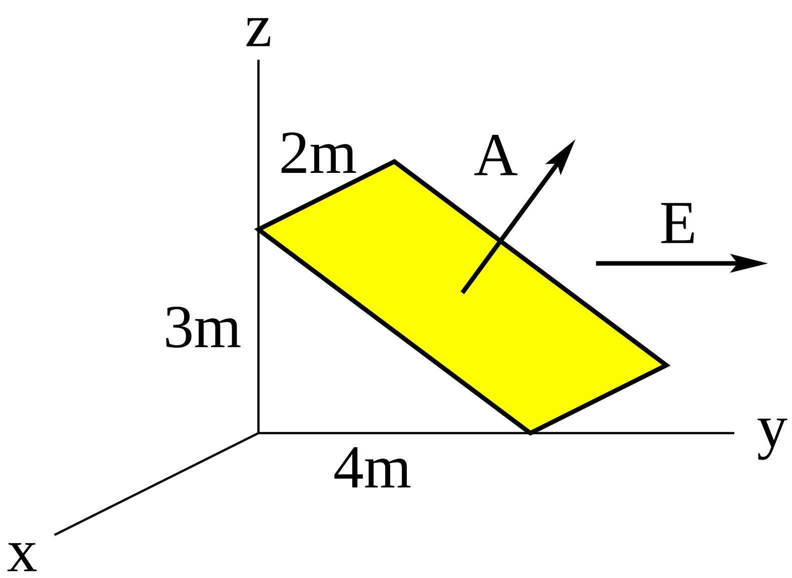
Electric Flux: Application (1)

Consider a rectangular sheet oriented perpendicular to the yz plane as shown and positioned in a uniform electric field $\vec{E} = (2\hat{j})$N/C.



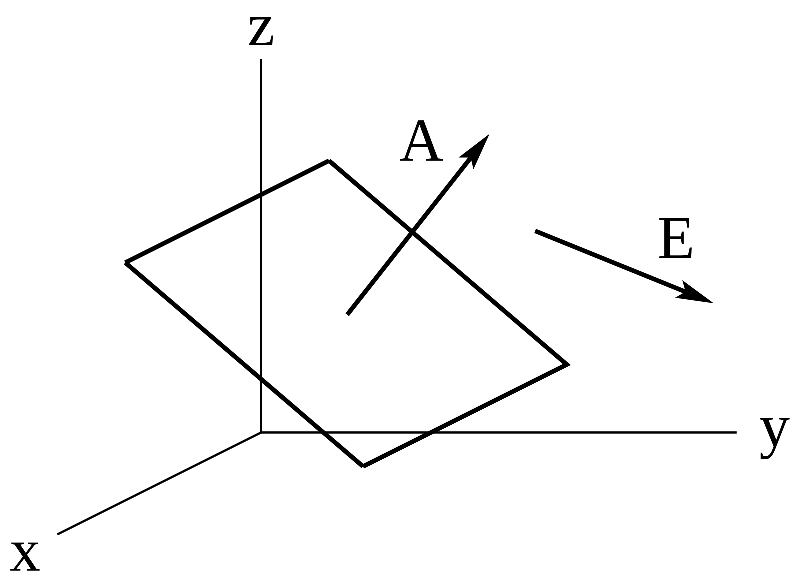
(a) Find the area A of the sheet.

(b) Find the angle between $\vec{A}$ and $\vec{E}$.

(c) Find the electric flux through the sheet.

Electric Flux: Application (2)

Consider a plane sheet of paper whose orientation in space is described by the area vector $\vec{A} = (3\hat{j} + 4\hat{k})\mathrm{m}^2$ positioned in a region of uniform electric field $\vec{E} = (1\hat{i} + 5\hat{j} - 2\hat{k})$N/C.



(a) Find the area of the sheet.

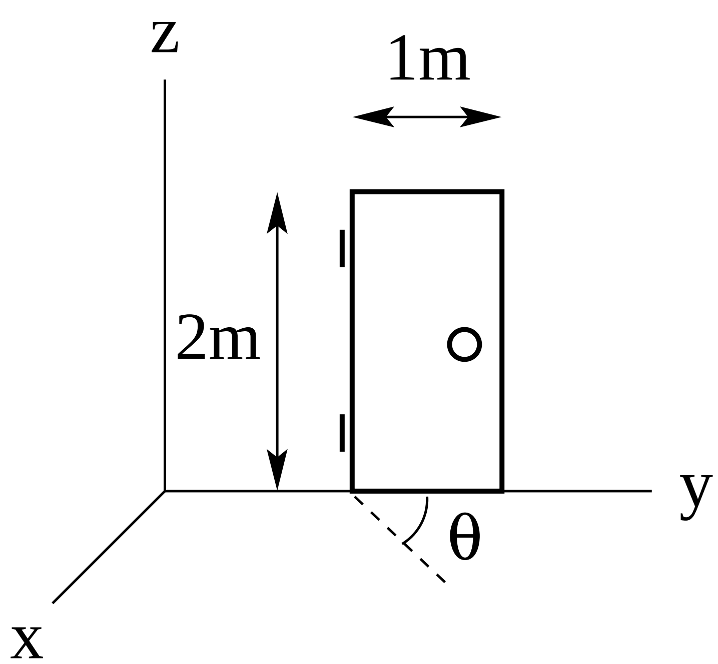
(b) Find the magnitude of the electric field.

(c) Find the electric flux through the sheet.

(d) Find the angle between $\vec{A}$ and $\vec{E}$.

Electric Flux: Application (3)

The room shown below is positioned in an electric field $\vec{E} = (3\hat{i} + 2\hat{j} + 5\hat{k})$N/C.



(a) What is the electric flux Φ_E through the closed door?

(b) What is the electric flux Φ_E through the door opened at $\theta = 90^\circ$?

(c) At what angle θ_1 is the electric flux through the door zero?

(d) At what angle θ_2 is the electric flux through the door a maximum?

Electric Flux: Application (4)

Consider a positive point charge Q at the center of a spherical surface of radius R. Calculate the electric flux through the surface.

- $\vec{E}$ is directed radially outward. Hence $\vec{E}$ is parallel to $d\vec{A}$ everywhere on the surface.
- $\vec{E}$ has the same magnitude, $E = kQ/R^2$, everywhere on the surface.
- The area of the spherical surface is $A = 4\pi R^2$.
- Hence the electric flux is $\Phi_E = EA = 4\pi kQ$.
- Note that Φ_E is independent of R.