21.27. **Visualize:** Please refer to Figure Ex21.27.
Solve: **(a)** The circular wave fronts emitted by the two sources indicate the sources are out of phase. This is because the wave fronts of each source have not moved the same distance from their sources.
(b) Let us label the top source as 1 and the bottom source as 2. The phase difference between the sources is $\Delta\phi_0 = \pi$. For the point P, $r_1 = 2\lambda$ and $r_2 = 3\lambda$. The phase difference is

$$\Delta\phi = \frac{2\pi\Delta r}{\lambda} + \Delta\phi_0 = \frac{2\pi(3\lambda - 2\lambda)}{\lambda} + \pi = 3\pi$$

This corresponds to destructive interference.
For the point Q, $r_1 = 3\lambda$ and $r_2 = \frac{3}{2}\lambda$. The phase difference is

$$\Delta\phi = \frac{2\pi\left(\frac{3}{2}\lambda\right)}{\lambda} + \pi = 4\pi$$

This corresponds to constructive interference.
For the point R, $r_1 = \frac{5}{2}\lambda$ and $r_2 = 3\lambda$. The phase difference is

$$\Delta\phi = \frac{2\pi\left(\frac{1}{2}\lambda\right)}{\lambda} + \pi = 2\pi$$

This corresponds to constructive interference.

	r_1	r_2	Δr	C/D
P	2λ	3λ	λ	D
Q	3λ	$\frac{3}{2}\lambda$	$\frac{3}{2}\lambda$	C
R	$\frac{5}{2}\lambda$	3λ	$\frac{1}{2}\lambda$	C

Assess: Note that it is not r_1 or r_2 that matter, but the difference Δr between them.