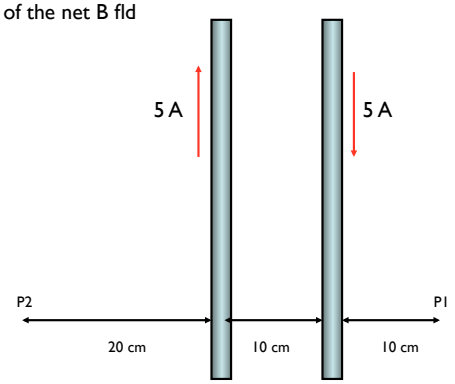
Problem 19.48

Examine the system of current carrying wires shown.

a.) What's the direction and magnitude of the net B fld between the two wires?



1.

a.) What's the direction and magnitude of the net B fld between the two wires?

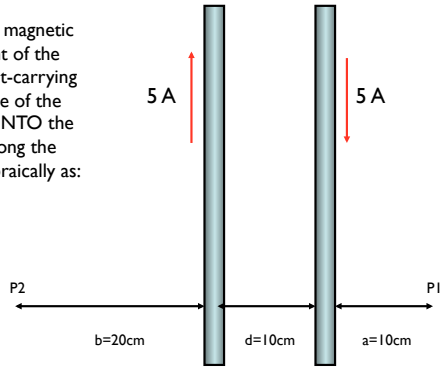
The left current-carrying wire will produce a magnetic field in the plane of the paper and to the right of the wire that is INTO the page. The right current-carrying wire will produce a magnetic field in the plane of the paper and to the left of the wire that is also INTO the page. Because the two magnetic fields are along the same line, their sum can be determined algebraically as:

$$B_{net} = -B_{leftwire} - B_{rightwire}$$

$$= -\left(\frac{\mu_o i}{2\pi\left(d/2\right)}\right) - \left(\frac{\mu_o i}{2\pi\left(d/2\right)}\right)$$

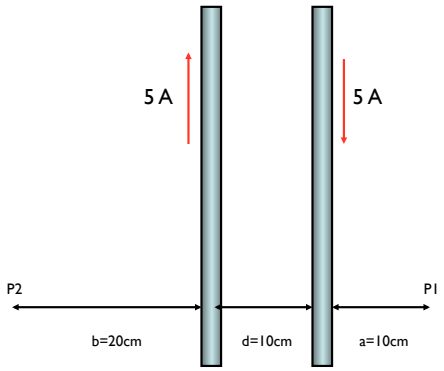
$$= -\left(\frac{\left(4\pi x10^{-7}\right)(5)}{2\pi\left(.1/2\right)}\right) - \left(\frac{\left(4\pi x10^{-7}\right)(5)}{2\pi\left(.1/2\right)}\right)$$

$$= -4x10^{-5}\ T$$



2.

b.) What's the direction and magnitude of the net B fld at point P1?



3.

b.) What's the direction and magnitude of the net B fld at point P1?

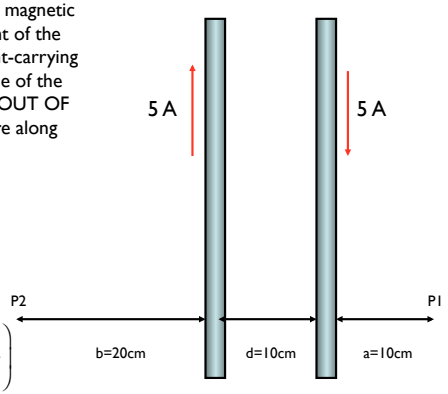
The left current-carrying wire will produce a magnetic field in the plane of the paper and to the right of the wire that is INTO the page. The right current-carrying wire will produce a magnetic field in the plane of the paper and to the left of the wire that is also OUT OF the page. Because the two magnetic fields are along the same line, their sum can be determined algebraically as:

$$B_{net} = -B_{leftwire} + B_{rightwire}$$

$$= -\left(\frac{\mu_o i}{2\pi\left(d+a\right)}\right) + \left(\frac{\mu_o i}{2\pi\left(a\right)}\right)$$

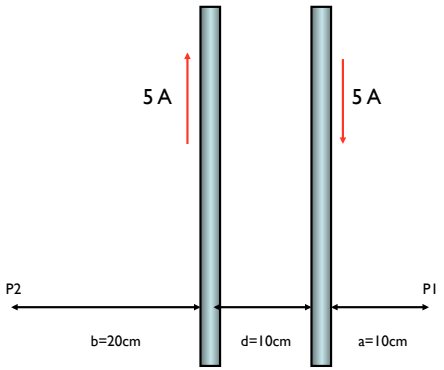
$$= -\left(\frac{\left(4\pi x10^{-7}\right)(5)}{2\pi\left(.2\right)}\right) + \left(\frac{\left(4\pi x10^{-7}\right)(5)}{2\pi\left(.1\right)}\right)$$

$$= -5x10^{-6}\ T$$



4.

c.) What's the direction and magnitude of the net B fld at point P2?



c.) What's the direction and magnitude of the net B fld at point P2?

The left current-carrying wire will produce a magnetic field in the plane of the paper and to the right of the wire that is OUT OF the page. The right current-carrying wire will produce a magnetic field in the plane of the paper and to the left of the wire that is also INTO the page. Because the two magnetic fields are along the same line, their sum can be determined algebraically as:

$$B_{net} = B_{leftwire} - B_{rightwire}$$

$$= \left(\frac{\mu_o i}{2\pi(b)}\right) - \left(\frac{\mu_o i}{2\pi(d+b)}\right)$$

$$= \left(\frac{(4\pi x10^{-7})(5)}{2\pi(.2)}\right) - \left(\frac{(4\pi x10^{-7})(5)}{2\pi(.3)}\right)$$

$$= -1.67^{-6}\ T$$