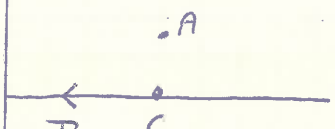
Practice Problems

a) 

Find magnitude and direction of B at Point A. The radius is D/2.

$$B = \frac{\mu_0 I}{2\, D/2} = \frac{\mu_0 I}{D}$$

b) 

Find B at Point A, after wire loop is straightened but still has same current I.

$$\frac{\mu_0 I\, 2a}{4\pi \times \sqrt{x^2+a^2}^3}$$

where wire length $= 2a = \pi D$

Eqn 28.8

c) Compare the B field strength for cases a) & b)

$$\frac{\mu_0 I/D}{\mu_0 I/D\sqrt{1+\pi^2}} = \sqrt{1+\pi^2}$$

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q_1 • → v_1

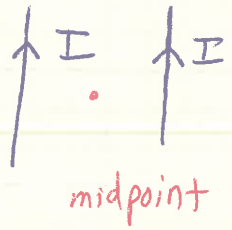
← • $q_2 = -2q_1$

$v_2 = 2v_1$

a) How many forces on #1? 3

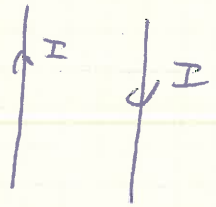
b) B direction at #1? ⊙

c) F_B on #1? ↓



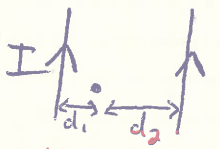
where is B=0?

midpoint



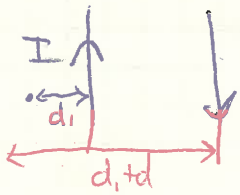
where is B=0?

nowhere



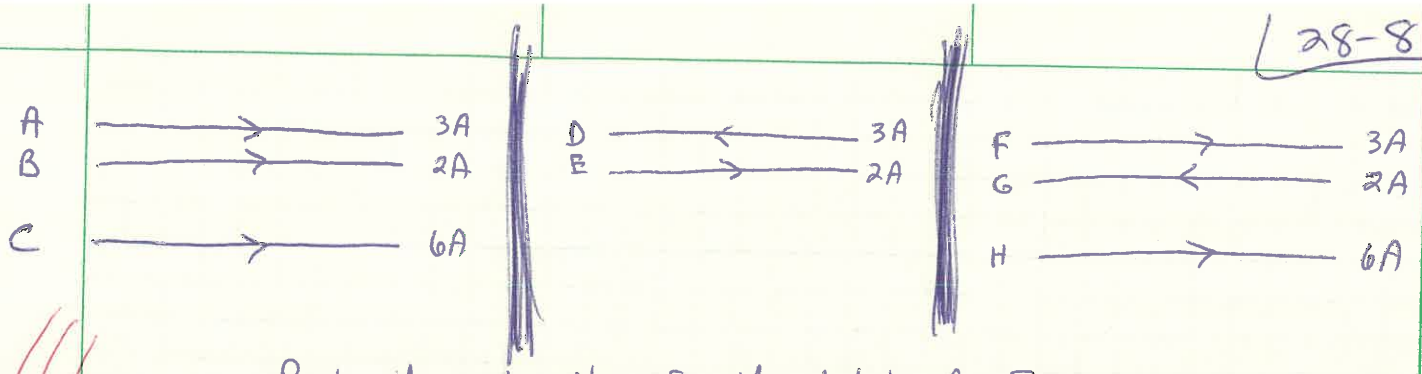
where is B=0?

$$\frac{\mu_0 I}{2\pi d_1} = \frac{\mu_0 2I}{2\pi d_2} \Rightarrow d_1 = \frac{1}{2} d_2$$

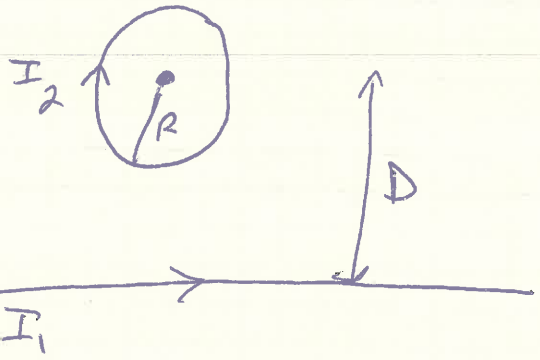


$$\frac{\mu_0 I}{2\pi d_1} = \frac{\mu_0 2I}{2\pi (d_1+d)}$$

$\rightarrow d_1 = d$



Rank the strength of the total B force on each wire.



What is magnitude and direction of I_1 if B at center of loop is zero?

$$\frac{\mu_0 I_2}{2R} = \frac{\mu_0 I_1}{2\pi D} \rightarrow I_1 = I_2 \frac{\pi D}{R}$$

$B_A: \frac{2}{1} + \frac{6}{3} = 4$

$B_B: \frac{-3}{1} + \frac{6}{2} = 0$

$B_C: \frac{-3}{3} + \frac{-2}{2} = -2$

$B_D: \frac{2}{1} = 2$

$B_E: \frac{3}{1} = 3$

$B_F: \frac{-2}{1} + \frac{6}{3} = 0$

$B_G: \frac{-3}{1} + \frac{6}{2} = 0$

$B_H: \frac{-3}{3} + \frac{2}{2} = 0$

$F_A: 3.4 = 12\,(-\hat{j})$

$F_B: 2.0 = 0$

$F_C: 6.2 = 12\,(+\hat{j})$

$F_D: 3.2 = 6\,(+\hat{j})$

$F_E: 3.2 = 6\,(-\hat{j})$

$F_F: 0.3 = 0$

$F_G: 2.0 = 0$

$F_H: 0.6 = 0$

$$\Rightarrow |F_A| = |F_C| > |F_D| = |F_E| > |F_B| = |F_F| = |F_G| = |F_H|$$