1. Given the uniform line-charge density ρ_l for finite length L as shown in Fig. 1, find the electric field intensity of P along the axis. (20%)

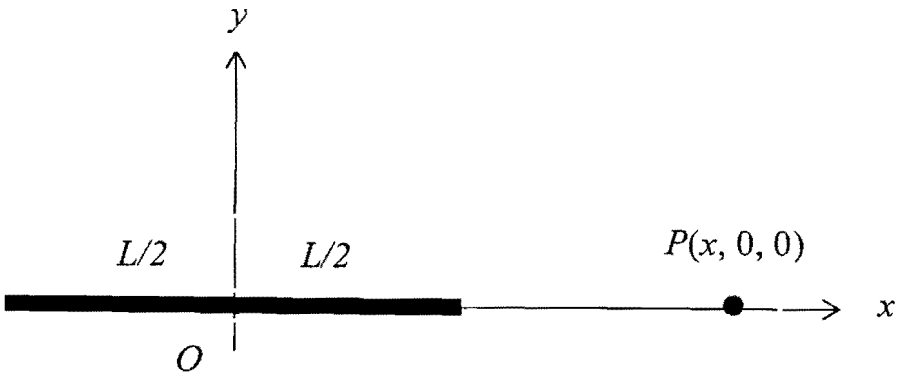

Fig. 1

2. Write down the *Poisson's equation* and *Laplace's equation* in Cartesian coordinates, Cylindrical coordinates, and Spherical coordinates. (15%)

3. Calculate the mutual inductance per unit length between two parallel two-wire transmission lines *A-A'* and *B-B'* separated by a distance D as shown in Fig. 2. Assume the wire radius to be much smaller than D and the wire spacing d. (20%)

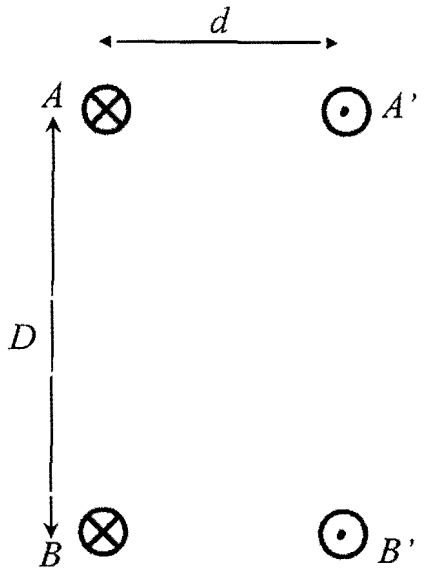

Fig. 2

(背面仍有題目,請繼續作答)

4. A dielectric fiber of a transparent material is used to guide light under the conditions of total internal reflection. Determine the minimum dielectric constant of the guiding medium so that a wave incident on one end at any angle may be confined within the fiber until it emerges from the other end. (15%)

5. Draw the diagram for an equivalent circuit of a differential length Δz of a two-conductor transmission lines. Define your parameters clearly. (15%)

6. A TE_{10} wave at 10 GHz propagates in a brass (conductivity = 1.57×10^7 S/m) rectangular wave guide with inner dimensions of 1.5 cm x 0.6 cm, which is filled with some material ($\varepsilon_r = 2.25$, $\mu_r = 1$, and loss tangent = 4×10^{-4}). Determine (a) the phase constant, (b) the wave impedance, and (c) the attenuation constant due to the loss in the dielectric. (15%)