**Special Problem 5-3.7**

A dielectric slab with a thickness of 1.0 m is placed in free space.

The **top** surface of the slab is described as $-\infty < x < \infty$, $-\infty < y < \infty$, $z = 1$. The **bottom** surface of the slab is described as $-\infty < x < \infty$, $-\infty < y < \infty$, $z = 0$.

The **relative** dielectric of the slab is given as:

$$\varepsilon_{r1}(\bar{r}) = 3 - z$$

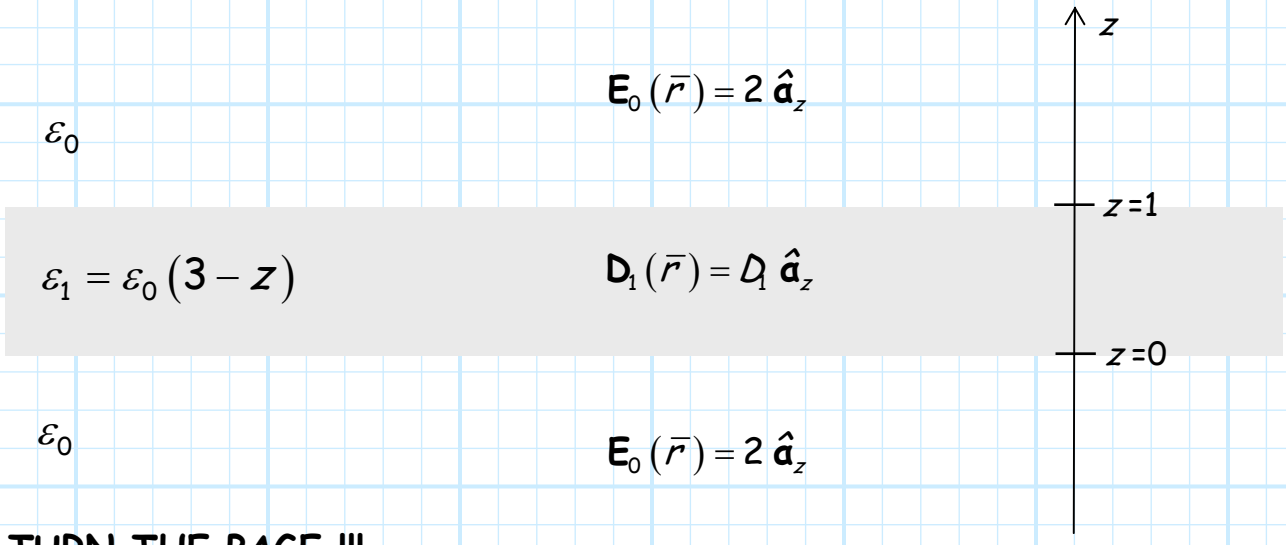
The electric field **above** and **below** the slab (in free space) is:

$$\mathbf{E}_0(\bar{r}) = 2\,\hat{\mathbf{a}}_z \qquad \left[V/m\right]$$

The electric flux density **inside** the slab has the form:

$$\mathbf{D}_1(\bar{r}) = D_1\,\hat{\mathbf{a}}_z \qquad \left[V/m\right]$$

where $D_1$ is an unknown **constant**.

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Determine:

1. The value of constant $D_1$.

2. The electric field $\mathbf{E}_1(\bar{r})$ **inside** the dielectric slab.

3. The **polarization vector** within the dielectric slab.

4. The value of the **polarization** (i.e., **bound**) surface charge density on the **top** surface of the slab.

5. The value of the **polarization** (i.e., **bound**) surface charge density on the **bottom** surface of the slab.