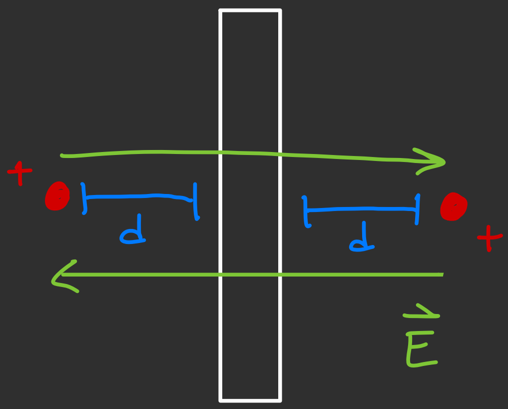
Week 3 Homework

Noah
Wilber

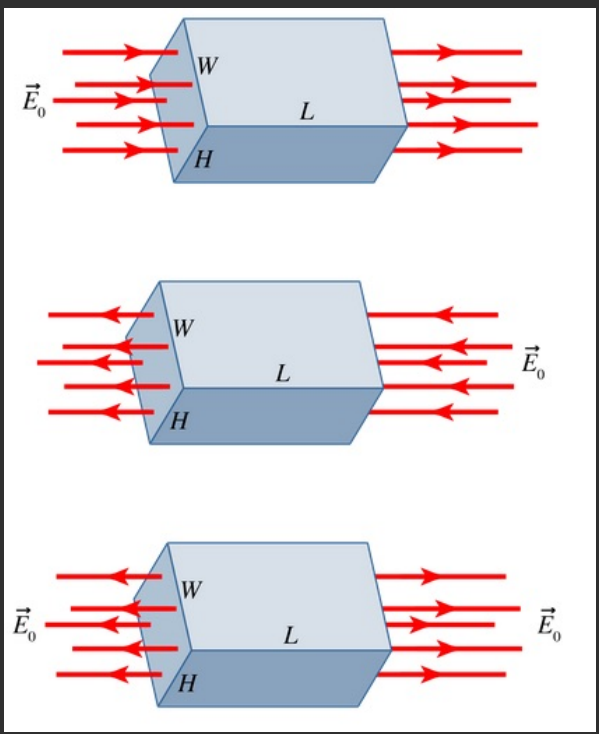
HW3

1/



Net electric field is Zero therefore Flux through object is Zero

2/



All electric field that enters is canceled by the electric field that leaves

a+b) $\phi = 0$

c) $\phi = E_0 \cdot 2wh$
$= 2E_0 wh$

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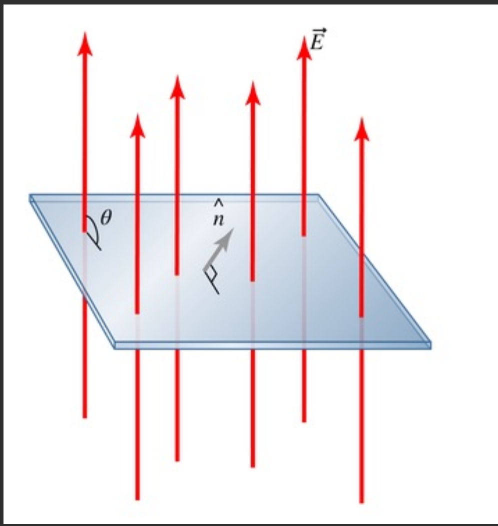


$\phi = 34.5 \frac{Nm^2}{C}$

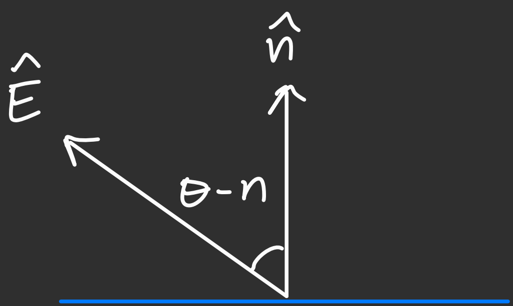
$L = 0.1 m$

$\theta = 161.0°$

$\theta - n = 71°$

$A = 0.01 m^2$

We only want the E-field passing vertically because all horizontal components are parallel and cancel



$$\cos(\theta - n) = \frac{E_{\hat{n}}}{E}$$

$$E_{\hat{n}} = E\cos(71°)$$

$$\phi = E_{\hat{n}} \cdot A \qquad \phi = E\cos(71°) \cdot 0.01 m^2$$

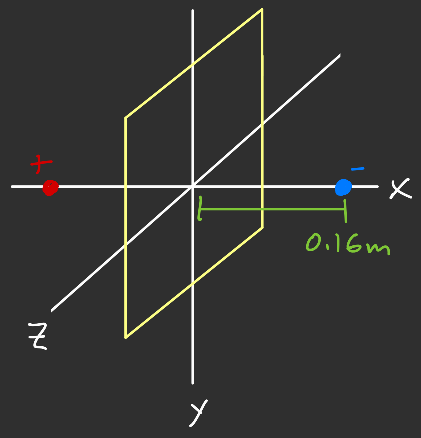
$$34.5 \frac{Nm^2}{C} = E\cos(71°) \cdot 0.01 m^2$$

$$E = 10597 \frac{N}{C}$$

4/ $$\phi = \frac{q_{encl}}{\varepsilon_0}$$

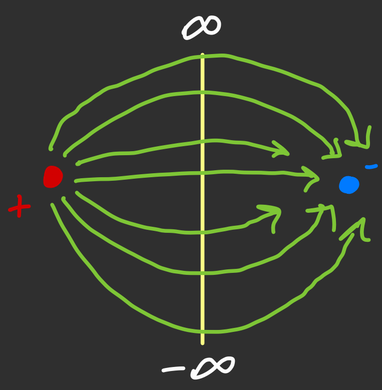
Flux does not depend on radius so it does not change

