

5. (a) Recalling the *straight sections* discussion in Sample Problem 29-1, we see that the current in the straight segments collinear with  $P$  do not contribute to the field at that point. Using Eq. 29-9 (with  $\phi = \theta$ ) and the right-hand rule, we find that the current in the semicircular arc of radius  $b$  contributes  $\mu_0 i \theta / 4\pi b$  (out of the page) to the field at  $P$ . Also, the current in the large radius arc contributes  $\mu_0 i \theta / 4\pi a$  (into the page) to the field there. Thus, the net field at  $P$  is

$$B = \frac{\mu_0 i \theta}{4} \left( \frac{1}{b} - \frac{1}{a} \right) = \frac{(4\pi \times 10^{-7} \text{ T} \cdot \text{m/A})(0.411 \text{ A})(74^\circ \cdot \pi / 180^\circ)}{4\pi} \left( \frac{1}{0.107 \text{ m}} - \frac{1}{0.135 \text{ m}} \right)$$

$$= 1.02 \times 10^{-7} \text{ T}.$$

(b) The direction is out of the page.