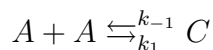


**Math 486/522 - Homework 7****Fall 2024****Len Washington III**

1. Consider the irreversible chemical reaction:  $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ .

- (a) Derive the system of differential equations for the concentrations  $A = A(t)$ ,  $B = B(t)$ , and  $C = C(t)$  with initial conditions  $A(0) = A_0$ ,  $B(0) = 0$ , and  $C(0) = 0$ .
- (b) Find a conservation law that replaces the need for the  $dC/dt$  equation.
- (c) Solve the equations in (a) for  $A$  and  $B$  then use the conservation law to find  $C$ .
- (d) If  $k_1 = k_2 = k$ , solve for  $A$ ,  $B$ , and  $C$ .
- (e) If  $k_1 = k_2 = k$ , find the maximum amount of  $B$  that is produced.

2. Consider the dimerization to two monomers example from class



- (a) Derive the system of differential equations for the concentrations  $A = A(t)$  and  $C = C(t)$  with initial conditions  $A(0) = A_0$  and  $C(0) = 0$ .
- (b) Find a conservation law that replaces the need for the  $dC/dt$  equation and derive the equation for  $A(t)$ .
- (c) If  $k_1 = k_2 = k$  and  $A_0 = 1$ , find the steady-state values for  $A(t)$  and  $C(t)$ , i.e. limits as  $t \rightarrow \infty$ .

3.