1. Probability of finding the electron at x

$$P(x) = \left| \langle x|1\rangle\langle 1|s\rangle + \langle x|2\rangle\langle 2|s\rangle \right|^2$$

Write $\langle x|j\rangle\langle j|s\rangle \equiv \rho_j e^{i\theta_j}$, $j=1,2$

where $\rho_j = |\langle x|j\rangle\langle j|s\rangle| = |\langle x|j\rangle| \cdot |\langle j|s\rangle|$.

We know $\dfrac{|\langle 2|s\rangle|^2}{|\langle 1|s\rangle|^2} = \dfrac{1}{100} \Rightarrow |\langle 2|s\rangle| = \dfrac{1}{10}|\langle 1|s\rangle|$

Since we are looking at a maximum and a minimum near the center and close to one another, we may assume $|\langle x|2\rangle| \simeq |\langle x|1\rangle|$.
Then

$$\frac{\rho_2}{\rho_1} = \frac{|\langle x|2\rangle|}{|\langle x|1\rangle|} \cdot \frac{|\langle 2|s\rangle|}{|\langle 1|s\rangle|} = \frac{1}{10}.$$

$$P(x) = \rho_1^2 + \rho_2^2 + 2\rho_1\rho_2 \cos(\theta_1 - \theta_2)$$

At a maximum, $\cos(\theta_1-\theta_2) = +1$ and $P_{max} = (\rho_1+\rho_2)^2$

At a minimum, $\cos(\theta_1-\theta_2) = -1$ and $P_{min} = (\rho_1-\rho_2)^2$.

$$\frac{P_{max} - P_{min}}{P_{min}} = \frac{4\rho_1\rho_2}{(\rho_1-\rho_2)^2} = \frac{4\rho_2 \cdot 10\rho_2}{(9\rho_2)^2} = \frac{40}{81} \simeq 0.5.$$