Verification:

Consider two parallel rays of light (in air) incident upon a refracting surface of refractive index μ, as shown in figure.

When $ray\ I$ reaches to point A, the $ray\ II$ reaches to point A'. Hence, AA' behave as the incident wavefront. Similarly, BB' behave as refracted wave front.

First law: As shown in figure, the incident ray ($ray\ I$), the normal line and the refracted ray ($ray\ I$), all meet at point A on the same plane. This verifies the first law of refraction.

In addition, in the time $ray\ I$ travels from point $A\ to\ B'$ through the medium, the $ray\ II$ travels from point $A'\ to\ B$ in air medium.

$$\therefore \quad AB' = vt \quad ; v = speed\ of\ light\ in\ medium.$$
$$\text{and,} \quad A'B = ct \quad ; c = speed\ of\ light\ in\ air. \qquad \ldots\ldots\ldots (1)$$

Now,

In triangles $\Delta AA'B \quad and \quad \Delta AB'B$

$$\sin i = \frac{A'B}{AB} \quad \text{and} \quad \sin r = \frac{AB'}{AB}$$

$$\text{or} \quad \sin i = \frac{c\,t}{AB} \quad \text{and} \quad \sin r = \frac{v\,t}{AB}$$

$$\text{Therefore,} \quad \frac{\sin i}{\sin r} = \frac{c\,t}{AB} \times \frac{AB}{v\,t}$$

$$\therefore \frac{\sin i}{\sin r} = \frac{c}{v} = \mu\ (constant\ for\ a\ medium)$$

This verifies the second law of refraction.

1. A plane wavefront is incident on a water surface at an angle of incidence 60^o then it gets refracted at an angle of 45^o.
   (i) The ratio of width of incident wavefront to that of refracted wavefront is:
   a. $\sqrt{2}$ b. 1.66 c. $\frac{\sqrt{3}}{2}$ d. $\frac{1}{\sqrt{2}}$
   (ii) The refractive index of water is:
   a. $\sqrt{2}$ b. $\sqrt{1.66}$ c. $\sqrt{\frac{3}{2}}$ d. $\frac{1}{\sqrt{2}}$
2. The wavelength of yellow light in air is 580 nm. The wavelength in diamond of refractive index 2.4 is
   a. 200 nm b. 240 nm c. 280 nm d. 320 nm