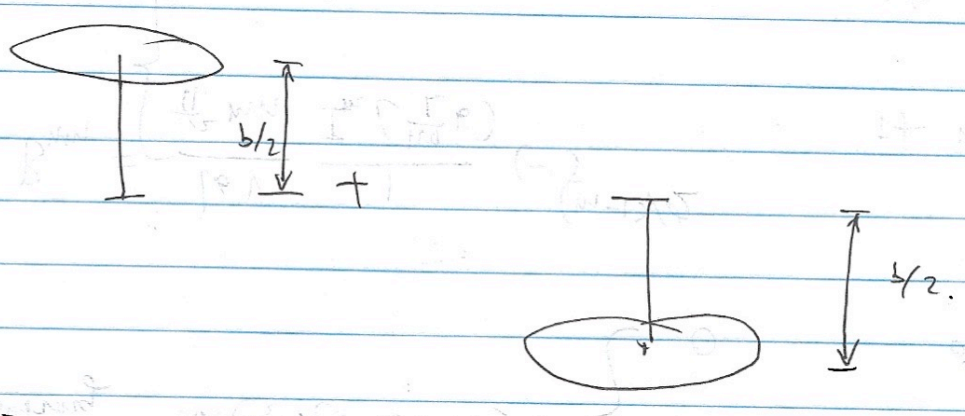
Jackson 5.7 (b)

① The magnetic induction is identical to that produced by 2 current loops



$$\Rightarrow \vec{B} = 2 \times \frac{\mu_0 I}{2} \frac{a^2}{(a^2 + (\frac{b}{2})^2)^{3/2}} \hat{z}$$

$$= \boxed{\frac{\mu_0 I}{} \frac{a^2}{(a^2 + \frac{b^2}{4})^{3/2}} \hat{z}}$$

$$\vec{B} = \cancel{2} \frac{\mu_0 I}{2} \left[\frac{a^2}{\left[a^2 + (\frac{b}{2} - z)^2\right]^{3/2}} + \frac{a^2}{\left[a^2 + (\frac{b}{2} + z)^2\right]^{3/2}} \right]$$

$$= \boxed{\frac{\mu_0 I a^2}{2} \left[\left[a^2 + (\frac{b}{2} - z)^2\right]^{-3/2} + \left[a^2 + (\frac{b}{2} + z)^2\right]^{-3/2} \right]}$$

Judson 5.7(b) ②

expanding $\left[a^2+\left(\frac{b}{2}-z\right)^2\right]^{-3/2}$ and

$\left[a^2+\left(\frac{b}{2}+z\right)^2\right]^{-3/2}$.

$\frac{d}{dz} = -\frac{3}{2}\left[a^2+\left(\frac{b}{2}-z\right)^2\right]^{-5/2}(2)\left(\frac{b}{2}-z\right)(-1)$

$\frac{d}{dz} = -\frac{3}{2}\left[a^2+\left(\frac{b}{2}+z\right)^2\right]^{-5/2}(2)\left(\frac{b}{2}+z\right)$

Cancel each other.

$= \frac{3}{2}\, 3\left[a^2+\left(\frac{b}{2}-z\right)^2\right]^{-5/2}\left(\frac{b}{2}-z\right)$

$- 3\left[a^2+\left(\frac{b}{2}-z\right)^2\right]^{-5/2}\left(\frac{b}{2}+z\right)$