

★ 共五大題，每大題各佔20分。
★ 請詳列或敘述計算過程，否則不予計分。

1. Find the electric field a distance z above the center of a circular flat disc of radius R (See Fig. 1), which carries a uniform surface charge σ . What does your formula give in the limit $R \rightarrow \infty$?

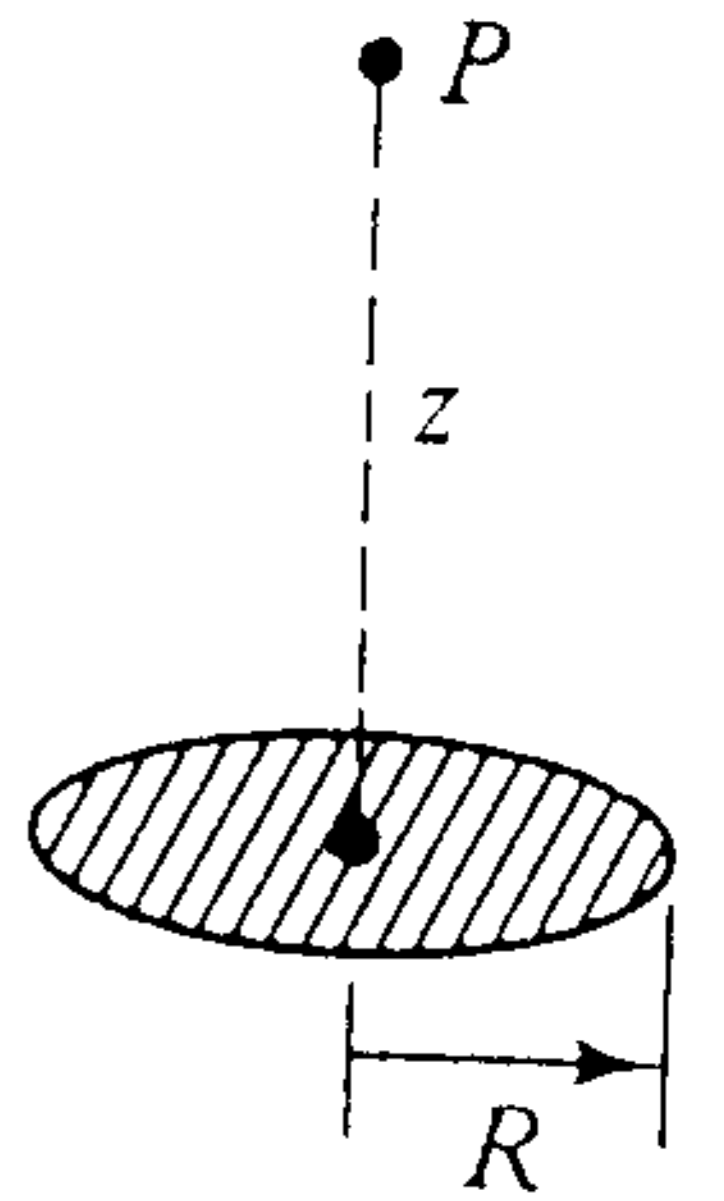


Fig. 1

2. Suppose the electric potential is given by the expression $V(\vec{r}) = Ae^{-\lambda r}/r$, for all r (A and λ are constants). Find: (a) the electric field $\vec{E}(\vec{r})$, (b) the charge density $\rho(\vec{r})$, and (c) the total charge Q .

3. A short solenoid (length l_1 , and radius R_1 , N_1 turns per unit length) lies on the axis of a very long solenoid (length l_2 and radius R_2 , N_2 turns per unit length) as shown in Fig 2, where $l_1 \ll l_2$. Current I flows in the short solenoid. What is the magnetic flux Φ through the long solenoid?

