1. Find matrix $A$ if

$$
\left[\begin{array}{cc}
5 & 1 \\
0 & -2
\end{array}\right]-2 A=\left[\begin{array}{cc}
-3 & 2 \\
-1 & 7
\end{array}\right]+A^{T}
$$

2. Let $A, B, C$ be symmetric matrices. Determine whether $A+B+C$ is symmetric. What about $A B C$ ?
3. Consited matrices

$$
A=\left[\begin{array}{ccc}
1 & 2 & 3 \\
0 & 0 & 2 \\
1 & 0 & -1
\end{array}\right], \quad B=\left[\begin{array}{ccc}
0 & 2 & -3 \\
-1 & 0 & 2
\end{array}\right], \quad C=\left[\begin{array}{lll}
3 & 2 & 0
\end{array}\right] .
$$

Find the following products if they are defined

$$
A B, \quad A C, \quad C A, \quad A B^{T}, \quad A^{T} B, \quad A^{2}, \quad B^{2}, \quad C^{2}
$$

4. A square matrix $P$ is called idempotent if $P^{2}=P$. Show that if $P$ is idempotent and $I$ is a unit matrix then $(I-P)^{2}$ is also idempotent.
Bonus: Show that $P+A P-P A P$ is idempotent given that $P$ is idempotent, and $A$ is any square matric of the same size as $P$.
5. Write the following system of linear equations in the form $A X=B$
$5 x_{1}-6 x_{2}-2 x_{3}-7=0, \quad 2 x_{1}+17 x_{3}+14=0, \quad 20 x_{1}+x_{2}-x_{4}-10=0, \quad x_{2}+x_{4}-1=0, \quad x_{1}+x_{5}=0$ namely, identify matrices $A, X, B$ and their dimentions.
6. Given augmented matrix for a homogeneous system of linear equations find the basic solutions and write the parametric solution in the vector form

$$
\left[\begin{array}{cccccc|c}
1 & -2 & 3 & -4 & 5 & -1 & 0 \\
0 & 0 & 0 & 5 & 7 & 1 & 0 \\
0 & 0 & 0 & 0 & 4 & 12 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0
\end{array}\right]
$$

7. Compose a word problem whose solution leads to matrix multiplication.
