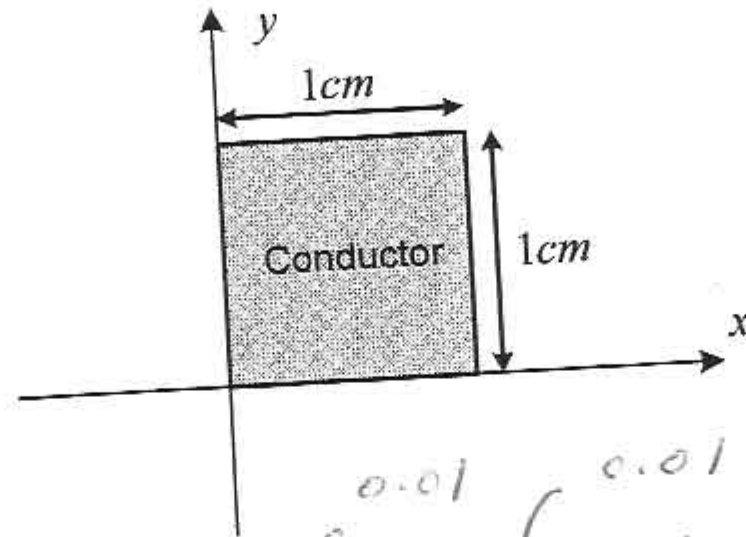


Name:

I.D. Number:

KEY

Consider an infinitely long conductor with a *square* cross-sectional area, 1 [cm] on the side (see figure). The conductor carries electric current with density $\vec{J} = 10^6 x^2 y \vec{a}_z$ [A/m²]. Calculate the current I (in Amperes) which flows through the conductor.



$$I = \int_S \vec{J} \cdot d\vec{s} = \int_0^{0.01} \int_0^{0.01} 10^6 xy \vec{a}_z \cdot dx dy \vec{a}_z$$

$$= 10^6 \left(\frac{x^3}{3} \Big|_0^{0.01} \right) \left(\frac{y^2}{2} \Big|_0^{0.01} \right) = \frac{10^{-4}}{6} \text{ A}$$

$$= 16.7 \mu\text{A}$$