MAE 103 Assignment 3: Due Thursday, April 25, 2002
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(Please turn in at the end of the class session at 10 am)

1. A two-dimensional velocity field is given by

$$\vec{v} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$$

in arbitrary units (either British or SI, doesn't matter). **At the location x = 2 and y = 1**, compute:

a.) the acceleration components a_x and a_y

b.) the velocity component in the direction $\theta = 30^o$ with respect to the horizontal (x-axis)

2. 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.

3. Problem 2.81 in Munson, et al.'s text.

4. Problem 2.83 in Munson, et al.'s text.

5. Problem 2.97 in Munson, et al.'s text.

6. Problem 3.3 in Munson, et al.'s text.

7. Problem 3.15 in Munson, et al.'s text.

8. Problem 3.30 in Munson, et al.'s text.

9. Problem 3.68 in Munson, et al.'s text.