

Homework 8 -Phys273-Spring 2003  
Tuesday April 22, 2003, by 9.30 am

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**Problem 1** [10 points]

Consider a simple magnetic field which increases exponentially with time

$$B = B_0 e^{bt} e_z, \quad (1)$$

where  $B_0$  and  $b$  are constants and  $e_z$  is a unit vector pointing in the  $z$ -direction. Find the electric field produced by this varying B-field.

**Problem 2** [10 points]

A parallel-plate capacitor consists of two circular plates of radius  $R = 10\text{cm}$ . Suppose that the capacitor is being charged at a uniform rate so that the electric field between the plates changes at the constant rate  $\frac{dE}{dt} = 10^{13} \text{ V m}^{-1} \text{ sec}^{-1}$ . Find the displacement current for the capacitor. Derive an expression for the magnitude of the B-field at a distance  $r$  from the center of the capacitor in a direction parallel to the plates. Evaluate  $B$  at  $r = R$ .

**Problem 3** [10 points]

Two long parallel wires a distance  $2d$  apart carry equal currents  $I$  in opposite directions. Derive an expression for  $B(x)$ , the magnitude of the net magnetic field for points on the  $x$ -axis and between the wires.

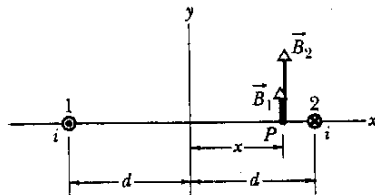


FIGURE PROBLEM 3

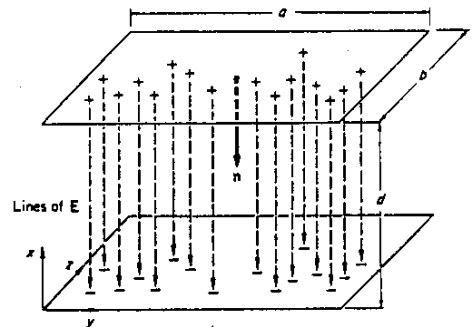


FIGURE PROBLEM 4

**Problem 8H** [10 points]

Determine the electric field of two equal and opposite (i.e. one positive one negative) distributions of charge on the surfaces of two conducting plates by using Maxwell's equations. For simplicity assume, that the plates are in free space and that fringing can be neglected (see figure below).