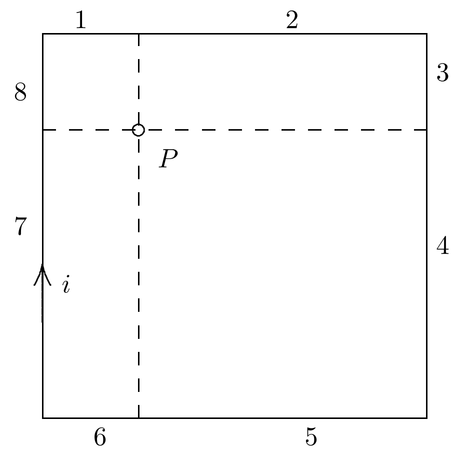
20. The two small wire-segments, each of length $a/4$, shown in Fig. 30-39 nearest to point P, are labeled 1 and 8 in the figure below.



Let $\vec{e}$ be a unit vector pointing into the page. We use the results of problems 13 and 16 to calculate B_{P1} through B_{P8}:

$$\begin{aligned}
B_{P1} &= B_{P8} = \frac{\sqrt{2}\mu_0 i}{8\pi(a/4)} = \frac{\sqrt{2}\mu_0 i}{2\pi a} \,, \\
B_{P4} &= B_{P5} = \frac{\sqrt{2}\mu_0 i}{8\pi(3a/4)} = \frac{\sqrt{2}\mu_0 i}{6\pi a} \,, \\
B_{P2} &= B_{P7} = \frac{\mu_0 i}{4\pi(a/4)} \cdot \frac{3a/4}{[(3a/4)^2 + (a/4)^2]^{1/2}} = \frac{3\mu_0 i}{\sqrt{10}\pi a} \,,
\end{aligned}$$

and

$$B_{P3} = B_{P6} = \frac{\mu_0 i}{4\pi(3a/4)} \cdot \frac{a/4}{[(a/4)^2 + (3a/4)^2]^{1/2}} = \frac{\mu_0 i}{3\sqrt{10}\pi a} \,.$$

Finally,

$$\begin{aligned}
\vec{B}_P &= \sum_{n=1}^{8} B_{Pn}\vec{e} \\
&= 2\,\frac{\mu_0 i}{\pi a}\left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{6} + \frac{3}{\sqrt{10}} + \frac{1}{3\sqrt{10}}\right)\vec{e} \\
&= \frac{2(4\pi \times 10^{-7}\,\mathrm{T{\cdot}m/A})(10\,\mathrm{A})}{\pi(8.0 \times 10^{-2}\,\mathrm{m})}\left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{6} + \frac{3}{\sqrt{10}} + \frac{1}{3\sqrt{10}}\right)\vec{e} \\
&= (2.0 \times 10^{-4}\,\mathrm{T})\,\vec{e} \,,
\end{aligned}$$

where $\vec{e}$ is a unit vector pointing into the page.