1.) Consider the following matrices of various dimensions. Perform the indicated operations.

\[ A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 0 \\ 0 & -2 & 3 \end{pmatrix}, \quad B = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 1 & 2 \\ 1 & 0 & -2 \end{pmatrix}, \quad C = \begin{pmatrix} 1 & -1 \\ 2 & 1 \end{pmatrix}, \quad D = \begin{pmatrix} 1 & -2 & 3 \\ 2 & 0 & -1 \end{pmatrix} \]

\[ E = \begin{pmatrix} 1 & -1 & 0 \\ 4 \end{pmatrix}, \quad F = \begin{pmatrix} 2 \\ -2 \\ 3 \\ -1 \end{pmatrix} \]

a.) \(3C\)  b.) \(A - B\)  c.) \(B'\), the transpose of \(B\)

d.) \(CD\)  e.) \(AB\)  f.) \(BA\)  g.) \(EF\)  h.) \(FE\)
i.) Compute \(C^{-1}\), the inverse of \(C\)  j.) Compute \(A^{-1}\), the inverse of \(A\).

2.) Consider the system \[
\begin{align*}
x - y &= 3 \\
2x + 3y &= 26
\end{align*}
\]
a.) Solve the system using matrix reduction.
b.) Rewrite the system in the form \(AX = B\) and solve it using \(A^{-1}\).

3.) Compute the determinant of each of the following matrices to determine which matrices are invertible. If the matrix is invertible, determine its inverse matrix.

a.) \(A = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}\)  b.) \(A = \begin{pmatrix} 2 & 4 \\ -3 & -6 \end{pmatrix}\)  c.) \(A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\)  d.) \(A = \begin{pmatrix} 0 & 0 \\ 3 & 5 \end{pmatrix}\)

4.) Determine the inverse for each 3x3 matrix.

a.) \(A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & -1 & 1 \\ 0 & 1 & -2 \end{pmatrix}\)  b.) \(A = \begin{pmatrix} 2 & -1 & 3 \\ 1 & 1 & -1 \\ 3 & -2 & 1 \end{pmatrix}\)  c.) \(A = \begin{pmatrix} 3 & 1 & 4 \\ 4 & 1 & 6 \\ 1 & 0 & 1 \end{pmatrix}\)

5.) Use your answer in part 4.a.) to solve the system \[
\begin{align*}
x + 3z &= 2 \\
2x - y + z &= -3 \\
y - 2z &= 0
\end{align*}
\]

6.) Let \(A = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix}\) and \(B = \begin{pmatrix} 5 & 0 \\ -1 & 4 \end{pmatrix}\). Show that \(AB\) is not equal to \(BA\).

7.) Let \(A = \begin{pmatrix} 2 & 3 \\ 0 & 0 \end{pmatrix}\).
a.) Find a 2x2 matrix $B$ so that $AB = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$, or explain why it is impossible.

b.) Find a 2x2 matrix $B$, where NOT ALL of the entries are zero, so that $AB = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$, or explain why it is impossible.

8.) Consider the Leslie matrix $L = \begin{pmatrix} 0.9 & 1.4 & 1.8 & 2.7 & 0.9 \\ 0 & 0.75 & 0 & 0 & 0 \\ 0 & 0 & 0.6 & 0 & 0 \\ 0 & 0 & 0 & 0.4 & 0 \end{pmatrix}$

a.) How many age classes are in this population?

b.) What percentage of 2-year old females survive to the end of the following breeding season?

c.) What percentage of 4-year old females survive to the end of the following breeding season?

d.) What is an average number of female offspring for a 0-year old female?

e.) What is an average number of female offspring for a 1-year old female?

f.) What is an average number of female offspring for a 3-year old female?

g.) If $N(0) = \begin{pmatrix} 1000 \\ 650 \\ 450 \\ 550 \\ 300 \end{pmatrix}$, determine $N(1)$.

"I hear and I forget. I see and I remember. I do and I understand." – Chinese Proverb