Show your work for full credit.

1. A person 6 feet tall observes an object at the bottom of a 10 foot-deep pool, as shown in the figure below. Given the geometry of that figure, and the fact that the index of refraction of water is about 1.5, find the distance, D. Note that you can assume that the light is perpendicularly polarized (to the plane of incidence).

Let \( \theta_1 \) be the angle relative to the normal on the incident side. Then \( \tan \theta_1 = \frac{20}{6} \).

Therefore, \( \theta_1 = 73.3^\circ \). Then, \( n_1 \sin \theta_1 = n_2 \sin \theta_2 \), so \( \theta_2 = \sin^{-1} \left( \frac{\sin 73.3^\circ}{1.5} \right) = 39.7^\circ \).

Finally, \( D = 20 + 10 \tan \theta_2 = 20 + 8.3 = 28.3' \).

2. Assume that randomly-polarized sunlight, that is light that is a mixture of both parallel and perpendicular polarizations, is incident upon the water. What will be the predominant polarization (vertical or horizontal to the surface of the water) of the reflected light? Give a reason for your answer for full credit.

\( R_{\text{perpendicular}} > R_{\text{parallel}} \) (see Figure 4.11 in Shen and Kong). Therefore, the reflected light is more perpendicularly polarized than it is parallel polarized, meaning that the predominant polarization is horizontal (relative to the water).