Consider the following differential equation, with the initial conditions shown:

$$y^{(3)} + 7\ddot{y} + 14\dot{y} + 8y = u^{(3)} + \ddot{u} - 2\dot{u} - 5u$$

$$u(0) = y(0) = 1$$
$$\dot{u}(0) = \ddot{u}(0) = 0$$
$$\dot{y}(0) = \ddot{y}(0) = 0$$

For this system:

1) Find its transfer function

2) Give three different state space representations:

   a. Phase variable (controllable canonical) form
   b. Diagonal form
   c. Any arbitrary form you can find

3) Solve for y(t) when the input is a unit step function, using Laplace transform techniques

4) Solve for y(t) when the input is a unit step function, using state-space techniques