

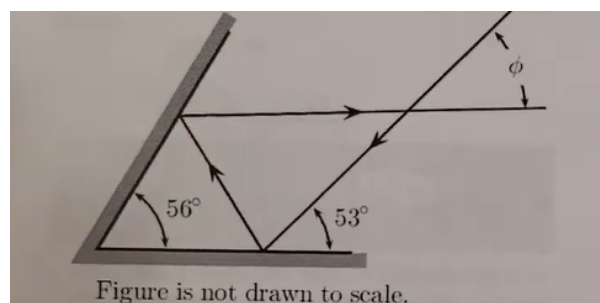
# 1 Geometric Optics

## 1.1 Formulas

Check chapter 13 formulas.

## 1.2 Two Mirrors Problem

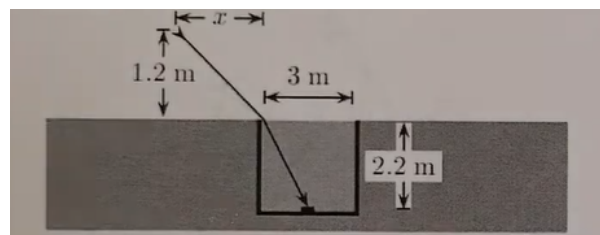
The reflecting surfaces of two intersecting flat mirrors are at an angle of  $56^\circ$ . A light ray strikes the horizontal mirror at an angle of  $53^\circ$  with respect to the mirror's surface.



Calculate the angle of  $\phi$ . Answer in units of  $^\circ$ .

## 1.3 Liquid in a Cistern Problem

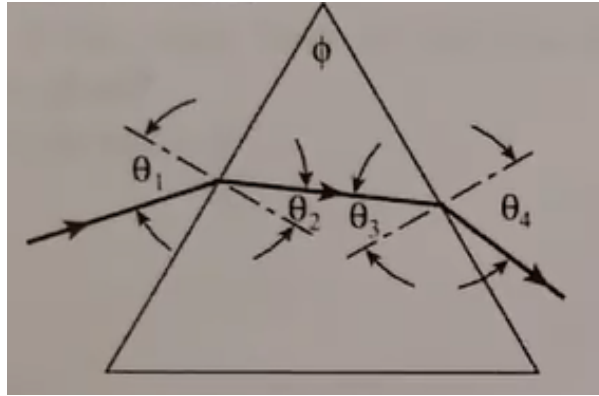
A cylindrical cistern, constructed below ground level, is 3 m in diameter and 2.2 m deep and is filled to the brim with a liquid whose index of refraction is 1.52. A small object rests on the bottom of the cistern at its center.



How far  $x$  from the edge of the cistern can a girl whose eyes 1.2 m from the ground stand and still see from the object? Answer in units of m.

## 1.4 Silica Prism Problem

Light of wavelength 700 nm is incident on the face of a silica prism at an angle of  $\theta_1 = 75^\circ$  (with respect to the normal to the surface). The apex angle of the prism is  $\varphi = 60^\circ$ . The value of the index of refraction for silica is  $n = 1.455$ .



- (a) Find the angle of refraction at this first surface. Answer in units of degrees.
- (b) Find the angle of incidence at the second surface. Answer in units of degrees.
- (c) Find the angle of refraction at the second surface. Answer in units of degrees.
- (d) Find the angle between the incident and emerging rays. Answer in units of degrees.

## 1.5 Two Beams in Glass Problem

A certain kind of glass has an index of refraction of 1.65 for blue light of wavelength 430 nm and an index of 1.615 for red light of wavelength 680 nm. A beam containing these two colors is incident at an angle of  $30^\circ$  on a piece of this glass.

What is the angle between the two beams inside the glass? Answer in units of  $^\circ$ .