

Answer on Question #73121 Physics / Electromagnetism

A disk with a uniform positive surface charge density lies in the xy plane, centered on the origin. The disk contains $\sigma = 2.5 \times 10^{-6} \text{ C/m}^2$ of charge, and is $R = 7.5 \text{ cm}$ in radius. What is the electric field at $z = 15 \text{ cm}$?

Solution:

The electric field at the axis of a disc

$$E(z) = 2\pi k\sigma \left[1 - \frac{z}{\sqrt{z^2 + R^2}} \right]$$

Thus

$$\begin{aligned} E(0.15) &= 2\pi \times 9 \times 10^9 \times 2.5 \times 10^{-6} \times \left[1 - \frac{0.15}{\sqrt{0.15^2 + 0.075^2}} \right] \\ &= 15 \times 10^3 \text{ N/C} \end{aligned}$$

Answer: $15 \times 10^3 \text{ N/C}$

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