

25. Each wire produces a field with magnitude given by  $B = \mu_0 i / 2\pi r$ , where  $r$  is the distance from the corner of the square to the center. According to the Pythagorean theorem, the diagonal of the square has length  $\sqrt{2}a$ , so  $r = a/\sqrt{2}$  and  $B = \mu_0 i / \sqrt{2}\pi a$ . The fields due to the wires at the upper left and lower right corners both point toward the upper right corner of the square. The fields due to the wires at the upper right and lower left corners both point toward the upper left corner. The horizontal components cancel and the vertical components sum to

$$\begin{aligned} B_{\text{total}} &= 4 \frac{\mu_0 i}{\sqrt{2}\pi a} \cos 45^\circ = \frac{2\mu_0 i}{\pi a} \\ &= \frac{2(4\pi \times 10^{-7} \text{ T}\cdot\text{m/A})(20 \text{ A})}{\pi(0.20 \text{ m})} = 8.0 \times 10^{-5} \text{ T} . \end{aligned}$$

In the calculation  $\cos 45^\circ$  was replaced with  $1/\sqrt{2}$ . The total field points upward.