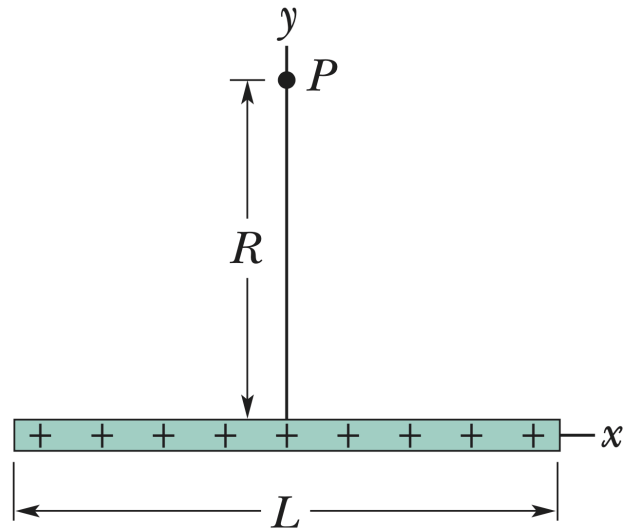


Electric Field Calculations

Uniformly charged rod of charge $+Q$ and length L at a point P a perpendicular distance R from the center of the rod

Determine the **linear charge density** λ of the rod.

Divide the rod into small segments of length dx . Take one of these infinitesimally small segments of the rod located a distance x from the center, where $x = 0$.



Determine the charge dq of this segment.

Determine the distance r from this segment to P .

Determine the magnitude of the electric field dE produced by this segment at P .

Determine $\cos \theta$ where θ is the angle the electric field vector dE makes with the y -axis.

Determine the y -component of the electric field dE produced by this segment.

Integrate to get the electric field E produced by all the segments.

Uniformly charged ring of charge $+Q$ and radius R at a point P a distance z along the z -axis.

Determine the **linear charge density** λ of the ring.

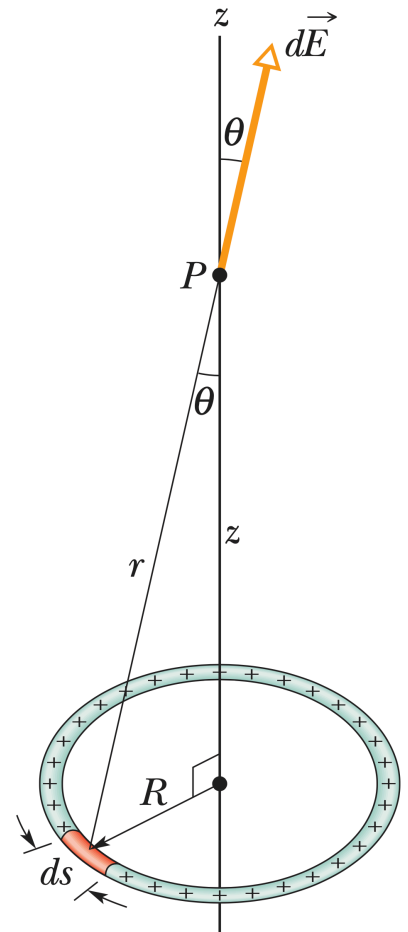
Divide the ring into small segments of length ds . Take one of these infinitesimally small segments of the ring.

Determine the charge dq of this segment.

Determine the distance r from this segment to P .

Determine the magnitude of the electric field dE produced by this segment at P .

Determine $\cos \theta$ where θ is the angle the electric field vector $d\vec{E}$ makes with the z -axis.



Determine the z-component of the electric field dE produced by this segment.

Integrate to get the electric field E produced by all the segments.

Uniformly charged disk of charge $+Q$ and radius R at a point P a distance z along the z -axis

Determine the **area charge density** σ of the ring.

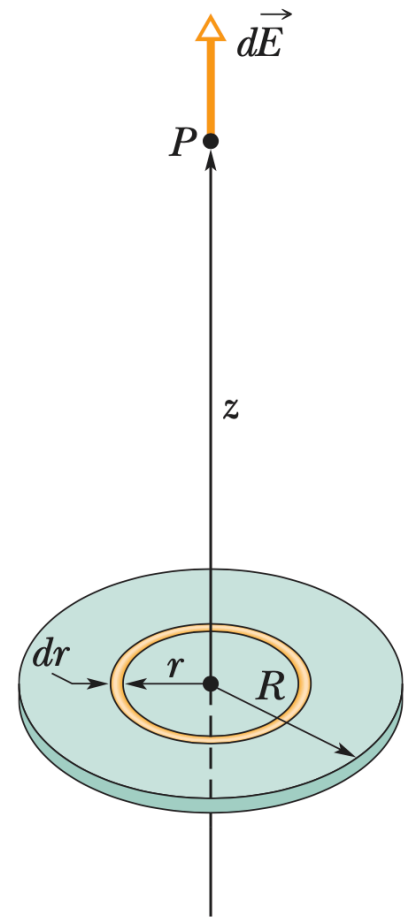
Divide the disk into thin rings of thickness dr . Take one of these infinitesimally thin rings with radius r .

