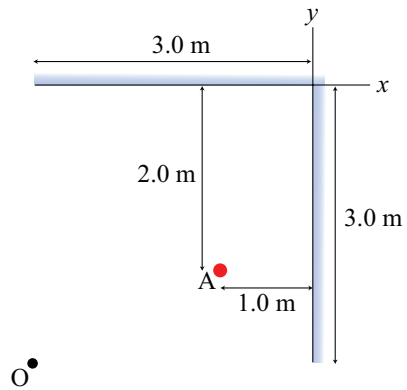


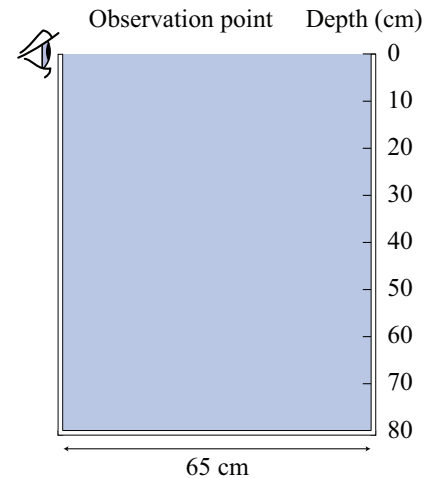
Homework Set 1

- 1) A red ball is placed at point A in the figure shown below
- (a) How many images are seen by an observer at point O?
- (b) What are the (x, y) coordinates of each image?



- 2) A microscope is focused on a black dot. When a 1.00-cm-thick piece of plastic is placed over the dot, the microscope objective has to be raised 0.40 cm to bring the dot back into focus. What is the index of refraction of the plastic? (*Hint: the small angle approximation will be very helpful here.*)
- 3) A ray of light makes an angle of incidence of 45° at the center of the top surface of a transparent cube of refractive index 1.414. Trace the ray through the cube. (*Hint: you are going to need to use Snell's law, trigonometry, and geometry to get values for angles and distances, along with a ruler and protractor.*)

- 4) The 80-cm-tall, 65-cm-wide tank shown is completely filled with water. The tank has marks every 10 cm along one wall, and the 0 cm mark is barely submerged. As you stand beside the opposite wall, your eye is level with the top of the water.



- (a) Can you see the marks from the top of the tank (the 0 cm mark) going down, or from the bottom of the tank (the 80 cm mark) going up? Explain.
- (b) Which is the lowest or highest mark, depending on your answer to part a, that you can see?

- 5) It's nighttime, and you've dropped your goggles into a 3.0-m-deep swimming pool. If you hold a laser pointer 1.0 m above the edge of the pool, you can illuminate the goggles on the bottom of the pool if the laser beam enters the water 2.0 m from the edge. How far are the goggles from the edge of the pool?
- 6) There is one angle of incidence β onto a prism for which the light inside an isosceles prism travels parallel to the base and emerges at angle β .

- (a) Find an expression for β in terms of the prism's apex angle α and index of refraction n .
- (b) A laboratory measurement finds that $\beta = 52.2^\circ$ for a prism shaped like an equilateral triangle. What is the prism's index of refraction?

