Draft Midterm 1

You have 1hr 15min. Answer each non-graph question neatly on the line provided.

Name: _

1. (10 points) For which value(s) of k does the system

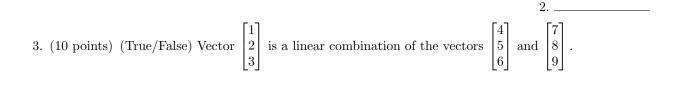
$$\begin{cases} x_1 + x_2 - x_3 = -2\\ 3x_1 - 5x_2 + 13x_3 = 18\\ x_1 - 2x_2 + 5x_3 = k \end{cases}$$
(1)

have no solution.

1. _____

3. _

2. (10 points) (True/False) There is a sequence of elementary row operations that transforms the matrix $\begin{bmatrix}
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9
\end{bmatrix}$ into $\begin{bmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{bmatrix}$?



- 4. (10 points) Let A be a 4×4 matrix, and let \vec{b} and \vec{c} be two vectors in \mathbb{R}^4 . We are told that the system $A\vec{x} = \vec{b}$ is inconsistent. What can you say about the number of solutions of the system $A\vec{x} = \vec{c}$.
- 5. (10 points) Draw a sketch showing the effect of the linear transformation $T(\vec{x}) = A\vec{x}$ on the unit circle $x^2 + y^2 = 1$ when $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$.
- 6. (10 points) Find the matrix P of the orthogonal projection onto the line spanned by $\vec{w} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$.

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- 7. (10 points) Find the matrix of the mirror reflection about the x z plane in \mathbb{R}^3 .
 - 7._____

6. _____

8. (10 points) (True/False)
$$\begin{bmatrix} 11 & 13 & 15\\ 17 & 19 & 21 \end{bmatrix} \begin{bmatrix} -1\\ 3\\ -1 \end{bmatrix} = \begin{bmatrix} 13\\ 19\\ 21 \end{bmatrix}$$

8. _____

9. (10 points) Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 5 \\ 1 & 3 & 9 \end{bmatrix}$. Find a basis of the image of A.

10. (10 points) Find a basis of the subspace of \mathbb{R}^3 defined by $2x_1 + 3x_2 + x_3 = 0$

11. (10 points) (True/False) The image of a 3×4 matrix is a subspace of \mathbb{R}^4 .

9. _____