Determine the area dA of this ring.

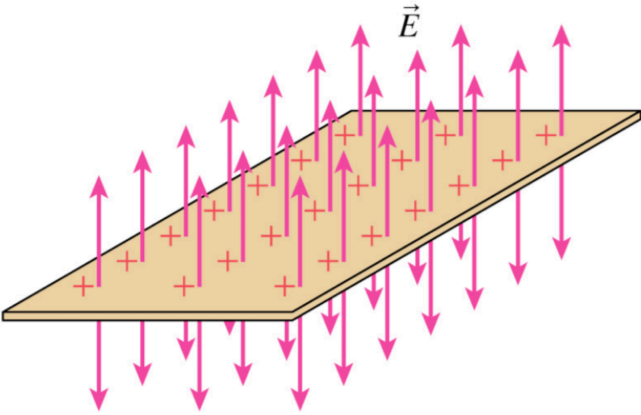
Determine the charge dq of this ring.

Determine the magnitude of the electric field dE produced by this ring at P .

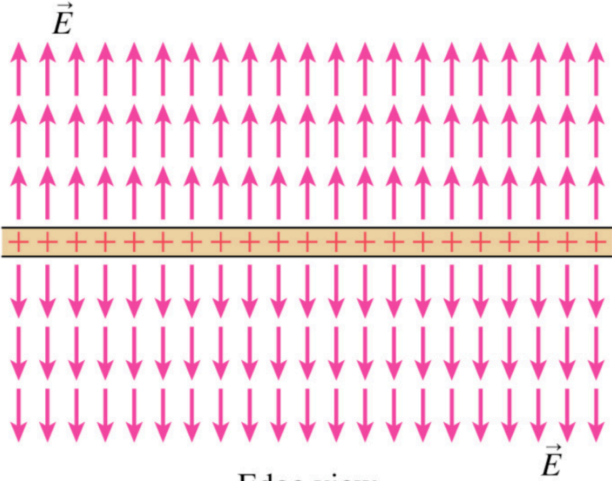
Integrate to get the electric field E produced by all the rings.



Infinite plane of area charge density σ

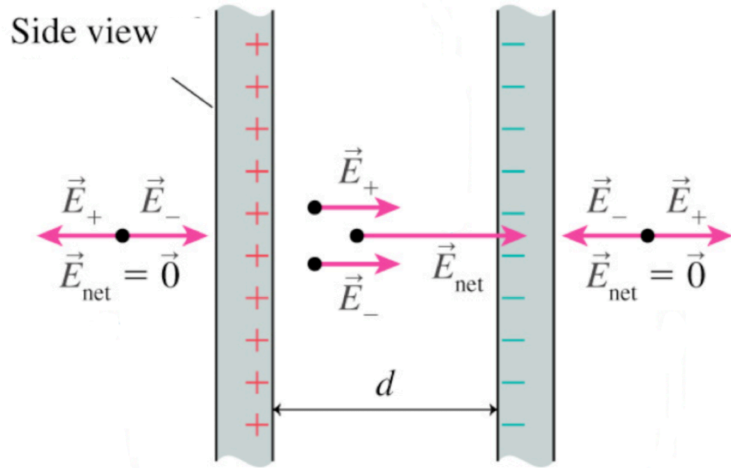


Perspective view

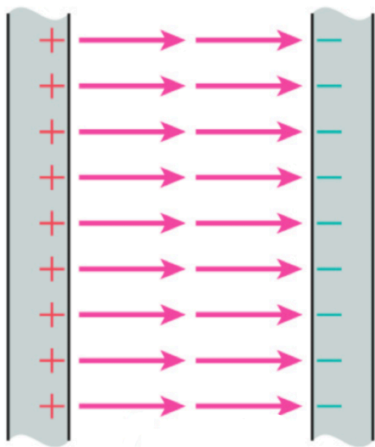


Edge view

Parallel plate capacitor



(a) Ideal capacitor



(b) Real capacitor

