

Books, watches, notes or cell phones are **not** allowed. The **only** calculators allowed are the Sharp EL-531***. You **must** show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. (5 marks) Let A and B be two 3×3 matrices such that $\det(A) = 2$ and $\det(B) = -4$. Find the following $\det(5B^{-1}A + \text{adj}(A^{-1}B))$.

Question 2. (5 marks) Given the vertices $A(2, -2, 4)$, $B(4, -1, 1)$, and $C(3, -1, 2)$ of a triangle. Only using vectors find the components of the vector \mathbf{u} with initial point being the midpoint of the side AB and terminal point being the midpoint of the side AC .

Question 3. (5 marks) Let \mathbf{u} and \mathbf{v} be vectors in \mathbb{R}^3 such that $\|\mathbf{u}\| = 4$, $\|\mathbf{v}\| = \sqrt{3}$ and $\mathbf{u} \cdot \mathbf{v} = -6$. For which values of t , if any, is the angle between $\mathbf{u} + \mathbf{v}$ and $\mathbf{u} + t\mathbf{v}$ acute. (An angle θ is said to be *acute* if $0 < \theta < \frac{\pi}{2}$).

Question 4. (3 marks) Determine whether the following statement is true or false. If the statement is false provide a counterexample. If the statement is true provide a proof of the statement.

If A is an $n \times n$ skew-symmetric matrix, such that n is odd, then $A\mathbf{x} = \mathbf{0}$ has nontrivial solutions. (A matrix is skew-symmetric if $A^T = -A$.)