38.68 After a laser beam passes through two thin parallel slits, the first completely dark fringes occur at ±19.0° with the original direction of the beam, as viewed on a screen far from the slits.

(a) What is the ratio of the distance between the slits to the wavelength of the light illuminating the slits? (b) What is the smallest angle, relative to the original direction of the laser beam, at which the intensity of the light is 1/2 the maximum intensity on the screen?

\[
d \sin \theta = \left( m + \frac{1}{2} \right) \lambda \quad m = 0, \pm 1, \pm 2, \ldots
\]

**Första min** \( m=0 \)

\[
\frac{d}{\lambda} = \frac{1}{2 \sin \theta} = \frac{1}{2 \sin 19^\circ} = 1.53
\]

**b.)** \( I = I_0 \cos^2 \frac{\phi}{2} \quad \phi = \frac{2 \pi d}{\lambda} \sin \theta \)

\[
\theta, \text{ such for } \frac{I}{I_0} = 0.1 \text{ odh } \frac{d}{\lambda} \text{ m.l. } \text{a-uppopp}
\]

\[
I = \cos^2 \frac{\phi}{2} \left( \frac{2 \pi d}{\lambda} \sin \theta \right)
\]

\[
\sin \theta \approx \theta
\]

\[
\pi d \cdot \theta = \arccos \sqrt{\frac{I}{I_0}}
\]

\[
\theta = \frac{1}{\pi} \left( \frac{d}{\lambda} \right) \arccos \sqrt{\frac{I}{I_0}}
\]

\[
= \frac{1}{\pi \cdot 1.93} \cdot \arccos \sqrt{0.1} = 14.9^\circ
\]