

65. Since the layers are parallel, the angle of refraction regarding the first surface is the same as the angle of incidence regarding the second surface (as is suggested by the notation in Fig. 34-55). We recall that as part of the derivation of Eq. 34-49 (Brewster's angle), the textbook shows that the refracted angle is the complement of the incident angle:

$$\theta_2 = (\theta_1)_c = 90^\circ - \theta_1 .$$

We apply Eq. 34-49 to both refractions, setting up a product:

$$\begin{aligned} \left(\frac{n_2}{n_1}\right) \left(\frac{n_3}{n_2}\right) &= (\tan \theta_{B1 \rightarrow 2}) (\tan \theta_{B2 \rightarrow 3}) \\ \frac{n_3}{n_1} &= (\tan \theta_1) (\tan \theta_2) . \end{aligned}$$

Now, since  $\theta_2$  is the complement of  $\theta_1$  we have

$$\tan \theta_2 = \tan(\theta_1)_c = \frac{1}{\tan \theta_1} .$$

Therefore, the product of tangents cancel and we obtain  $n_3/n_1 = 1$ . Consequently, the third medium is air:  $n_3 = 1.0$ .