Show all work on this sheet, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation. \[\boxed{\text{Box}}\] short final answers.

1. a) Compute the exact area $\Delta A$ of the ring of inner radius $r$ and outer radius $r + \Delta r$.

b) Use the differential approximation to calculate this area, assuming $\Delta r$ is much smaller than $r$.

c) Evaluate the error (approx-exact) in this approximation, simplifying your result.

2. Find the absolute maximum of the function $f(x) = x^3 - x^2 - x$ on the interval $-10 \leq x \leq 1$. 