5/

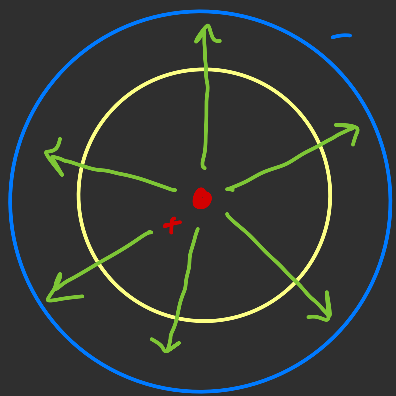


In this question we have an electric dipole and must abuse the properties of a dipole.

Since our plane is in between the two charges we can ignore all fields going away from the charges and just look between



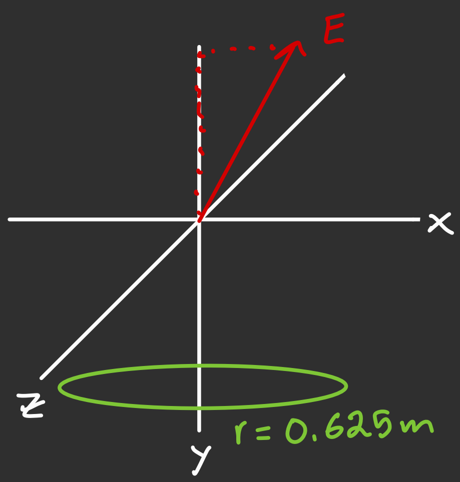
All fields in between the dipoles travel from the positive charge to the negative charge no matter what angle they are at.



Therefore we can redraw our dipole and plane as a sphere and use gauss's law

$$\phi = \frac{q_{encl}}{\varepsilon_0} \qquad \phi = \frac{19E\text{-}9C}{8.85E\text{-}12} = 2147 \frac{Nm^2}{C}$$

6/ $\vec{E} = (34.7\frac{N}{C})i + (70.5\frac{N}{C})j$



$\phi = E \cdot A$

$A = \pi r^2 j$

$\phi = (34.7\frac{N}{C} \cdot 0) + (70.5\frac{N}{C} \cdot 1.23m^2)$

$\phi = 86.52 \frac{Nm^2}{C}$

For the bumped source there is no y component so the flux is zero

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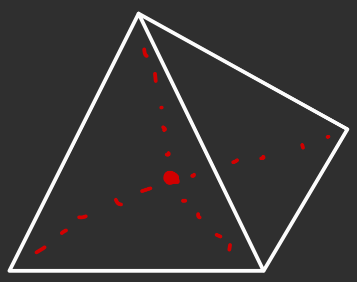
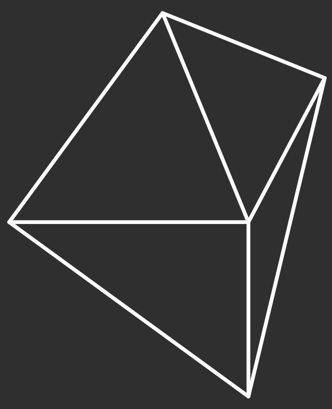


Surface area of a pyramid is too complicated to calculate, so we need a shape that keeps the area of the sides, but doesnt have a base.



The shape that matches this description is a diamond

Now we have 8 equal sides that are also equal to the 4 sides of the pyramid

Therefore $\phi = \frac{1}{8} \cdot \frac{Q}{\varepsilon_0}$

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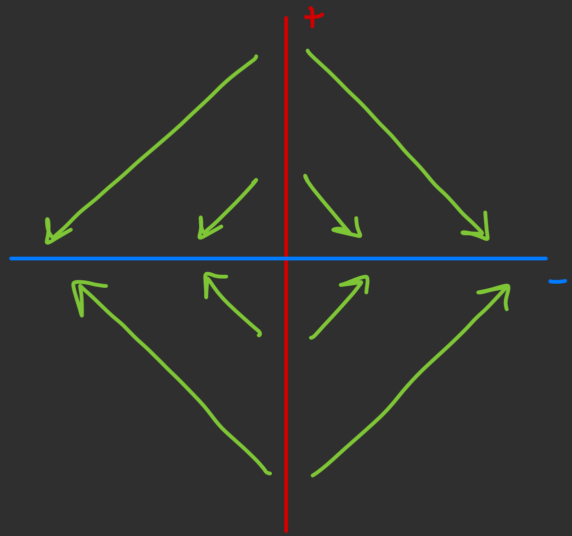

$$\vec{E} = \frac{\sigma}{2\varepsilon_0}$$ (Electric field from infinite plane)

$$\vec{E} = \frac{50C}{2 \cdot 8.85E\text{-}12}$$

$$\vec{E} = 2.825E12 \ \tfrac{N}{C}$$

$$2.825E12 / \cos(45) \Rightarrow$$

$$\vec{E}_{tot} = 3.995E12 \ \tfrac{N}{C}$$