1. For each the following matrices, compute the inverse (show your work). If the matrix inverse is not defined, briefly explain why.

(a) \[
\begin{pmatrix}
5 & 3 \\
2 & 1
\end{pmatrix}
\]

(b) \[
\begin{pmatrix}
3 & 1 \\
0 & 2
\end{pmatrix}
\]

(c) \[
\begin{pmatrix}
6 & -2 \\
9 & -3
\end{pmatrix}
\]

2. Consider the following system of linear equations:

\begin{align*}
x + 2y &= -13 \\
3x + 2y &= 1
\end{align*}

(a) Express the system in matrix form as \( M\vec{u} = \vec{v} \).

(b) Compute the inverse of the square matrix \( M \) (show your work).

(c) Solve the linear system as \( \vec{u} = M^{-1}\vec{v} \) (show your work).

3. Solve the linear system. As in the previous problem, express the system in matrix form, compute the matrix inverse, and then solve. If the system cannot be uniquely solved, briefly explain why. Show all your work.

\begin{align*}
-x + y &= -1 \\
2x + 3y &= 17
\end{align*}

4. Solve the linear system. As in the previous problem, express the system in matrix form, compute the matrix inverse, and then solve. If the system cannot be uniquely solved, briefly explain why. Show all your work.

\begin{align*}
-2x + y &= 1 \\
-4x + 2y &= 2
\end{align*}

5. Given the matrix

\[
M = \begin{pmatrix}
a & b \\
c & d
\end{pmatrix}
\]

(a) Specify the form of \( M^{-1} \).

(b) Verify that \( M^{-1}M = I \), where \( I \) is the identity matrix.

(c) Verify that \( MM^{-1} = I \), where \( I \) is the identity matrix.