Answer on Question #74649, Physics / Electromagnetism

Two parallel long wire carry i1 and i2 with i1 > i2 . When the current are in the same direction, the magnetic field at a point midway between the wires is 10 micro T. If the direction of i2 is reversed, the field becomes 30 microT. The ratio of i1/i2 is (1)4. (2)3 (3)2. (4)1.

Answer:

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

Magnetic field due to the two current carrying wire in the same direction

$$B_{net} = B_1 - B_2$$

Where

$$B_1 = \frac{\mu_0 i_1}{2\pi d}$$

and

$$B_2 = \frac{\mu_0 i_2}{2\pi d}$$

So

$$B_{net} = \frac{\mu_0 i_1}{2\pi d} - \frac{\mu_0 i_2}{2\pi d}$$

or

$$10 = \frac{\mu_0}{2\pi d}(i_1 - i_2) \dots\dots..(1)$$

Magnetic field due to the two current carrying wire in the in the direction of i2 is reversed

$$B_{net} = B_1 + B_2$$

$$B_{net} = \frac{\mu_0 i_1}{2\pi d} + \frac{\mu_0 i_2}{2\pi d}$$

or

$$30 = \frac{\mu_0}{2\pi d}(i_1 + i_2) \dots\dots…..(2)$$

Dividing 1 by 2. We have

$$\frac{1}{3} = \frac{(i_1 - i_2)}{(i_1 + i_2)}$$

$$(i_1 + i_2) = 3(i_1 - i_2)$$

Finally, we get

$$2i_1 = 4i_2$$

$$\frac{i_1}{i_2} = \frac{4}{2} = 2$$

Answer: 2