Q- Two long parallel conductors, separated by 10.0 cm, carry currents in the same direction. The first wire carries current I_1 = 5.00A and the second one carries I_2 = 8.00A.
a) What is the magnitude of the magnetic field created by I_1 at the location of I_2?

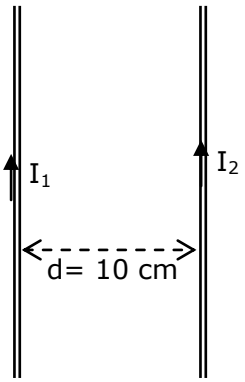
The magnitude of magnetic field at distance d from an infinitely long straight wire carrying a current I is given by

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

Hence the field at the wire carrying current I_2 due to current in wire I_1 will be

$$B_{21} = 2*10^{-7} * \frac{5.00}{0.1} = 1*10^{-5} T$$

The direction of the field with right hand rule will be into the paper.



b) What is the force per unit length exerted by I_1 on I_2?

The force on the wire carrying current I in an external magnetic field B perpendicular to the wire is given by

F = BI L

Hence the current per unit length will be

F/L = B*I

Hence the force per unit length on wire 2 due to the magnetic field of current in wire 1 will be

$(F/L)_{21} = B_{21}*I_2 = (1*10^{-5})*8.00 = 8*10^{-5}$ N/m.

The direction of the force according to Fleming's left hand rule will be towards the first wire.

c) What is the magnitude of the magnetic field created by I_2 at the location of I_1?

As $$B = \frac{\mu_0 I}{2\pi d}$$

Hence the field at the wire carrying current I_1 due to current in wire I_2 will be

$$B_{12} = 2*10^{-7} * \frac{8.00}{0.1} = 1.6*10^{-5} T$$

The direction of the field with right hand rule will be out of the paper.

d) What is the force per unit length exerted by I_2 on I_1?

as F/L = B*I

The force per unit length on wire 1 due to the magnetic field of current in wire 2 will be

$(F/L)_{12} = B_{12}*I_1 = (1.6*10^{-5})*5.00 = 8*10^{-5}$ N/m

The direction of the force according to Fleming's left hand rule will be towards the second wire.