G3FERREF

Calculation of the law of refraction

Differentiation of the two expressions depending on time

$$\left(\frac{d}{dy}\sqrt{xq^2+y^2}\right)\cdot\frac{1}{v1} \qquad \left[\frac{d}{dy}\sqrt{\left[(xf-xq)^2+(yf-y)^2\right]}\right]\cdot\frac{1}{v2}$$

$$\frac{1}{\sqrt{xq^2+y^2}}\cdot\frac{y}{v1} \qquad \frac{1}{\left(2\cdot\sqrt{xf^2-2\cdot xf\cdot xq+xq^2+yf^2-2\cdot yf\cdot y+y^2}\right)}\cdot\frac{(-2\cdot yf+2\cdot y)}{v2}$$

This may be written as

$$\frac{1}{\left[2\cdot\sqrt{(xf-xq)^2+(yf-y)^2}\right]}\cdot\frac{(-2\cdot yf+2\cdot y)}{v2}$$

The differentiated expressions depending on time may be written as

$$\frac{y}{\sqrt{xq^2+y^2}}=\sin(\theta1) \qquad \frac{(y-yf)}{\sqrt{(xf-xq)^2+(yf-y)^2}}=-\sin(\theta2)$$

Substituting into

$$\left(\frac{d}{dy}\sqrt{xq^2+y^2}\right)\cdot\frac{1}{v1}+\frac{1}{v2}\cdot\left[\frac{d}{dy}\sqrt{\left[(xf-xq)^2+(yf-y)^2\right]}\right]=0$$

results in

$$\frac{\sin(\theta1)}{v1}=\frac{\sin(\theta2)}{v2}$$

or

$$n1\cdot\sin(\theta1)=n2\cdot\sin(\theta2)$$