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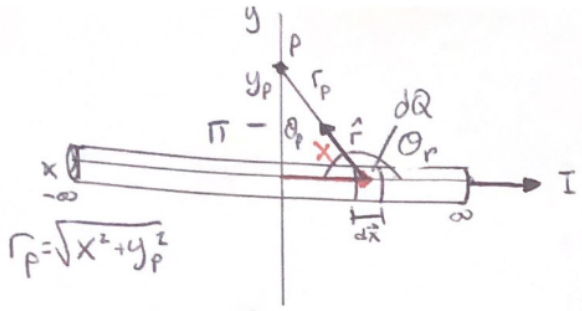
PH213

HIP 7

a. Use the Biot-Savart Law to calculate the magnetic field a distance r away from a long current carrying wire.



Since $d\vec{x}$ and $\hat{r}$ are always on the xy-plane we know that their cross product will be along the z-axis. we can rewrite $d\vec{x} \times \hat{r}$ as $(dx)(1)\sin\theta_P$

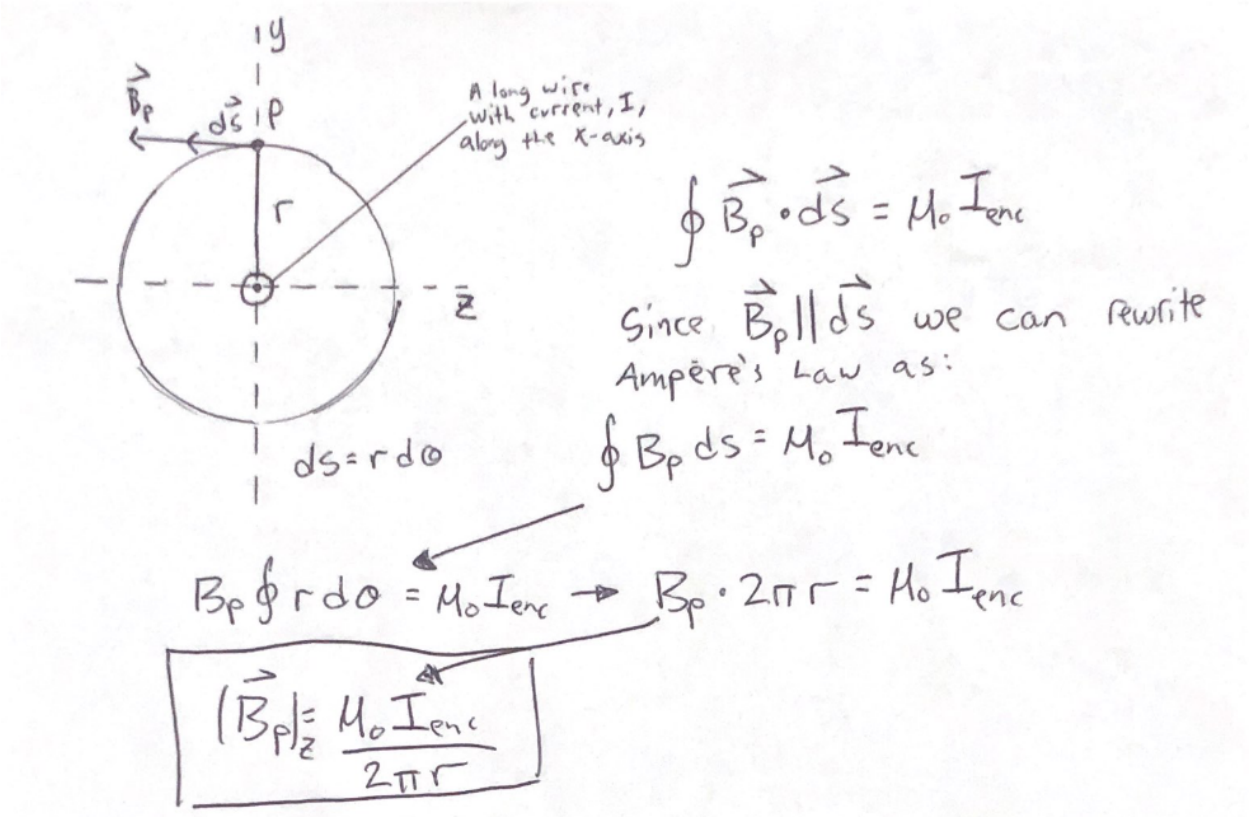
$$(\vec{B}_P)_z = \int_{-\infty}^{\infty} \frac{\mu_0}{4\pi} \cdot \frac{I\,dx\sin\theta_P}{r_P^2} \rightarrow \int_{-\infty}^{\infty} \frac{\mu_0}{4\pi} \cdot \frac{I\sin\theta_P}{x^2 + y_P^2}\,dx$$

$$\sin\theta_P = \sin(\pi - \theta_P) = \frac{y}{r_P} = \frac{y}{\sqrt{x^2 + y_P^2}}$$

$$(\vec{B}_P)_z = \int_{-\infty}^{\infty} \frac{\mu_0}{4\pi} \cdot \frac{Iy}{(x^2 + y_P^2)^{3/2}}\,dx \rightarrow (\vec{B}_P)_z = \frac{\mu_0 I y}{4\pi} \int_{-\infty}^{\infty} \frac{dx}{(x^2 + y_P^2)^{3/2}}$$

$$(\vec{B}_P)_z = \frac{\mu_0 I y}{4\pi} \cdot \left(\frac{x}{y_P^2 (x^2 + y_P^2)^{1/2}} \right|_{-\infty}^{\infty} \rightarrow \boxed{(\vec{B}_P)_z = \frac{\mu_0 I}{2\pi y_P}}$$

b. Use Ampere's Law to calculate the magnetic field a distance r away from a long current carrying wire.



We see that if $r = y_p$ and $I = I_{enc}$ then our equation for the magnetic field from a current carrying wire is corroborated by both Biot-Savart's Law and Ampere's Law.

GORY	PLARY (1.5)	MPLISHED (1)	LOPING (0.5)	GENT (0)
Statement and tion	arning tool for our class is written	blem is clearly presented for reader in n words.	blem is directly copied or is hard .	p into some calculation
	tch could be dropped into a novel as it stands.	a clear sketch, larger than a credit the problem set up with important and data noted	some sketch of the problem	etch?
s Tools	iate physics tools are correlated xercise in textbook quality and	iate physics tools are correlated to the . Appropriate tools include: pictures, onservational laws utilized, etc…	hysics tools are correlated to the .	e a few equations written.
m Solution tation	is very clearly presented with g asides or annotations	is complete and clearly presented no significant intuitive demands on the	olution I have to read between	es version of solution with only nts present
	ution can serve as solution	g is larger than a credit card, tion is fluid, notation used is clear.	gure the path of your solution with	read it.
		correctly given	ions & quantities are presented s	nits at the results
n			close	t reasonable
ant Figures		Sig Figs	ffort to use correct significant	he number from the calculator
nableness	more than one type of ableness check.	e clear rationale for appropriateness of tion in the setting	that the answer is reasonable but sn't given any evidence	ssion
Graded			e	ut your self-assessment is from mine by at least two steps.