36.32. The wavelength range of the visible spectrum is approximately 400–700 nm. White light falls at normal incidence on a diffraction grating that has 350 slits/mm. Find the angular width of the visible spectrum in (a) the first order and (b) the third order.

\[ d \sin \theta = n \lambda \]

\[ d = \frac{10^{-3}}{350} = 2.85 \times 10^{-6} \text{ m} \]

\[ \sin \theta_1 = \frac{\lambda}{d} = \frac{400 \text{ nm}}{400 \text{ nm}} = 1 \]
\[ \theta_1 = 6.04^\circ \]

\[ \sin \theta_2 = \frac{300 \text{ nm}}{d} \]
\[ \sin \theta_2 = 0.245 \]
\[ \theta_2 = 14.21^\circ \]

\[ \sin \theta_3 = \frac{700 \text{ nm}}{2.85 \times 10^{-6}} = 0.421 \]
\[ \theta_3 = 24.90^\circ \]

\[ \sin \theta_4 = \frac{2100 \text{ nm}}{2.85 \times 10^{-6}} = 0.737 \]
\[ \theta_4 = 47.5^\circ \]

\[ \Delta \theta = 47.5 - 24.9 \]
\[ = 22.6^\circ \]

\[ M = 3 \]

\[ \Delta \theta = 14.2 - 6.0 \]
\[ = 8.2^\circ \]