# Additional Parts for HW1

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Due 11 Jan 2009, 5 pm

## 1 HW3 Problem 1

Consider a slab of constant charge density $\rho_0$, with its midplane on the $-y$ plane. It extends over the range $-d < z < +d$. The slab contains a bubble, void of charge, centered at $z = +d/5$ on the $z$-axis and with radius $d/3$. Find the electric field at the center of the bubble. Describe the electric field outside the slab, and give an expression for the electric field along the $z$-axis outside the slab.

## 2 HW3 Problem 3

f) Using your expression from **3e** (or by arguing from the Poisson Equation), find the electric potential $V(r)$ due to a charge distribution

$$\rho(z') = \rho_0 \sin(\pi z'/a), \qquad -a \leq z' \leq a \tag{1}$$

with conducting, grounded surfaces at $z = -a$ and $z = +a$. Thus, we demand that $V(-a) = 0$ and $V(a) = 0$. Why is your result different from that in part d? (Hint: You may want to do this integral with Mathematica, if you use 3e).

g) Now suppose that the walls are not grounded, but at some nonzero potential: perhaps $V(-a) = V_{m0} = +5$ V and $V(a) = V_{p0} = -7$ V. Find the potential between the walls, if no charge lies between them: $\rho(z') = 0$ for $-a < z' < a$.

What is the potential if the walls have these nonzero potentials, and the charge density has the form given in parts **3f**? Ought you to revise your integral expression for the potential given in part **3e**? State the best approach.