

Geometry of Linear Systems Modeling Activity Assessment:

Students should submit a written report of their findings from the activity. The slides and video suggest a written format with 4 sections. (You may prefer for students to label individual questions as in the handout, or write their solutions in paragraph form – this is left to the individual instructor to clarify)

- Introduction: Summary of the situation you are modeling, relevant background information & your labeled diagram for the compartment model
- Activity 1 & 2: Differential equations, answers to all questions in complete sentences.
- Activities 3&4: Parameter values, answers to all questions, phase plane produced by software
- Activity 5: IVP graphed in phase plane, answers to all questions

We suggest having students submit the project in parts so they can receive feedback as they go. In an in-person setting, the instructor would provide valuable formative feedback, particularly early on in the process while the students work in class. To simulate this in a remote environment, we've instructed students to build a diagram and then check their work with the solution given in the video. We've then instructed students to turn in their system of general equations for assessment/feedback. Individual instructors may choose to give only formative feedback, allowing students to correct and be graded only at the end, or they may grade this portion when it is first turned in, but provide the correct solution for the remaining project.

We recommend having students turn in the other parts at intermittent deadlines as well. You may choose to glance over and provide formative feedback or formally grade them in parts as they come in.

We also recommend providing the rubric below to students. In a remote/virtual environment, students may have less opportunity to check in with fellow students or the instructor and this rubric allows them to self check that their report contains all components. No answers are given in the rubric.

Component	Pts Possible	Comments	Pts Earned
Part 1: Intro			
Introduction summarizes the scenario with relevant background information	10		
Includes a properly labeled diagram of 2 compartment model	2		
Correctly sets up general system of differential equations with parameters	5		
Part II: Activities 1 & 2			
Correct system of general differential equations	10		
Correctly identifies the set of parameters for renal failure and explains	5		
Part III Activities 3 & 4			
Determines correct values of parameters k_{12} , k_{21} , k_{10}	3		
Gives correct expression for dC_p/dC_t	4		
Gives correct values of $C_p(0)$, $C_t(0)$ for information given	4		
Creates a phase plane/vector field for given system	4		
Finds C_p nullcline and sketches on phase plane*	2		
Answers question 4.3	3		
Finds C_t nullcline and sketches on phase plane*	2		
Answers question 4.5	3		
Answers question 4.6 by describing whether C_p , C_t are inc/decreasing and describes in context of the scenario	3		
Gives appropriate initial condition and includes solution curve on phase portrait. Answers 4.7 fully	5		
Part IV Activity 5			
Converts linear system to matrix form and gives coefficient matrix	2		
Finds eigenvalues and eigenvectors	3		
Gives correct general solution, and identifies α and β as asked	3		
Explains connection between eigenvalues, eigenvectors, general solution and geometric behavior	5		

Graphs C_p , C_t on same set of axes using software	3		
Describes behavior of C_p , C_t	2		
Indicates phases on graph, explains meaning of alpha phase	5		
Finds time at which C_t is at a max and gives values for t , C_p , C_t and indicates on graph where this occurs	6		
General			
Graphs and images are labeled and easy to read	3		
There are no spelling or grammatical errors	3		
Total	100		

*The software provided does not easily allow for sketching on phase plane. You may want to allow students to sketch by hand or by using a drawing tool on the image in another software.