

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. (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 the number of equations in a linear system is strictly less than the number of unknowns, then the system must be inconsistent.

Question 2. (3 marks) In each of the following, find (if possible) conditions on a and b such that the system has no solution, one solution, and infinitely many solutions.

$$\begin{cases} ax + y = 1 \\ 2x + y = b \end{cases}$$

Question 3. (2 marks) Multiplying a row by zero is not an elementary row operation because it does not necessarily preserve the solution set. Find an example where it does preserve the solution set. Find an example where it increases the number of solutions.

Question 4. (3 marks) Illustrate **all** relative positions of lines in an inconsistent linear system consisting of three lines.