

19. The maxima of a two-slit interference pattern are at angles  $\theta$  given by  $d \sin \theta = m\lambda$ , where  $d$  is the slit separation,  $\lambda$  is the wavelength, and  $m$  is an integer. If  $\theta$  is small,  $\sin \theta$  may be replaced by  $\theta$  in radians. Then,  $d\theta = m\lambda$ . The angular separation of two maxima associated with different wavelengths but the same value of  $m$  is  $\Delta\theta = (m/d)(\lambda_2 - \lambda_1)$ , and their separation on a screen a distance  $D$  away is

$$\begin{aligned}\Delta y &= D \tan \Delta\theta \approx D \Delta\theta = \left[ \frac{mD}{d} \right] (\lambda_2 - \lambda_1) \\ &= \left[ \frac{3(1.0 \text{ m})}{5.0 \times 10^{-3} \text{ m}} \right] (600 \times 10^{-9} \text{ m} - 480 \times 10^{-9} \text{ m}) = 7.2 \times 10^{-5} \text{ m} .\end{aligned}$$

The small angle approximation  $\tan \Delta\theta \approx \Delta\theta$  (in radians) is made.