Tiebreaks A

1. The equation
$$(\log_{\sqrt{10}} x)(\log_{10}(20x))(\log_{10}(900x^2)) = -1$$
has 3 real solutions, whose product can be expressed as $\frac{1}{n}$. Compute n.

2. Amy, Bob, and Carol each have 1000 slips of paper numbered 1 to 1000. They each independently choose 100 of their slips at random. What is the expected number of distinct numbers among their 300 chosen slips?

3. Let points A, B, and C be on circle O such that BC is a diameter. Let the tangents at A and B meet at D. Construct point E on line AD such that $BE \parallel AC$. Given that $AC = 1$ and $BE = 2$, compute CD.

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