Prove the following statements.
Please use a separate sheet of paper for each proof.
Please do not hand your exam in early. Rewrite all your solutions carefully inserting the reasons why everything you say is true.

1. If $f : X \to Y$ is continuous and onto and $X$ is connected, then $Y$ is connected.

2. Suppose $A \subseteq X$, $A$ is compact (in the subspace topology), and $X$ is a Hausdorff space. Then $A$ is closed.

3. The closed unit interval $[0, 1]$ is compact.

4. Suppose that $X$ is a compact metric space and $\langle x_n \in X : n \in \omega \rangle$ is a sequence. Then there exists a subsequence $\langle x_{k_n} : n \in \omega \rangle$ which converges to some $x \in X$. 