

淡江大學 97 學年度碩士班招生考試試題

系列：物理學系

科目：電 磁 學

本試題共 1 頁，4 大題

※ 請詳細列出各步驟及計算過程,否則不予計分.

※ 每題 25 分

1. A straight-line segment carries a uniform line charge density λ , as shown in Fig. 1.
 - (a) Find the electric field at P, a distance s above the line.
 - (b) What is the field at P for the straight-line extended to infinite?

2. A point charge q is held a distance d above an infinite grounded conducting plane, (x - y plane at $z = 0$) as shown in Fig. 2.
 - (a) What are boundary conditions for the potential V in the region above the plane ($z \geq 0$)?
 - (b) Find the potential $V(x,y,z)$ in the region above the plane, $z \geq 0$, and prove that it satisfy the boundary conditions.

3. A square loop of wire, with side a , lies in the x - y plane, centered at the origin, and carries a steady current I running counterclockwise as viewed from the positive z axis.
 - (a) Find the magnetic field at the center of the square loop.
 - (b) What is the magnetic dipole moment of the loop?
 - (c) What is the approximate magnetic field and vector potential at point $(x, 0, 0)$ for $x \gg a$.

4. A square loop of wire, of side a , lies midway of a very long rectangular loop of side $3a$. (Actually, the short ends are so far away that they can be neglected.) A counterclockwise current I in the square loop is gradually increasing $dI/dt = k$ (a constant), as shown in Fig. 3.
 - (a) What is the flux through the long rectangular loop?
 - (b) Find the mutual inductances.
 - (c) Find the emf induced in the large loop. Which way will the induced current flow?

