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Math 2250-4
Super Quiz 2
November 1, 2013

1a) What is the span of a collection of vectors $\underline{\boldsymbol{v}}_1, \underline{\boldsymbol{v}}_2, \ldots \underline{\boldsymbol{v}}_n$?

(1 point)

1b) What does it mean for vectors $\underline{\boldsymbol{v}}_1, \underline{\boldsymbol{v}}_2, \ldots \underline{\boldsymbol{v}}_n$ to be linearly independent?

(1 point)

1c) What is a basis for a vector space/subspace W ?

(1 point)

2a) Find a basis for the solution space to homogeneous matrix equation $A\,\underline{\boldsymbol{x}} = \underline{\mathbf{0}}$, where A is the matrix on the left below, and its reduced row echelon form is on the right.

$$\begin{bmatrix} 2 & 6 & 0 & -6 & 1 \\ 0 & 0 & 3 & 6 & 7 \\ 3 & 9 & -8 & -25 & 5 \\ -1 & -3 & 4 & 11 & 6 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 3 & 0 & -3 & 0 \\ 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

(6 points)

2b) What is the dimension of the solution space in part 2a?

(1 point)

3) Consider the differential equation below for a function $x(t)$, which could arise from an unforced mass-spring configuration:

$$x''(t) + 2x'(t) + 10x(t) = 0.$$

3a) Find the general solution to this homogeneous linear differential equation. Hint: use the characteristic polynomial method to first find a basis.

(6 points)

3b) Which of the three damping phenomena is exhibited by solutions to this differential equation?

(1 point)

3c) Now consider the inhomogeneous DE

$$x''(t) + 2x'(t) + 10x(t) = -20.$$

Notice that $x_P(t) = -2$ is a particular solution. Use this fact and your previous work to write down the general solution to the inhomogeneous DE.

(2 points)

3d) Solve the initial value problem

$$\begin{aligned} x''(t) + 2x'(t) + 10x(t) &= -20 \\ x(0) &= 1 \\ x'(0) &= 3. \end{aligned}$$

(6 points)