

58. (a) The contribution to B_C from the (infinite) straight segment of the wire is

$$B_{C1} = \frac{\mu_0 i}{2\pi R} .$$

The contribution from the circular loop is

$$B_{C2} = \frac{\mu_0 i}{2R} .$$

Thus,

$$B_C = B_{C1} + B_{C2} = \frac{\mu_0 i}{2R} \left(1 + \frac{1}{\pi} \right) .$$

\vec{B}_C points out of the page.

- (b) Now $\vec{B}_{C1} \perp \vec{B}_{C2}$ so

$$B_C = \sqrt{B_{C1}^2 + B_{C2}^2} = \frac{\mu_0 i}{2R} \sqrt{1 + \frac{1}{\pi^2}} ,$$

and \vec{B}_C points at an angle (relative to the plane of the paper) equal to

$$\tan^{-1} \left(\frac{B_{C1}}{B_{C2}} \right) = \tan^{-1} \left(\frac{1}{\pi} \right) = 18^\circ .$$