function on the interval  $-3 \leq x \leq 3$ .



- a. Sketch the cosine series for the function on the interval  $-3 \leq x \leq 3$ .



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4. (30 pts) Given:  $\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}$  where  $\begin{cases} u(0, t) = u(\pi, t) = 0 \\ u(x, 0) = (\pi - x)x^3 \end{cases}$ .

Find a general solution  $u(x, t)$ . Assume that the eigenvalues for  $\lambda \leq 0$  produce trivial solutions.

