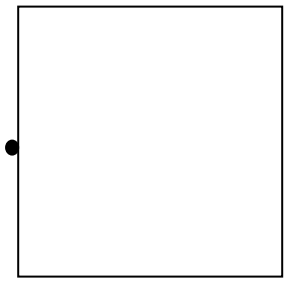
WS7 Physics 322 Apparent Depth

Imagine that you are looking at an object beneath the water. Does the object appear closer to you than it really is (in the absence of the water), farther from you than it really is, or the same distance from you? Explain your reasoning.

Take an empty water tank and place it on a board with some paper beneath it. Place a pin behind the water tank. This pin will serve as the object. Using four additional pins and looking through the empty tank, define two unique rays to locate the object pin. Try to keep the angles small with respect to the normal. Describe your procedure and why it works.

Without moving the tank or your pins, fill the tank with water so that the water is deeper than the source pin is high. Do the rays that you previously defined identify the location of the source pin? Explain why or why not.

Pull the four pins from the board and redefine the rays to determine the *apparent* location of the source pin.



Consider the drawing at left. In light of your observations, sketch several rays that would indicate why we see the object nearer to the eye than it really is.

Write out an expression that describes the apparent location of the source pin in terms of the angles, indices of refraction and Snell's law.

If you were to use small angles, then you should be able to use the small angle approximation to relate the index of refraction and the apparent depth of the object.