Homework #4, 4B

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February 12, 2025

1 Question 1

A surface that has the area vector $\vec{A} = \left(2\hat{i} + 3\hat{j}\right)$ m^2. What is the flux of a uniform electrc field that is (a) $\vec{E} = 4\hat{i}$N/C and (b) $\vec{E} = 4\hat{k}$N/C?

2 Question 3

3 Problem 6

Three infinite nonconducting sheets, with uniform positive surface charge densities σ, 2σ, and 3σ, are arranged to be parallel like the two sheets in Fig. 23-19a. What is their order, from left to right, if the electric field $\vec{E}$ produced by the arrangement has magnitude $E = 0$ in one region and $E = 2\sigma/\epsilon_0$ in another region?

Solution

For an infinite nonconducting sheet of densty σ, the electric field from it is equal to $E = \sigma/2\epsilon_0$. We can use this to provide a system of equations for electric field strengths (a, b, c), which have unique magnitudes in the set $(\sigma/2\epsilon_0, 2\sigma/2\epsilon_0, 3\sigma/2\epsilon_0)$ or alternatively $(E, 2E, 3E)$.

$$\begin{aligned}
a - b - c &= 0 \\
a + b - c &= 2\sigma/\epsilon_0 = 4E \\
0a + 2b + 0c &= 4E \\
b &= 2E = 2\sigma/2\epsilon_0 \\
a - 2E - c &= 0 \rightarrow a - c = 2E
\end{aligned}$$

There is only one combination of the remaining two that this works for: $a = 3E$ and $c = E$. Thus, the order is $\boxed{\langle 3\sigma, 2\sigma, \sigma \rangle}$.

4 Problem 8

5 Problem 10

6 Problem 12

7 Problem 18

8 Problem 22

9 Problem 28

10 Problem 34