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**Teaching Module**

**Geometric Behavior of Linear Systems Module Overview**

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This module concentrates on the geometric properties of a system of 2 linear, homogeneous first order differential equations in 2 variables as dictated by the corresponding eigenvalues. Students should be familiar with using eigenvalues to solve linear, homogeneous first order systems before beginning this unit.

Prerequisites (Reviewed in the materials):

• Converting a 2 x 2 linear homogenous system to matrix form

• Finding eigenvalues and eigenvectors

• Creating general solutions using eigenvalues and eigenvectors (real and complex)

Module Components:

* Video Series covering geometric properties of linear systems. This can be assigned to students in asynchronous or synchronous classes.
  + Video 1: General review of how to convert 2 x 2 linear systems to matrix form and find eigenvalues
  + Video 2: Geometric properties of systems with 2 distinct real eigenvalues
  + Video 3: Geometric properties of systems with complex eigenvalues
  + Video 4: Special cases (repeated and zero eigenvalues)
  + Video 5: Trace Determinant Plane
* Slide Deck containing all slides in video series – can be used for synchronous presentation in remote format, or as a basis to create your own videos for students.
* Modeling Activity Student Handout
* <https://qubeshub.org/publications/3206/serve/1/15901?el=1&download=1>
* Modeling Activity Teacher Version with Solutions

<https://qubeshub.org/publications/3206/serve/1/15903?el=1&download=1>

* Modeling Activity Video Series
  + Video 1: Introduction to the scenario, guidance through creating a diagram and the system of differential equations.
  + Video 2: Overview of the rest of the project and instructions on how to use free online graphing software.

<https://homepages.bluffton.edu/~nesterd/apps/slopefields.html>

<https://www.desmos.com/calculator>

* Modeling Activity Assessment Guide