Ques1.

A parallel plate capacitor, filled with free space between the plates at $x = 0$ and $x = 2$, has potentials 0 and 10, respectively, on the plates. Assume that the plates extend to infinity in y and z directions. The electric potential and electric field between the plates, respectively, is given by nx and $m\hat{x}$. The values of n and m, respectively, are [5] and [-5]. All quantities are in SI units. Provide the answer in integer form.

Ques2.

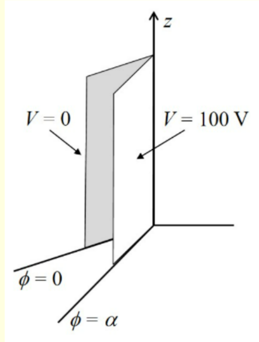
An arrangement of two concentric conducting spherical shells of radii $r_a = 30$ and $r_b = 60$ is centered at the origin and the region between the shells is filled with free space. The potentials on inner and outer shells are 10 and 0, respectively. If the surface charge density on the outer conductor is $n\epsilon_0$, the value of n is [-0.17]. All quantities are in SI units. Round off the answer to the second place of decimal.

Ques3.

In cylindrical coordinate system, two planes kept at $\phi = 0$ and $\phi = \alpha$ in free space form a wedge (see figure). The planes are insulated along the z-axis. If the potentials of the planes are 100 V for $\phi = \alpha$ and 0 V for $\phi = 0$, then the electric field between the planes will be:

$$\nabla T = \frac{\partial T}{\partial s}\hat{\mathbf{s}} + \frac{1}{s}\frac{\partial T}{\partial \phi}\hat{\boldsymbol{\phi}} + \frac{\partial T}{\partial z}\hat{\mathbf{z}}$$

$$\nabla^2 T = \frac{1}{s}\frac{\partial}{\partial s}\left(s\frac{\partial T}{\partial s}\right) + \frac{1}{s^2}\frac{\partial^2 T}{\partial \phi^2} + \frac{\partial^2 T}{\partial z^2}$$



- $-\frac{100}{\alpha}\frac{1}{s}\hat{z}$
- $-\frac{100\pi}{\alpha}\frac{1}{s}\hat{z}$
- $\frac{100\alpha}{s}\hat{z}$
- $100\pi\frac{1}{s}\hat{z}$
- $\frac{100}{\alpha}\frac{1}{s}\hat{z}$
- $\frac{100}{s}\hat{z}$

Ques4.

A $5\ \mu\mathrm{C}$ point charge is kept at a distance 8 cm from the surface of a grounded conducting sphere of radius 2 cm. The force experienced by the charge will be [10] Expected Solutions: 5 -5 N. Given that $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9\ \mathrm{Nm^2C^{-2}}$. Round off the answer to the nearest integer.