Ch. 28 – 66

66. Four long straight parallel wires located at the corners of a square of side d carry equal currents I_0 perpendicular to the page as shown in Fig. 28–59. Determine the magnitude and direction of $\vec{\mathbf{B}}$ at the center C of the square.

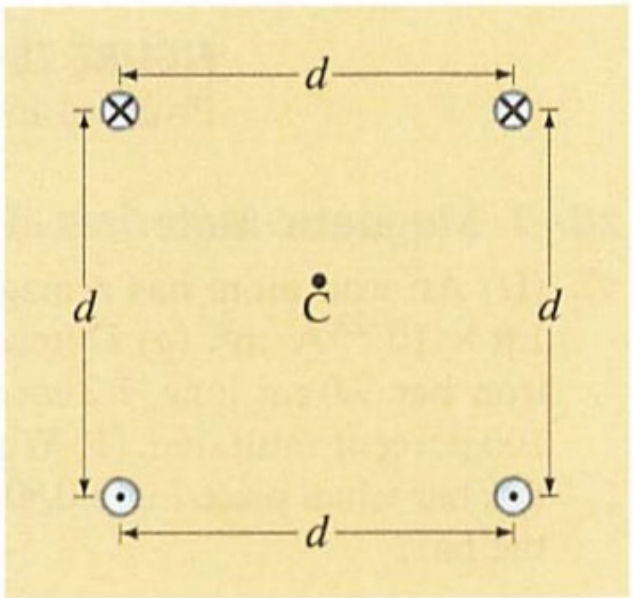
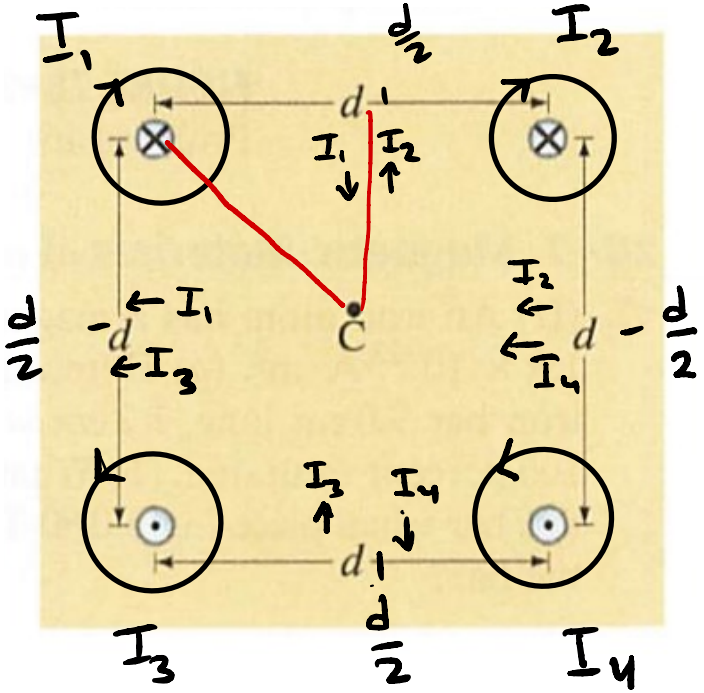
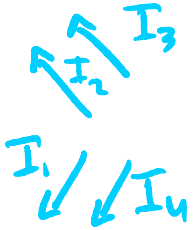
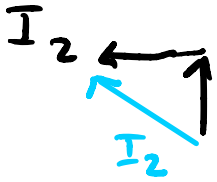


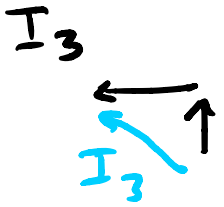
FIGURE 28–59
Problem 66.

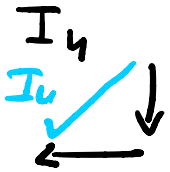
Ch. 28 – 66











x- component

$$\vec{B}_1 = \frac{\mu_0 I}{2\pi r}\cos(45^\circ)(-\hat{i}) + \frac{\mu_0 I}{2\pi r}\sin(45^\circ)(-\hat{j})$$

$$\cos(45^\circ) = \frac{\sqrt{2}}{2}$$

$$\vec{B}_T = 4\vec{B}_1 \cdot \hat{i}$$

$$= -4\frac{\mu_0 I}{2\pi r}\cos(45^\circ)\hat{i}$$

$$\sqrt{\frac{d^2}{4} + \frac{d^2}{4}} = r$$

$$\sqrt{\frac{2d^2}{4}} = \frac{\sqrt{2}}{2}d = r$$

$$= \frac{4\mu_0 I}{2\pi\left(\frac{\sqrt{2}}{2}d\right)} \cdot \frac{\sqrt{2}}{2} = \frac{-2\mu_0 I}{\pi d}\hat{i}$$

$$\vec{B} = \frac{-2\mu_0 I}{\pi d}\hat{i}$$