Factors affecting Magnetic Field Strength around a straight conductor

The magnetic field around a straight conductor will be determined by:
(i) current (I)
(ii) magnetic permeability (μ)
(iii) perpendicular distance away from wire (r)

Mathematically this is called Biot's Law

$$B = \frac{\mu_o I}{2\pi r}$$

B: Magnetic field Strength in Tesla (T)
μ: magnetic permeability ($4\pi \times 10^{-7}\ T \cdot \frac{m}{A}$)
I: current in Amperes (A)
r: perpendicular distance away from straight conductor in meters (m)

If you read 643-644 do not despair, we are only dealing with the simplified version of Biot Law as found on the bottom of 644, and only for straight conductors.

Assign read 639 - 641
do p. 663 #17, 18, 22
Assign Homework Set #10 Biot's Law

P. 663 #17

$I = 12.5\,A$

$B = 3.1 \times 10^{-5}\,T$

$r = ?$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$3.1 \times 10^{-5} = \frac{(4\pi \times 10^{-7})\,12.5}{2\pi r}$$

$$3.1 \times 10^{-5} r = (2 \times 10^{-7})(12.5)$$

$$r = 0.08\ m$$

18. $r = 12\,m$

$I = 4.5 \times 10^{3}\,A$

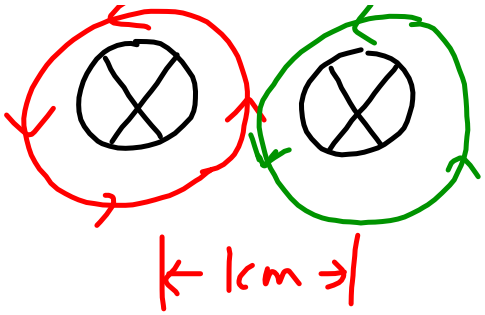
$B = ?$

$$B = \frac{\mu I}{2\pi r}$$

$$B = \frac{(4\pi \times 10^{-7})(4.5 \times 10^{3})}{2\pi (12)}$$

$$B = 0.000075\,T$$

22.

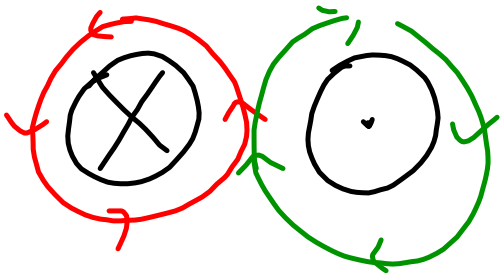


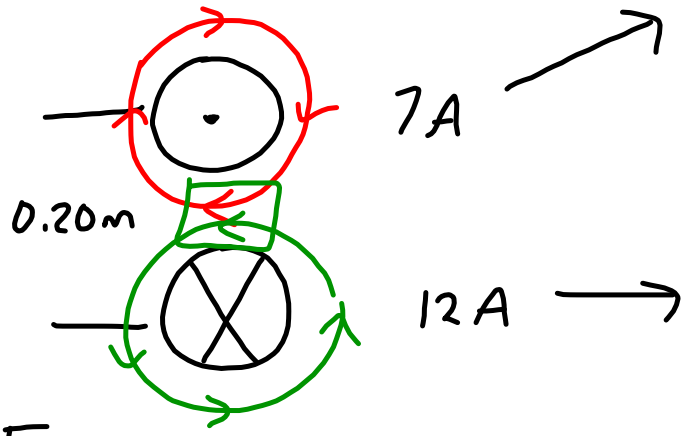
I=10A
in both

What is B at the midpoint between the wires?

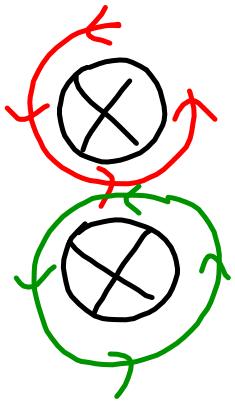
(a) same size B
same dir.I

b)





Find the mag. field strength at the mid-point.



$(1.0\times10^{-5}\ T\ LL)$