MAE 103 Assignment 4: Due Thursday, May 2, 2002
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(Please turn in at the end of the class session at 10 am)

1. **NOTE this was formerly problem number 2 on HW set 3.** Show that the **pathline** of a particle initially located at $x = x_o$, $y = y_o$, and $z = z_o$ (at time $t = 0$), with the velocity field given by

$$\vec{v} = ay\hat{i} - ax\hat{j} + 0\hat{k}$$

   is a **circle. HINT**: evaluate $\frac{d^2x}{dt^2}$ and $\frac{d^2y}{dt^2}$ to obtain $x(t)$ and $y(t)$. This is a challenging problem, but use your knowledge of (even very elementary) ordinary differential equations to show that the equation relating x and y for the pathline is $x(t)^2 + y(t)^2 =$ constant.

2. A velocity field in arbitrary units is given by

$$\vec{v} = 2x^2\hat{i} - xy\hat{j} - 3xz\hat{k}$$

   Find the volume flux Q passing through the unit square bounded by (x,y,z) = (1,0,0), (1,1,0), (1,1,1), and (1,0,1).

3. Problem 4.7 in Munson, et al.'s text.

4. Problem 4.10 in Munson, et al.'s text.

5. Problem 4.19 in Munson, et al.'s text.

6. Problem 4.23 in Munson, et al.'s text.