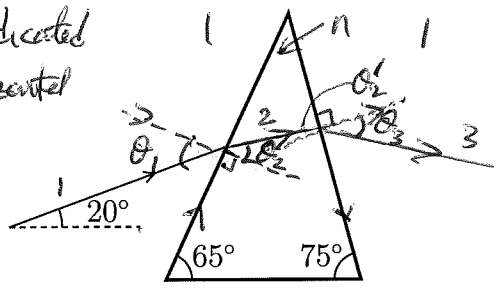
*. (12 points) A light ray is incident upon a triangular prism ($n = 1.50$) as shown below.

All line/ray directions indicated as ccw angle from horizontal



(c) ray within prism directed 3.13° above horizontal

(d) ray coming out of prism directed 2.98° below horizontal

a. (6 points) Determine the direction of the transmitted light ray (i) as it passes through the prism, and (ii) as it leaves the prism. In each case, indicate the direction by giving the angle relative to horizontal.

left side of prism = +65°

left side surface normal = 65 − 90 = −25°

incident ray = +20° (given)

$\theta_1 = +20° - (-25°) = 45°$

$\theta_2 = \arcsin\left(\frac{(1)\sin\theta_1}{n}\right) = 28.13°$

ray #2 = 28.13° + (−25°) = +3.13°

right side of prism = −75°

right side surface normal = (−75°) + 90° = +15°

$\theta_2' = +15° - (+3.13°) = 11.87°$

$\theta_3 = \arcsin\left(\frac{(n)\sin\theta_2'}{1}\right) = 17.98°$

ray #3 = +15° − (17.98°) = −2.98°

b. (6 points) Assuming that the incident light is polarized parallel to the plane of incidence, determine the fraction of light that is transmitted through the prism and out the other side.

$$r_{\parallel,1\to2} = \frac{-(n/1)\cos\theta_1 + \cos\theta_2}{(n/1)\cos\theta_1 + \cos\theta_2} \quad (1.06066,\ 0.88192)$$

$$= -0.092013$$

$$R_{1\to2} = r_{\parallel,1\to2}^2 = 0.00846665$$

$$T_{1\to2} = 1 - R_{1\to2} = 0.991534$$

$$r_{\parallel,2\to3} = \frac{-(1/n)\cos\theta_2' + \cos\theta_3}{(1/n)\cos\theta_2' + \cos\theta_3} \quad (0.65240,\ 0.9511?)$$

$$= +0.18632$$

$$R_{\parallel,2\to3} = r_{\parallel,2\to3}^2 = 0.034714$$

$$T_{2\to3} = 1 - R_{2\to3} = 0.965286$$

$$T = T_{1\to2}\,T_{2\to3} = 0.957113$$