No books, watches, notes or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. (2 marks) A matrix B is said to be a square root of a matrix A if BB = A. Find two square roots of  $A = \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$ 

Question 2. Determine whether the following statements are true or false. If the statement is false provide a counterexample. If the statement is true provide a proof of the statement.

a. (3 marks) If A is a square matrix matrix, then  $tr(A + A^T) = 2tr(A)$ .

b. (3 marks) If A and B are square matrices of the same order, then tr(AB) = tr(A)tr(B).

c. (3 marks) If B has a column of zeros, then so does AB if this product is defined.

d. (3 marks) If AB + BA is defined, then A and B are square matrices of the same size.