87. (a) The path length difference is $0.5\,\mu$m $= 500$ nm, which is represents $500/400 = 1.25$ wavelengths – that is, a meaningful difference of 0.25 wavelengths. In angular measure, this corresponds to a phase difference of $(0.25)2\pi = \pi/2$ radians.

(b) When a difference of index of refraction is involved, the approach used in Eq. 36-9 is quite useful. In this approach, we count the wavelengths between S_1 and the origin

$$N_1 = \frac{Ln}{\lambda} + \frac{L'n'}{\lambda}$$

where $n = 1$ (rounding off the index of air), $L = 5.0\,\mu$m, $n' = 1.5$ and $L' = 1.5\,\mu$m. This yields $N_1 = 18.125$ wavelengths. The number of wavelengths between S_2 and the origin is (with $L_2 = 6.0\,\mu$m) given by

$$N_2 = \frac{L_2 n}{\lambda} = 15.000 \ .$$

Thus, $N_1 - N_2 = 3.125$ wavelengths, which gives us a meaningful difference of 0.125 wavelength and which "converts" to a phase of $\pi/4$ radian.