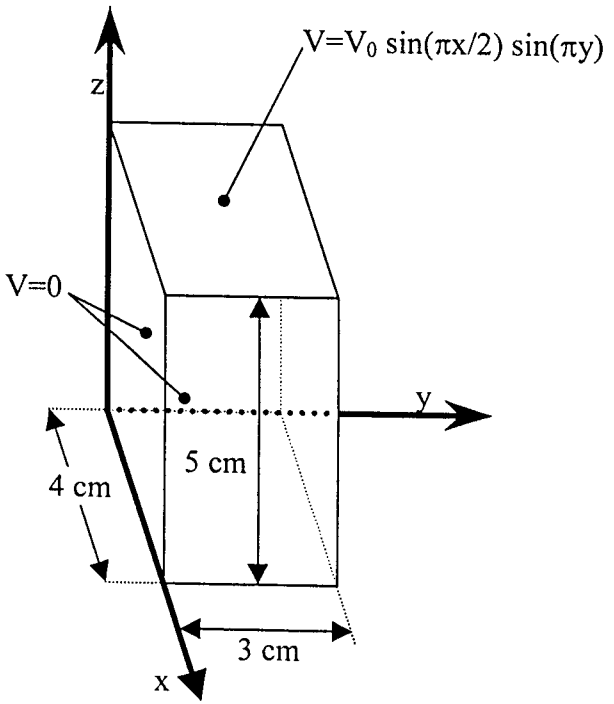
EM Spring 00B

One corner of a rectangular box with dimensions 4 cm × 3 cm × 5 cm is at the origin, as shown in the figure below.



The box's 4 cm edges are parallel to the x axis, while its 3 cm and 5 cm edges are parallel the y and z axes, respectively. Five of its sides are grounded, while the top, at $z = 5$ cm, is held at a voltage

$$V(x, y, z{=}5) = V_0 \sin\left(\frac{\pi}{2}x\right) \sin(\pi y).$$

(a) Calculate the voltage $V(x, y, z)$ everywhere inside the box.

(b) A thin coating of dust is applied uniformly to the top of the box. All dust particles remain on the box top. The dust particles are electrically neutral, but are polarizable. They move under the influence of the electric field and friction and finally come to rest. Sketch the top of the box, showing where the dust particles accumulate.