Math 3323 **MATRIX ALGEBRA** Fall 2009
Dr. Duval **Investigation 1**
due Friday, September 4

## How to Use the "System" Module

In the context of two linear equations with two unknowns, this module is designed to illustrate the geometric representations of linear equations, and one of the elementary operations used to solve them.

Start by choosing the Hide Points option, and hit the Reset button. The system of equations

$$\begin{aligned} 2x - y &= -2 \\ -4x - y &= -8 \end{aligned}$$

with their graphs is displayed. The graphs of the linear equations in the system are two blue lines (in the initial stage one blue line coincides with a red line; sliding $k$ makes the two blue lines visible). The first equation is multiplied by a constant $k$ (initially $k = 0$), and then added to the second equation. The resulting equation's graph is a red line.

The objective is to choose a value for $k$ so that the resulting red line becomes horizontal or vertical. Then you can read its $y$- or $x$-intercept. For those values of $k$ the resulting equation can be put in a form having one of the coefficients equal 0.

- The Show Points option displays two pairs of points defining the two equations of a system on their corresponding blue lines. New systems of equations can now be created by dragging the two red points on each blue line. The Hide Points option hides those points, and disallows you to change the blue lines.
- The Reset button returns the system to the initial settings.
- The Show Grid button displays a grid of points, which allows you to read the values of $k$ and the solution of the system more accurately. The Hide Grid button turns this option off.

## Assignment

1. Consider the initial system (press Reset and Hide Points).

   (a) Choose appropriate $k$ so that the red line is either vertical or horizontal. Read and record the values of the corresponding $x$- or $y$-intercept of the red line for the value of $k$. At the same time watch the resulting algebraic equations on the left of the screen.

   (b) Now repeat part 1a, but trying to get a vertical red line instead of a horizontal red line, or vice versa.

   (c) Describe your observation of the connection between the changing equations, positions of the red line and the value of $k$ in a few sentences using mathematical language.

2. Next, select the Show Points option and obtain new systems. Repeat your experiment from part 1, varying the values of $k$. State the operation(s) applied to equations in the system and comment about the geometric meaning of the operation(s) performed.

3. Consider the initial system (press Reset and Hide Points).

   (a) No matter how you change the scalar $k$, one of the blue lines seems to be impossible to cover with the red one. Explain why.

   (b) Change the setting by dragging the defining points of the lines and decide if it is *always* impossible to cover one of the blue lines.

4. Does the method of solving the system of equations by finding appropriate $k$ as in the initial system apply to all systems? Explain your answer.

5. Choose a new system where the blue lines are parallel. Then change the value of $k$. The red line stays parallel to both of the blue lines. Explain why.