

Question 1.¹ (3 marks) Show that $A^T(4A)$ must be symmetric. **Justify your work completely, do not skip steps!**

Question 2.² (5 marks) Solve for x where

$$\begin{vmatrix} \sin x & \cos x \\ -\cos x & \sin x \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ e^x & 1 & e^x \\ 1 & e^x & 0 \end{vmatrix}$$

Question 3. 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. (2 marks) If A^2 is a symmetric matrix, then A is a symmetric matrix.

b. (2 marks) If A is a square matrix whose minors are all zero, then $\det(A) = 0$.

Question 4. (3 marks) A matrix A is said to be *skew-symmetric* if $A^T = -A$. Prove: If A is an invertible skew-symmetric matrix, then A^{-1} is skew-symmetric.

¹From a past John Abbott final examination

²From a past Dawson College final examination