General Instructions. Write your name on only the outside of your blue book. Do all of your work inside your blue book. Do not write your answers on this test paper. Write neat, complete solutions to each of the questions below. Point values are as indicated. There are problems on the front and back. To butter your bread from edge to edge, try leaving the butter out of the refrigerator until it is room temperature.

1. Define the following terms (5 points each):
   
   (a) A subspace of a vector space
   (b) The span of a set of vectors
   (c) A linearly independent set of vectors

2. (10 points) Write the equation of the plane

   \[3x - 2y + 5z = 30\]

   in parametric form. That is, describe the solution set as a point plus a set of linear combinations of a pair of vectors.

3. (10 points) Find the equation of the plane that is parallel to \(3x - 2y + 3z = 5\) and that contains the point \(Q(1, 6, 2)\).

4. (15 points) Write the matrix

   \[A = \begin{bmatrix} 1 & 3 \\ -2 & -4 \end{bmatrix}\]

   as a product of elementary matrices. Recall that a matrix is an elementary matrix if it is obtained from the identity matrix by means of an elementary row operation.

5. (10 points) Solve the system of equations:

   \[\begin{align*}
   2x + y + z &= 5 \\
   x + y &= 4
   \end{align*}\]

6. (15 points) Solve the system of equations

   \[\begin{align*}
   x + y + z &= 1 \\
   2x + y + z &= 3 \\
   5x + 3y + 3z &= 6
   \end{align*}\]

7. (15 points) Let

   \[A = \begin{bmatrix} 2 & -5 \\ 3 & 1 \end{bmatrix}\]

   Compute \(f(A)\) where \(f(x) = x^2 - 3x + 17\).
8. (10 points) The reduced row echelon form of the augmented matrix \([A|B]\) that is associated to the system of equations

\[
\begin{align*}
2x + 2y - z + 6w &= 4 \\
4x + 4y + z + 10w &= 13 \\
8x + 8y - z + 26w &= 23
\end{align*}
\]

is

\[
\begin{bmatrix}
1 & 1 & 0 & 0 & \frac{3}{2} \\
0 & 0 & 1 & 0 & 2 \\
0 & 0 & 0 & 1 & \frac{1}{2}
\end{bmatrix}.
\]

Determine the solution set.

9. (10 points) Determine if the set of vectors indicated is linearly independent.

\[
\left\{ \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} -2 \\ -1 \\ 3 \end{bmatrix}, \begin{bmatrix} 2 \\ 3 \\ 2 \end{bmatrix} \right\}.
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