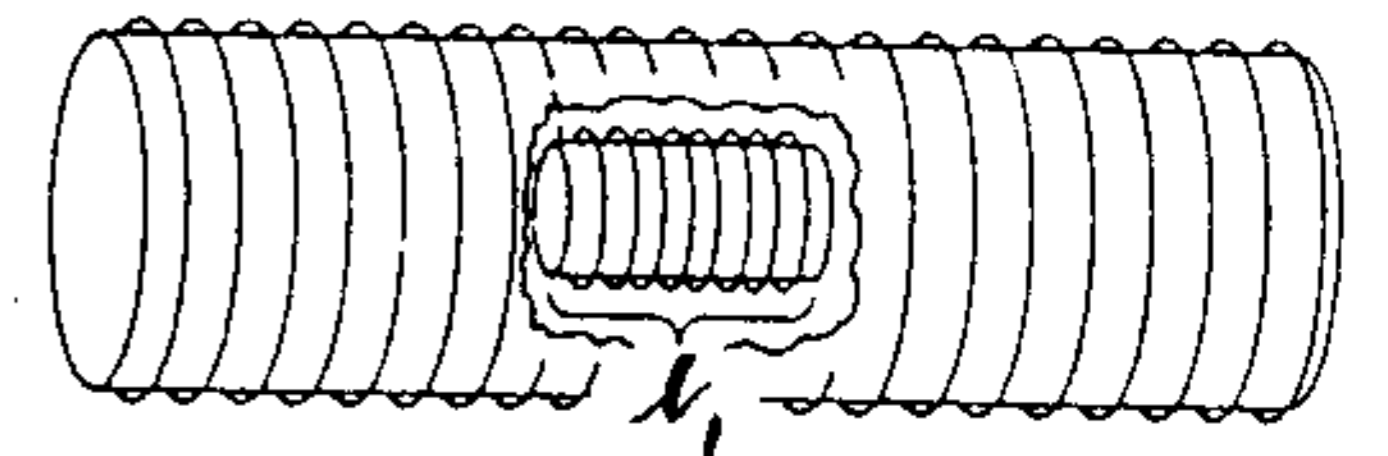


Fig. 2

4. (See Fig 3) Find the magnetic field \vec{B} a distance z above a very long straight wire carrying a steady current I , by using (a) the Biot-Savart law and (b) the Ampere's law (in integral version).

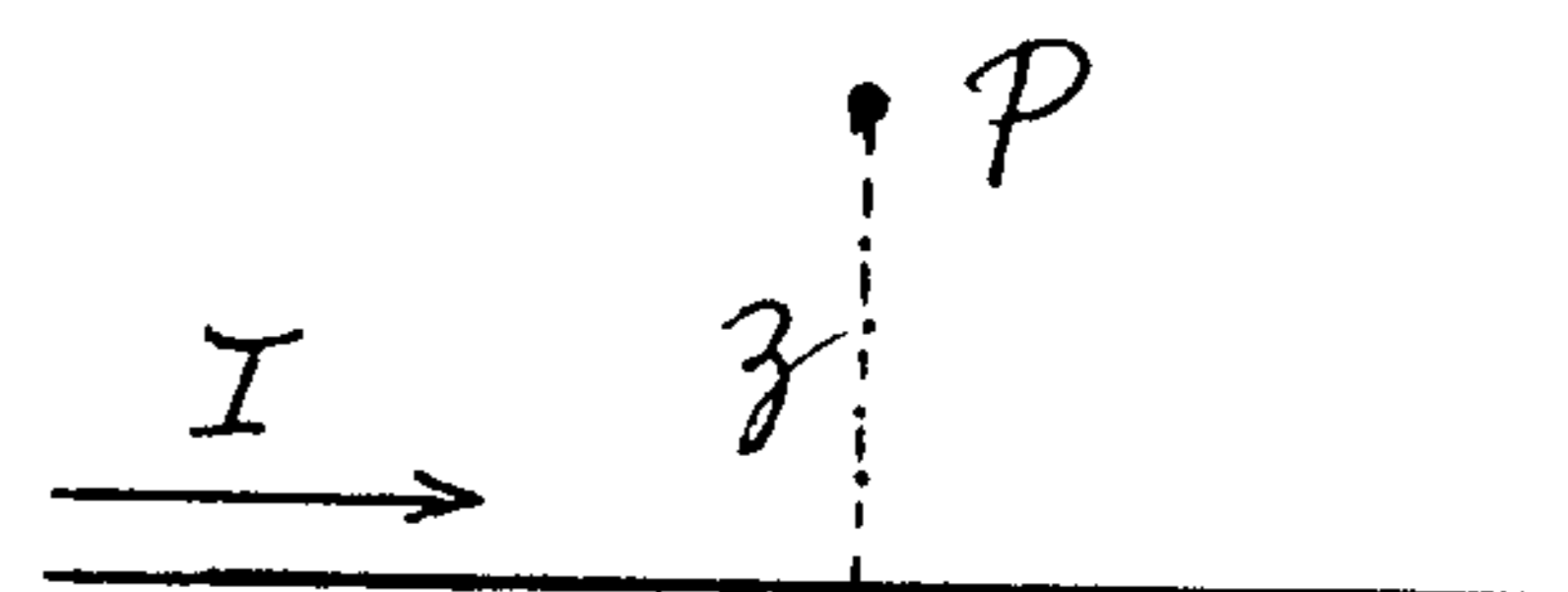


Fig. 3

5. A point charge q and mass m is released from rest at a distance d from an infinite grounded conducting plane. How long will it take for the charge to hit the plane?