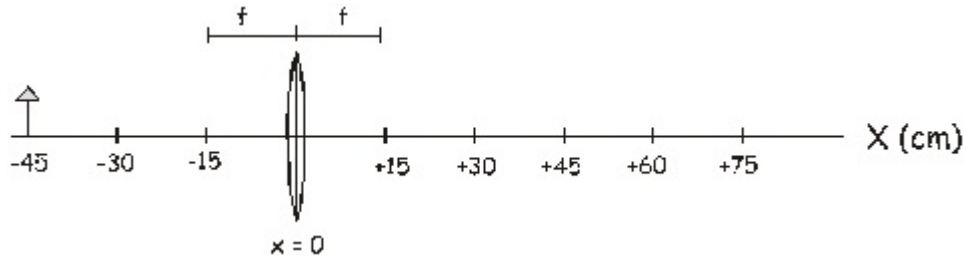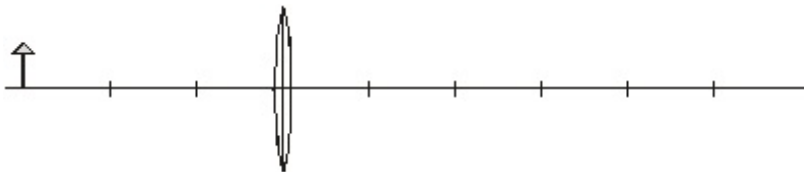# Optics

Name: _____

1. A thin double convex lens of focal length 15.0 cm is located at the origin of the x-axis, as shown below. An 8.00 cm tall object is placed 45.0 cm to the left of the lens.


a. On the figure below, draw a ray diagram to show the formation of the image by the lens. Clearly show the principle rays.


b. Calculate (do not measure) each of the following:
   i. The position of the image formed by the lens.
   ii. The size of the image formed by the lens.

c. A concave mirror with focal length of + 15.0 cm is placed at x = + 30.0 cm. On the figure below, indicate the position of the image formed by the lens, and draw a diagram to show the formation of the image by a mirror. Clearly show the principle rays. (note: the image formed by the lens acts as the object that will be reflected by the mirror.)
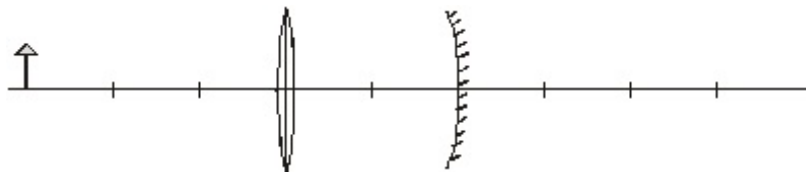
2. A beam of light reflects off of a fish that is under the surface of a lake. The ray is refracted at the surface and is seen by a person in a boat. The angle of refraction is 43.0°. Find: (a) The angle of incidence made by the ray, (b) the fish is 2.20 m below the surface, if the fish rises straight up, at what depth will it no longer be visible to the person in the boat?
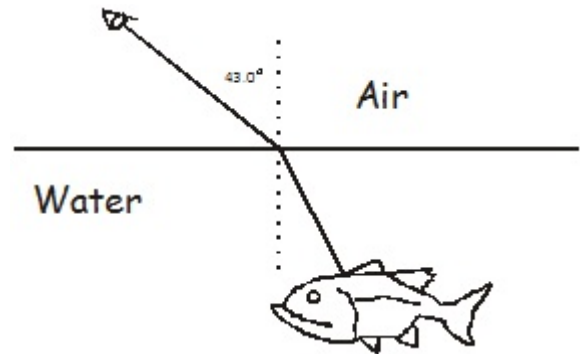
3. 615 nm light is incident on a single slit that is 0.250 mm in width. The observing screen is 3.00 m away. Find (a) the position of the first dark fringe and (b) the width of the central bright fringe.

4. A 235 g mass is attached to a spring (k = 145 N/m) and displaced 15.0 cm. The mass is released and allowed to oscillate on a frictionless surface, what is the (a) period of the motion, (b) frequency of the motion, (c) the amplitude of the motion, and (d) the max PE of the thing?

5. What is the fundamental frequency and wavelength that resonates in a tube that is closed at one end which has a length of 2.35 m?

6. You are hanging out in front of the library, looking cool. A fire truck is headed south towards you at a speed of 87.5 km/h. It is sounding its 1 050 Hz siren. What frequency do you hear?

7. A diffraction grating has exactly 5 000 lines per centimeter. Helium laser light of wavelength 633 nm is incident on the grating. (a) What is the angle for the first order maxima? (b) If the grating is 1.25 m from a screen, what is the distance from central maxima to the first order maxima?