

1. (10 points)
 - a) (5 points) Give a definition of “linearly dependent”.
 - b) (5 points) Are the columns of $\begin{bmatrix} 0 & 0 & 4 \\ 0 & 1 & 3 \\ 2 & 0 & 4 \\ 1 & 7 & 4 \end{bmatrix}$ linearly dependent?
2. (10 points)
 - a) (5 points) Give a definition of “the span of vectors $\{v_1, v_2, \dots, v_p\}$ ”.
 - b) (5 points) Do the columns of $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 1 \\ 0 & 2 & 0 \end{bmatrix}$ span \mathbb{R}^3 ?
3. (10 points) Determine the number of solutions (0,1, or infinitely many) to the system of equations:

$$\begin{cases} 3x_1 + 2x_2 - x_3 = 1 \\ 2x_1 + x_2 + x_3 = 1 \\ x_1 + + 3x_3 = 1 \end{cases}$$

If you find that this system is consistent then determine the general solution.

4. (10 points)
 - a) (5 points) Find a parametric representation of the line through the points $(3, -1, -1)$ and $(2, 0, 0)$.
 - b) (5 points) In what point does this line intersect the plane with equation $x_1 + x_2 + x_3 = 3$?

5. (10 points) Find the matrix for the linear transformation $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$ which transforms the vector $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$ to $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and the vector $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ to $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$.

6. (10 points) My airline has three hubs: JFK, LAX, and BOS. My flight personnel does not necessarily return the same day to the hub they started from but will return at the end of the day to one of them, which they then use as starting point for the next day. The following table summarizes what fraction of my flight personnel starting at one my hubs ends where at the end of the day:

	<i>From:</i>		
<i>To</i> ↓	JFK	LAX	BOS
JFK	.7	.3	.4
LAX	.2	.4	.4
BOS	.1	.3	.2

- a) (6 points) Suppose that at the beginning of the day 1, I have 1000 flight personnel at each of the hubs. What will these numbers be at the end of day 1?
- b) (4 points) What will the numbers be at the end of the day 2?