12. It is useful to study Sample Problem 18-3 before working this problem. We label the two point sources 1 and 2 and assume they are on the x axis (a distance $D = 2\lambda$ apart). When we refer to the circle of large radius, we are assuming that a line drawn from source 1 to a point on the circle and a line drawn to it from source 2 are approximately parallel (and thus both at angle θ measured from the y axis). In terms of the theory developed in §18-4, we find that the phase difference at P (on the large circle of radius R) for the two waves emitted from 1 and 2 is

$$\Delta\phi \approx \frac{2\pi\Delta x}{\lambda} = \frac{2\pi D \sin\theta}{\lambda} = 4\pi \sin\theta \ .$$

(a) For maximum signal, we set $\Delta\phi = 2m\pi$ ($m = 0, \pm 1, \pm 2, \ldots$) to obtain $\sin\theta = m/2$. Thus we get a total of 8 possible values of θ between 0 and 2π, given by $\theta = 0,\ \sin^{-1}(1/2) = 30^\circ,\ \sin^{-1}(1) = 90^\circ$ and (using symmetry properties of the sine function) $150^\circ, 180^\circ, 210^\circ, 270^\circ$, and 330°.

(b) Since there must be a mininum in between two successive maxima, the total number of minima is also eight.