1. (10 points) Compute the product ABC of the following three matrices

$$A = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix},\ B = \begin{bmatrix} 0 & 1 & 3 \\ -1 & 0 & -2 \end{bmatrix},\ \text{and } C = \begin{bmatrix} 4 \\ -1 \\ 0 \end{bmatrix}.$$

2. (10 points) Simplify the following matrix expression

$A(A+2B)+3B(2A-B)-A^2+7B^2-5AB$

3. (10 points) The set of solutions to a homogeneous system of linear equations is closed under addition and under scalar multiplication. It is a subspace.
4. (10 points) Let A and B be matrices and c be a scalar.
   A. $(A + B)^t$ = ________
   B. $(cA)^t$ = ________
   C. $(AB)^t$ = _______
   D. $(A^t)^t$ = _______
5. (10 points) Let A and B be symmetric matrices of the same size. Let C be a linear combination of A and B. Prove that C is symmetric.
6. (10 points) Let A and B be symmetric matrices of the same size. Prove that the product AB is symmetric if and only if $AB = BA$.
7. (10 points) Give the definition of inverse
8. (10 points) If a matrix has an inverse, that inverse is unique. Prove it
9. (10 points) State how to determine the inverse of a matrix.
10. (20 points) Inverse properties
   A. $(A^{-1})^{-1}$=_______
   B. $(cA)^{-1}$=________
   C. $(AB)^{-1}$=________
   D. $(A^n)^{-1}$=_________
   E. $(A^t)^{-1}$=_________