MATH2F95   SECOND MIDTERM   MARCH 8, 1999
Full credit given for three correct and complete answers.
Open-book exam.   Duration: 50 minutes

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1. Solve
$$2xy'' + y' + \frac{y}{1-x} = 0$$

2. Find tangential and normal acceleration (each will be a *vector*) of the following motion
$$\mathbf{r}(t) = [2te^{-t}, 3 + t^3, 4 + 2t^2]$$
at $t = 1$.

3. Compute the moment of inertia of a curve defined as the *full* perimeter (including the diameter) of a half disk of radius a, with respect to its symmetry axis (connecting the midpoints of the half circle and the diameter). Assume uniform mass density; M is the total mass.

4. Evaluate:

$$\int_{(0,1,2)}^{(2,3,4)} \frac{y \ln z}{(1+xy)^2} dx + \left(\frac{x \ln z}{(1+xy)^2} + \frac{z}{y} \right) dy + \left(\ln y - \frac{1}{z(1+xy)} - \frac{1}{z^2} \right) dz$$

5. Find the volume of the following three-dimensional region:

$$\begin{cases} x^2 + y^2 < z \\ 1 < z < 4 \end{cases}$$