1. Find the inverse of each of the following matrices or explain why it is not possible.

$$
\begin{aligned}
& A=\left[\begin{array}{cc}
10 & 20 \\
2 & 4
\end{array}\right], \quad B=\left[\begin{array}{cc}
10 & 20 \\
5 & 4
\end{array}\right] . \quad C=\left[\begin{array}{ccc}
3 & -5 & 1 \\
5 & -10 & 5 \\
2 & 0 & -1
\end{array}\right], \\
& D=\left[\begin{array}{lll}
-2 & 1 & 3 \\
-3 & 1 & 2 \\
-4 & 2 & 1
\end{array}\right] . \quad F=\left[\begin{array}{lll}
1 & 0 & 0 \\
0 & 0 & 1 \\
0 & 1 & 0 \\
2 & 2 & 2
\end{array}\right], \quad G=\left[\begin{array}{lll}
1 & 2 & 1 \\
2 & 1 & 2 \\
3 & 3 & 3
\end{array}\right] .
\end{aligned}
$$

2. Solve the system of equations by writing it in the form $A X=B$ and finding $A^{-1}$. Check your answer.
Hint: you can use your result obtained in problem 1 if appropriate.
(a) $\left\{\begin{array}{l}2 x-5 y=-14 \\ -x+2 y=5\end{array}\right.$
(b) $\left\{\begin{array}{c}-2 x+13 y=24 \\ 11 x+23 y=35\end{array}\right.$
(c) $\left\{\begin{array}{l}-2 x+y+3 z=-1 \\ -3 x+y+2 z=-3 \\ -4 x+2 y+1 z=-2\end{array}\right.$
(d) $\left\{\begin{array}{l}-2 x+y+3 z=1 \\ -3 x+y+2 z=-1 \\ -4 x+2 y+1 z=-3\end{array}\right.$
3. Explain why each of the following matrices is elementary. Find its inverse in the easy way.
$A=\left[\begin{array}{lllll}1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1\end{array}\right], B=\left[\begin{array}{ccccc}1 & 0 & 0 & 0 & 0 \\ 0 & 2^{k} & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1\end{array}\right], C=\left[\begin{array}{ccccc}1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & -5 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1\end{array}\right]$.
4. Explain in your words, using the definition of inverse matrix and/or examples of your choice, why each of the following statements is true.
a) If a matrix has an inverse then it must be a square matrix.
b) Not any square matrix is invertable.
c) Every elementary matrix is invertable.
d) If matrix $A$ is invertable then the system $A X=B$ has a unique solution for any vector-column $B$.
