

## PH332 - Chapter Twelve Solutions

P1) Constructive interference occurs when the path difference is an integer number of wavelengths.

$$\text{Symbolically, } \Delta L = m\lambda \quad m \in \{0, 1, 2, 3, \dots\}$$

Destructive interference occurs when the path difference is an integer number of wavelengths plus half a wavelength.

$$\text{Symbolically, } \Delta L = (m + \frac{1}{2})\lambda \quad m \in \{0, 1, 2, 3, \dots\}$$

$$(a) \Delta L = 3\lambda \quad \text{constructive } (m=3)$$

$$(b) \Delta L = \lambda/2 \quad \text{destructive } (m=0)$$

$$(c) \Delta L = 5\lambda/2 = (2 + \frac{1}{2})\lambda \quad \text{destructive } (m=2)$$

$$(d) \Delta L = 0 = 0\lambda \quad \text{constructive } (m=0)$$

P17) The image gets fuzzier because of the effects of Fraunhofer diffraction.

$$\text{P12) (a) fringe spacing} = x = \lambda \frac{D}{d}$$

$$\lambda = 500 \text{ nm} = 500 \times 10^{-9} \text{ m}$$

$$D = 1 \text{ m}$$

$$d = 1 \text{ mm} = 1 \times 10^{-3} \text{ m}$$

$$x = 500 \times 10^{-9} \left( \frac{1}{1 \times 10^{-3}} \right) = 500 \times 10^{-6} \text{ m}$$

$$x = 500 \mu\text{m} = 500 \text{ microns}$$

$$x = 0.5 \times 10^{-3} \text{ m} = 0.5 \text{ mm} = 0.5 \text{ millimeter}$$