

7. Each of the semi-infinite straight wires contributes $\mu_0 i / 4\pi R$ (Eq. 30-9) to the field at the center of the circle (both contributions pointing “out of the page”). The current in the arc contributes a term given by Eq. 30-11 pointing into the page, and this is able to produce zero total field at that location if

$$\begin{aligned} B_{\text{arc}} &= 2B_{\text{semi infinite}} \\ \frac{\mu_0 i \phi}{4\pi R} &= 2 \left(\frac{\mu_0 i}{4\pi R} \right) \end{aligned}$$

which yields $\phi = 2$ rad.