

Your Name: \_\_\_\_\_

TA Name: \_\_\_\_\_

Section: \_\_\_\_\_

## Written Homework 8

**(due Friday, March 19th, 2010 at 3PM)**

Turn in this written homework in the appropriate slot in the tall wooden Homework Cabinet at the entrance of the HelpRoom, Duane G2B90. Please STAPLE pages together and **put your name and TA name at the top of every page!**

*In this and all subsequent written homework, you will be graded on the clarity and completeness of your answer. **No credit** will be given for an answer without a derivation, even if the answer is correct. A calculation without units is also incorrect. **Every physics equation used should be named and have a brief explanation for why it was chosen.** Also, all final answers must be written only in terms of variables given, universal constants like  $k$  or  $\epsilon_0$ , and dimensionless numbers like 2 or  $\pi$ .*

Here is the problem:

After finishing your physics classes with the firm conviction that the questions were strange and out of touch with reality, you decide to take up spear fishing. While wading through water (of index of refraction= $n$  and depth  $h$ ) you spot a fish that appears to be a distance away **touching** the rocky soil at the bottom of the water. Under the water the light seems to travel a horizontal distance  $d$ . It exits the water at point  $p$  and then travels a horizontal distance  $D$  to your eye. Please calculate where the fish actually is in terms of vertical distance under the water and horizontal distance from you. It will be helpful to calculate the diagonal distance the light the light travels in and out of the water. (Take the index of refraction of air to be 1.)

