Math 107 Fall '12 **Exam 3** **Score:** _____

Name: _____ **TA's Name:** _____

Instructions: You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

1(15pts) (a) Find the first three nonzero terms for the Taylor series of the function $f(x) = \sqrt{x}$ at the point $x = 1$.

(b) Use the Taylor series $\ln(1+x) = \sum_{n=1}^{\infty} (-1)^{n-1} \frac{x^n}{n}$ to find the Taylor series of $x \ln(1-2x)$ at $x = 0$.

2(10pts) Which two of the three vectors are perpendicular, $\vec{u} = \langle 1, 2, 3 \rangle$, $\vec{v} = \langle 1, 0, -2 \rangle$, $\vec{w} = \langle 2, -1, 0 \rangle$? Show work to support your answer.

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3(15pts) Use either the Lagrange Error Bound estimate or the Alternating Series Error Bound estimate to determine the number of terms from the Taylor series of e^x that are needed to approximate the value of $e^{-0.1}$ to 4 decimal places accuracy.

4(10pts) A freshly brewed cup of coffee of 200° F is placed in a 70° F room. Use Newton's Law of Heating and Cooling to write down a differential equation with initial condition for the temperature H of the coffee as a function of time in minutes. **Do Not Solve The Equations.**

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5(15pts) Find the solution to the differential equation $\frac{dy}{dt} = \frac{2t+1}{e^y}$ that also satisfies the initial condition $y(0) = 1$.

6(10pts) Which is traveling faster, a car whose velocity vector is $21\vec{i} + 35\vec{j}$, or a car whose velocity if $40\vec{i}$, assuming that units are the same for both directions? Show work to support your answer.

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7(15pts) Let $\vec{u} = \langle 1, 2, 3 \rangle$ and $\vec{v} = \langle -1, 0, 1 \rangle$.

(a) Find the angle θ between the two vectors.

(b) Find the projection, $\vec{v}_{\text{parallel}}$, of vector $\vec{v}$ on vector $\vec{u}$.

8(10pts) Find an equation for the plane which contains the point $(1, 0, -2)$ and is perpendicular to the vector $\vec{n} = \langle 3, 2, 1 \rangle$.

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2 Bonus Points: Isaac Newton was born in: (a) the 16th century, (b) the 17th century, (c) the 18th century, (d) the 19th century.

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