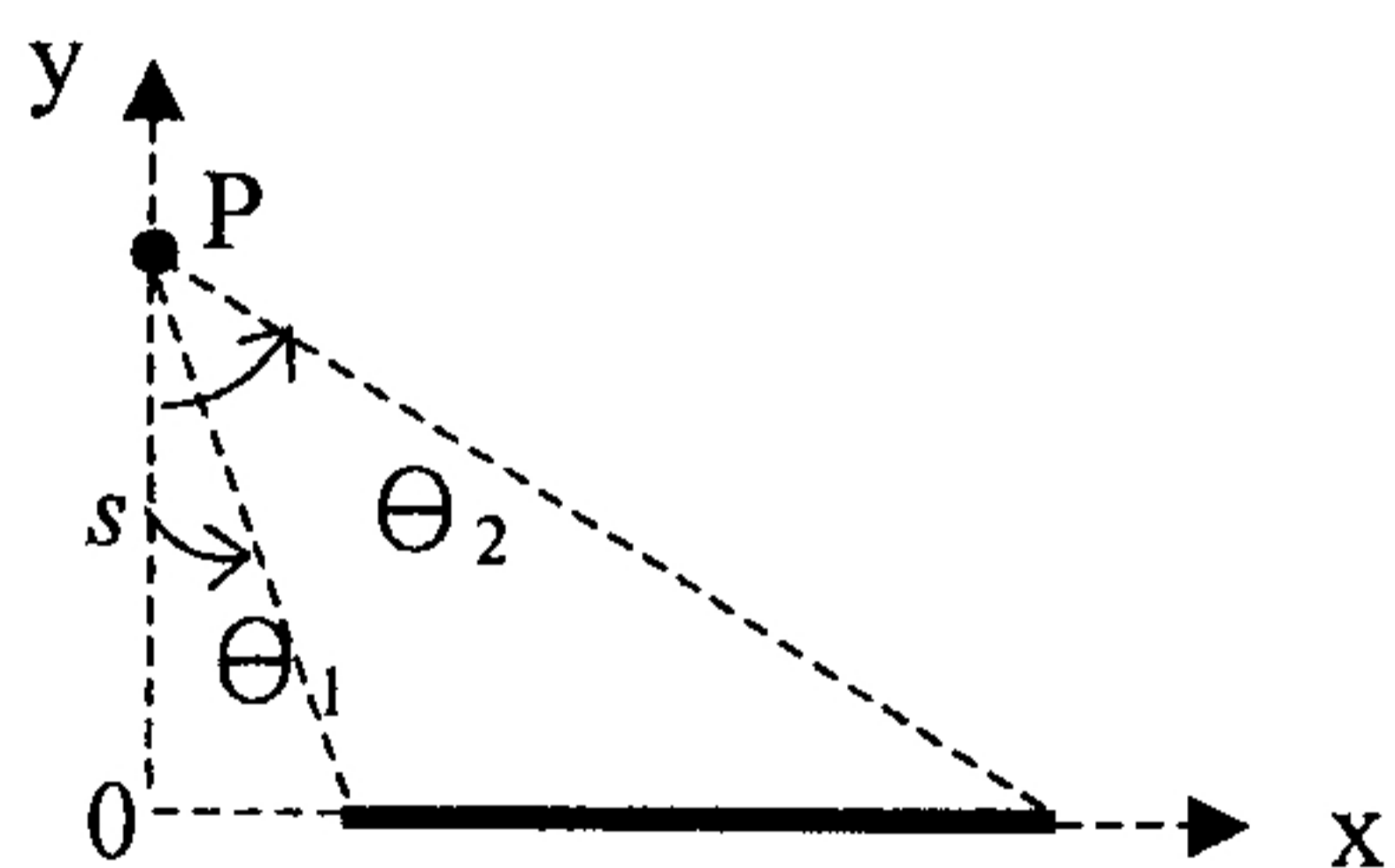


Fig. 1

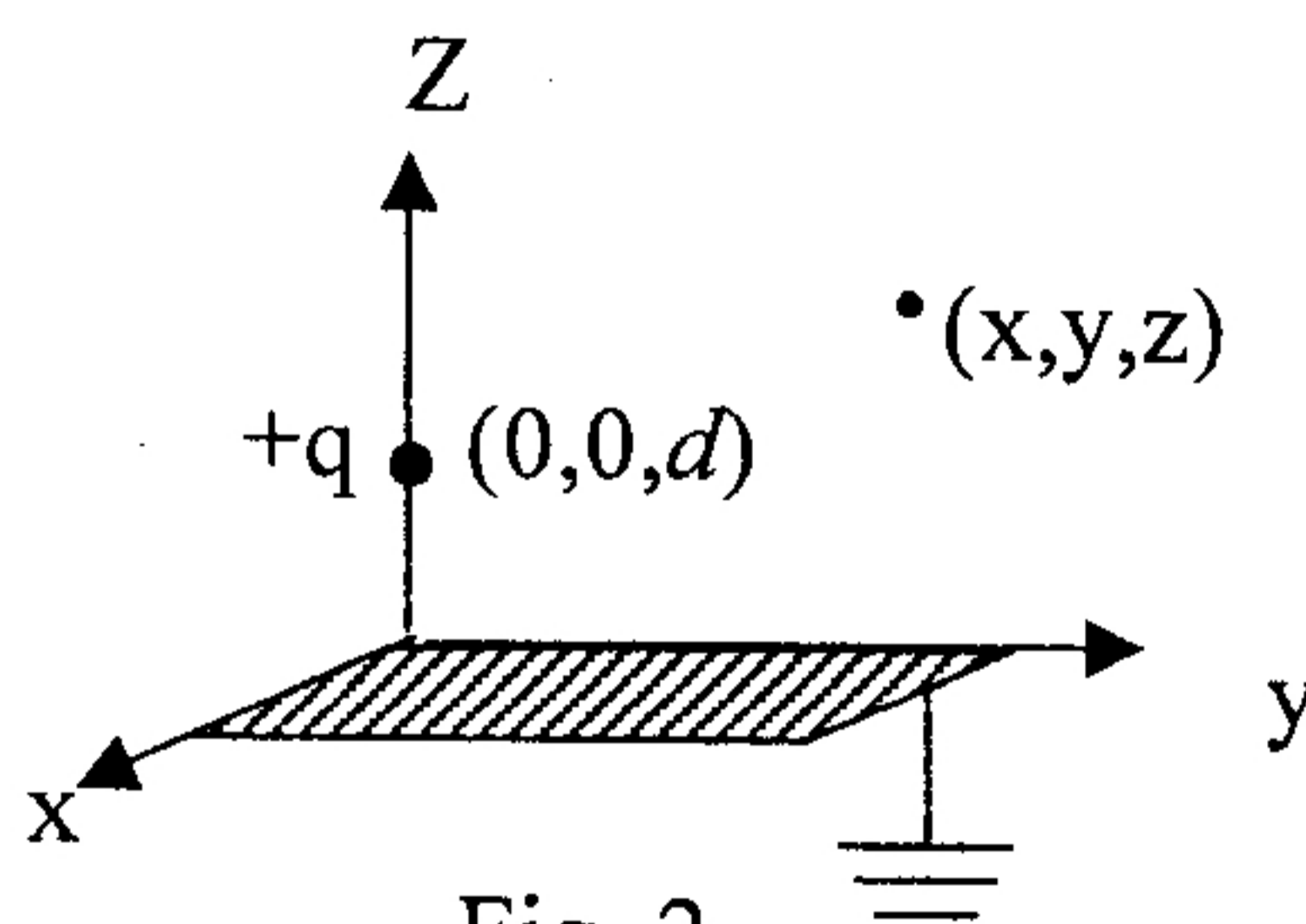


Fig. 2

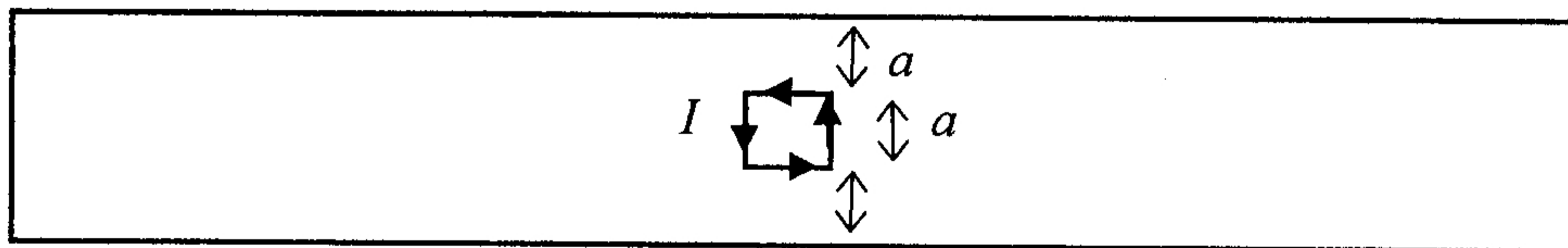


Fig. 3