## CENG 301 Fall 2005

## Homework Assignment #5

Due October 12, 2005

- The first two problems only ask you to derive the transient balance equations.
- You must find analytical solutions to problems 3 and 4.
- You may <u>not</u> use Maple or another computer program to solve problems 3 and 4.

1. Consider the conical water tank shown in Figure 1 below. Write the dynamic material balance equation if the flowrate out of the tank is proportional to the square root of the height of the water in the tank, i.e.

$$F_0 = \beta \sqrt{h}$$

List state variables, input variables and parameters. (Hint: Use h as a state variable).



2. Model the mixing tank with two feedstreams as shown in Figure 2. Assume that each feedstream has two liquid components A and B. Model the following cases:

- a. Constant liquid volume, constant liquid density.
- b. Variable volume, constant liquid density.
- c. Variable volume, liquid density varies linearly with concentration.



Figure 2

- 3. A car tire has a slow leak. The flowrate of air out of the tire is proportional to the square root of the air pressure in the tire (we are using gauge pressure). The initial pressure is 40 psig and after a week the pressure is down to 25 psig. How long will it take to reach 15 psig? Compare your results with problem 3.
- 4. Problem 11.16 (from Felder & Rousseau).
- 5. Problem 7.3 ((from Felder & Rousseau).
- 6. Problem 7.8 (from Felder & Rousseau).