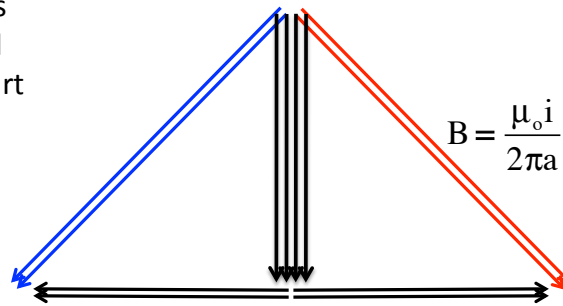
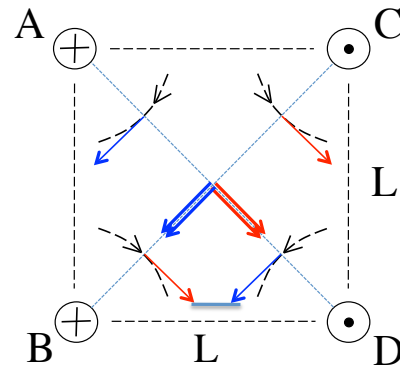


### Problem 30.32

I'm not sure why they've asked for the magnitude first, because if we know the net direction, determining the net magnitude may be easier than expected. As such, I'm doing Part b first.

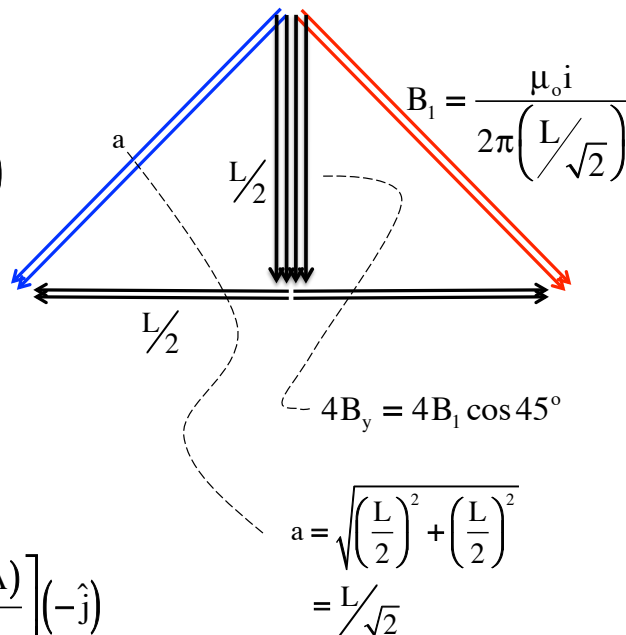
b.) Using the right thumb rule, the sense of the circulation of the B-flds generated by the currents is shown on the first sketch. As the horizontal components add to zero, all we need is the vertical components . . . and the answer to Part b is "downward."



1.)

a.) magnitude?

$$\begin{aligned}
 \vec{B}_{\text{net}} &= 4B_y(-\hat{j}) \\
 &= 4 \left[ \frac{\mu_0 i}{2\pi \left(\frac{L}{\sqrt{2}}\right)} \cos 45^\circ \right] (-\hat{j}) \\
 &= \left[ \frac{4\mu_0 i}{2\pi \left(\frac{L}{\sqrt{2}}\right)} \left(\frac{1}{\sqrt{2}}\right) \right] (-\hat{j}) \\
 &= \left[ \frac{2\mu_0 i}{\pi L} \right] (-\hat{j}) \\
 &= \left[ \frac{2(4\pi \times 10^{-7} \text{ T} \cdot \text{m} / \text{A})(5 \text{ A})}{\pi(0.2 \text{ m})} \right] (-\hat{j}) \\
 &= (20 \times 10^{-6} \text{ T})(-\hat{j})
 \end{aligned}$$



2.)