

50. (a) We find m from the last formula obtained in problem 49:

$$m = \frac{r^2}{R\lambda} - \frac{1}{2} = \frac{(10 \times 10^{-3} \text{ m})^2}{(5.0 \text{ m})(589 \times 10^{-9} \text{ m})} - \frac{1}{2}$$

which (rounding down) yields $m = 33$. Since the first bright fringe corresponds to $m = 0$, $m = 33$ corresponds to the thirty-fourth bright fringe.

(b) We now replace λ by $\lambda_n = \lambda/n_w$. Thus,

$$m_n = \frac{r^2}{R\lambda_n} - \frac{1}{2} = \frac{n_w r^2}{R\lambda} - \frac{1}{2} = \frac{(1.33)(10 \times 10^{-3} \text{ m})^2}{(5.0 \text{ m})(589 \times 10^{-9} \text{ m})} - \frac{1}{2} = 45 .$$

This corresponds to the forty-sixth bright fringe (see remark at the end of our solution in part (a)).