Chapter 7.3

Linear Algebra with applications to differential equations

College of the Atlantic. Winter 2019

1. (Re)introduce yourself to your partners. I dunno. Make small talk for a moment.

2. A mass slides horizontally on a surface that is not frictionless. The differential equation that describes this motion is:

$$x'' = -kx - ax' \,, \tag{1}$$

   Where k is the spring constant and a is the friction coefficient. Let $k = 8$ and $a = 4$.

   (a) Convert this second-order equation to a system of first-order equations.

   (b) Use matrix methods to determine the general solution to the differential equation.

   (c) Find the solution that satisfies $x(0) = 3$, $x'(0) = 0$.

. . . . . .

3. Consider the following system:

$$\vec{x}\,' = \begin{bmatrix} 9 & 4 & 0 \\ -6 & -1 & 0 \\ 6 & 4 & 3 \end{bmatrix} \vec{x} \,. \tag{2}$$

   It turns out that the characteristic equation for this matrix is:

$$(5 - \lambda)(3 - \lambda)^2 = 0 \,. \tag{3}$$

   Find the general solution to the differential equation.

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4. Consider the following system:

$$\vec{x}\,' = \begin{bmatrix} 1 & -3 \\ 3 & 7 \end{bmatrix} \vec{x} \,. \tag{4}$$

   (a) Find the general solution to the differential equation.

   (b) Uhhh.