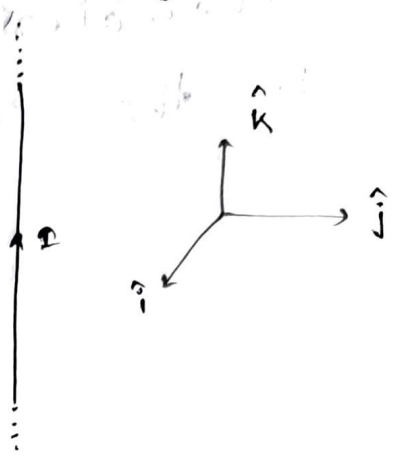
ASSIGNMENT-II

1. let us take our wire oriented along +ve $\hat{z}$ axis, so the equation becomes:

$x=0$ & $y=0$



2. "attached to this pdf."

3. say I ~~that~~ want to calculate B-field at P.(1, 0, 0)

4. now the biot-savart law:

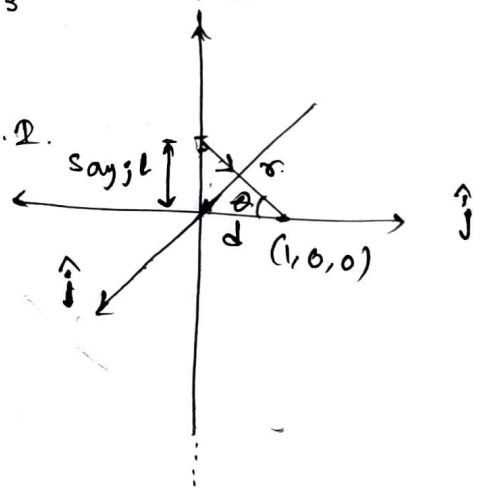
$$\vec{dB}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{\vec{dl} \times \vec{r}}{|\vec{r}|^3} \quad \text{--- I.}$$

$\hat{k}$ also wire's direct

$$\vec{dB}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{dl(\sin\theta + \hat{r}_2)}{r^2} \quad \text{--- I.}$$

$$\vec{dB}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{dl\cos\theta}{r^2} \quad \text{--- I.}$$

--- (III)



Since $\cos\theta = \frac{l}{r}$

$\Rightarrow r\cos\theta = l$

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or $\tan\theta = \frac{l}{d}$; $r^2 = l^2 + d^2$. --- (I)

$\Rightarrow d\sec^2\theta\, d\theta = dl$ --- (II)

again $r = \frac{d}{\cos\theta}$ --- (IV)

substituting (ii) & (iv) into (iii) ⇒

$$d\vec{B}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{d \sec^2\theta \cdot \cos\theta \cdot d\theta}{d^2/\cos^2\theta} \cdot I.$$

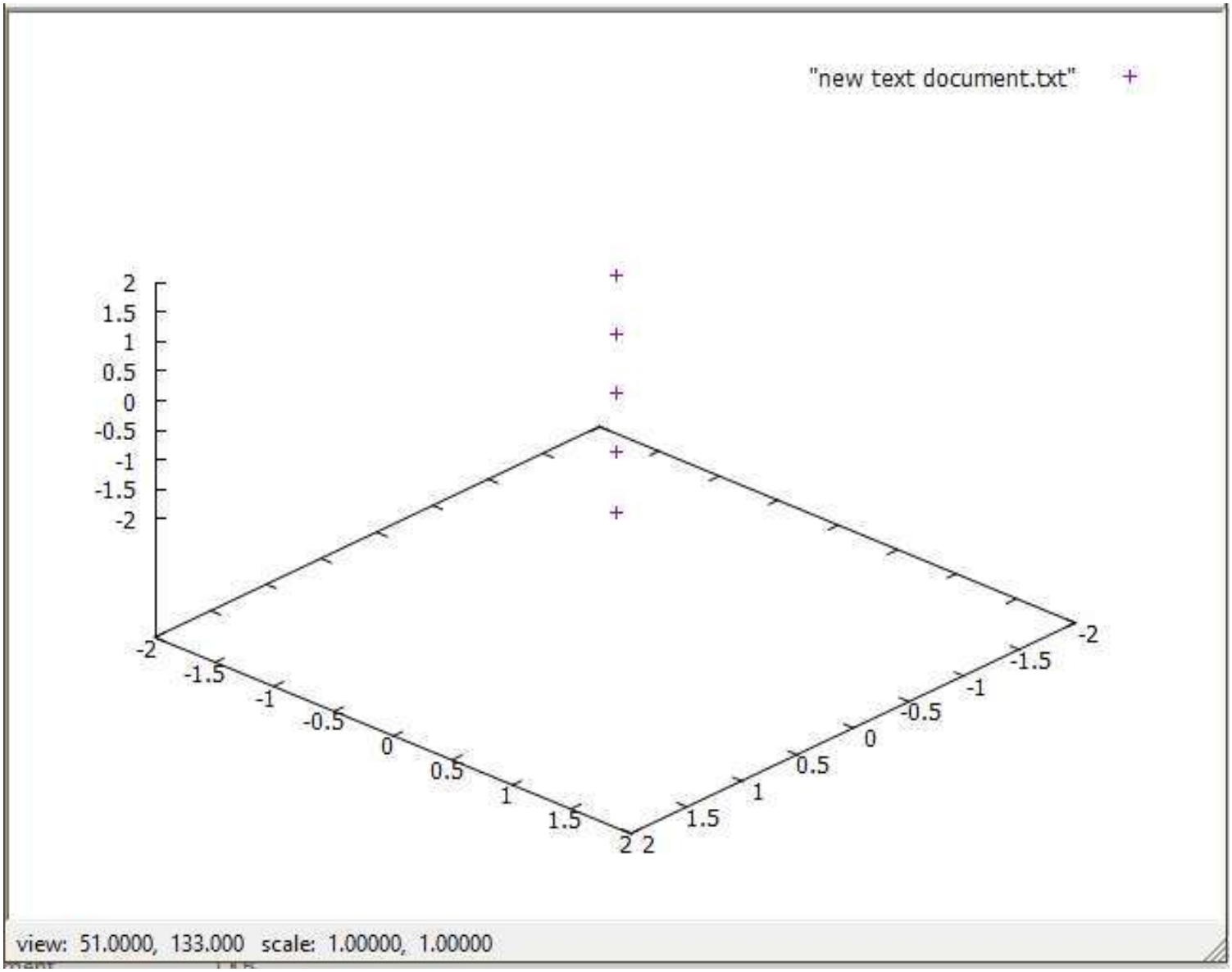
$$= \frac{\mu_0}{4\pi} \int_{-\pi/2}^{\pi/2} \frac{\cos\theta \, d\theta}{d} \cdot I.$$

$$= \frac{\mu_0}{4\pi d} \left[\sin\theta\right]_{-\pi/2}^{\pi/2} \cdot I.$$

$$= \frac{\mu_0}{4\pi d} \cdot 2. = \frac{\mu_0}{4\pi \cdot 1} \cdot 2I.$$

$[\because d = 1]$.

$\therefore B = \frac{\mu_0}{4\pi} \cdot 2I.$ Answer.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1.5
1
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