

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) Prove: If $p(x) \in \mathbb{P}_{n-1}$ then $\{p(x), p'(x), p''(x), \dots, p^{(n)}(x)\}$ is linearly dependent.

Question 2. (5 marks) Consider the subspace $W = \{X \mid X \in \mathcal{M}_{3 \times 3} \text{ and } X^T = X \text{ and } \text{trace}(X) = 0\}$ of $\mathcal{M}_{3 \times 3}$.

a. (4 marks) Find a basis for W .

b. (1 mark) Determine the dimension of W .

c. (2 marks) Find a non-zero vector of W and find the coordinates of that vector relative to the basis found in part a.

d. (1 mark) Find a vector in $\mathcal{M}_{3 \times 3}$ but not in W .