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. There are 105 points. There are problems on the front and back.

Peanut butter and jam sandwiches can be eaten at breakfast.

1. Define the following terms (5 points each):

   (a) The span of a set of vectors $S = \{a_1, a_2, \ldots, a_m\}$

   (b) A linearly independent set $S = \{a_1, a_2, \ldots, a_m\}$

   (c) The function $W \leftarrow V : T$ is a linear transformation.

2. (10 points) Write the solution to the equation

   $$3x - 2y + 5z + 7w = 210$$

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

3. (10 points) Find the line of intersection between the plane $x - 2y + 3z = 6$ and the plane $x = 0$.

4. (10 points) Solve the system of equations:

   $$\begin{align*}
   3x + 2y + 7z &= 0 \\
   -3z &= -3 \\
   -y - 4z &= 13
   \end{align*}$$

5. (10 points) Water freezes at 0°C Celsius or 32°F Fahrenheit. It boils at 100°C Celsius or 212°F Fahrenheit. At what temperate is the Celsius temperature equal to the Fahrenheit temperature?

6. (15 points) Solve the homogeneous system of equations

   $$\begin{align*}
   2x + 6y - 9z - 4w &= 0 \\
   -3x - 11y + 9z - w &= 0 \\
   x + 4y - 2z + w &= 0
   \end{align*}$$

7. (10 points) Determine if the set of vectors indicated is linearly independent.

   $$\begin{bmatrix}
   3 \\
   1 \\
   2
   \end{bmatrix}, \begin{bmatrix}
   2 \\
   0 \\
   1
   \end{bmatrix}, \begin{bmatrix}
   2 \\
   -1 \\
   3
   \end{bmatrix}, \begin{bmatrix}
   2 \\
   3 \\
   2
   \end{bmatrix}.$$
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. (15 points) Use row reduction to compute the inverse of matrix

\[
A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}
\]

under the assumptions that \(a \neq 0\) and \(ad - bc \neq 0\).