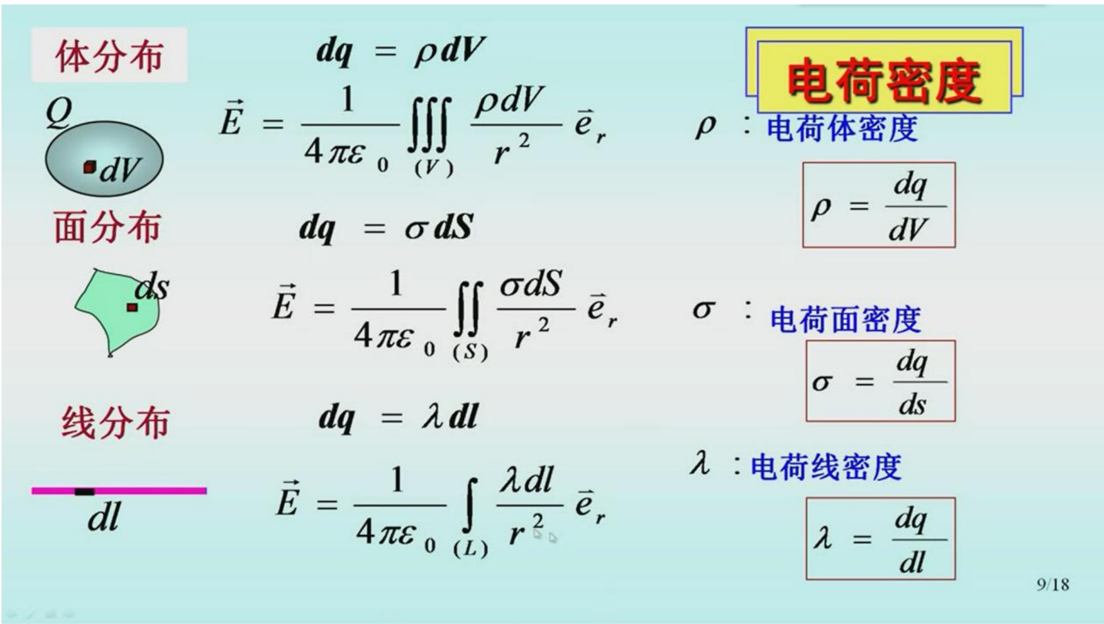
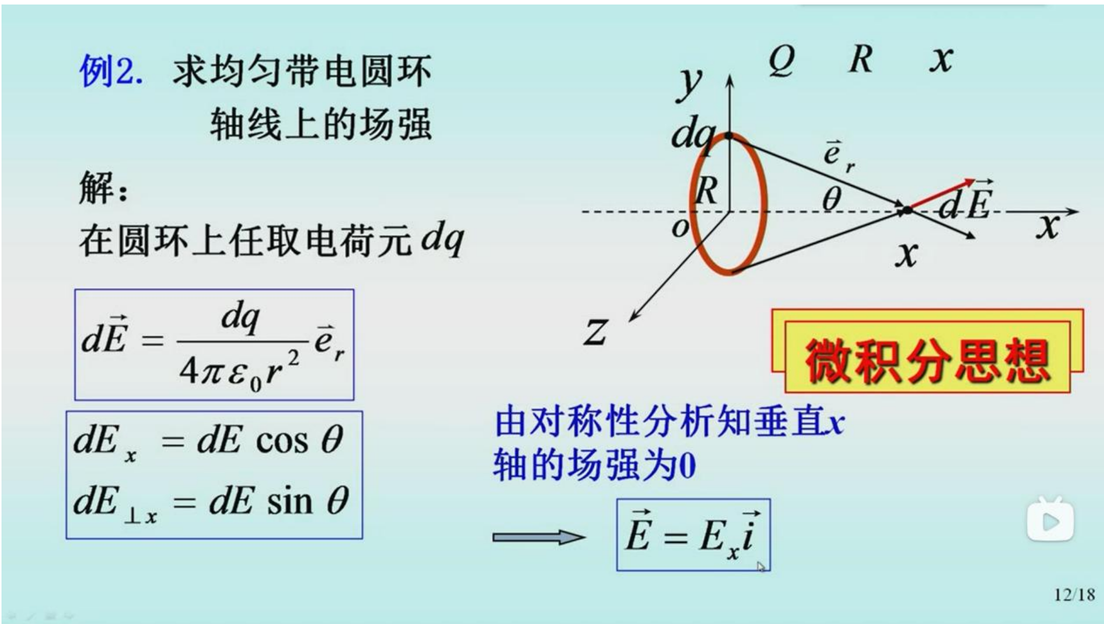
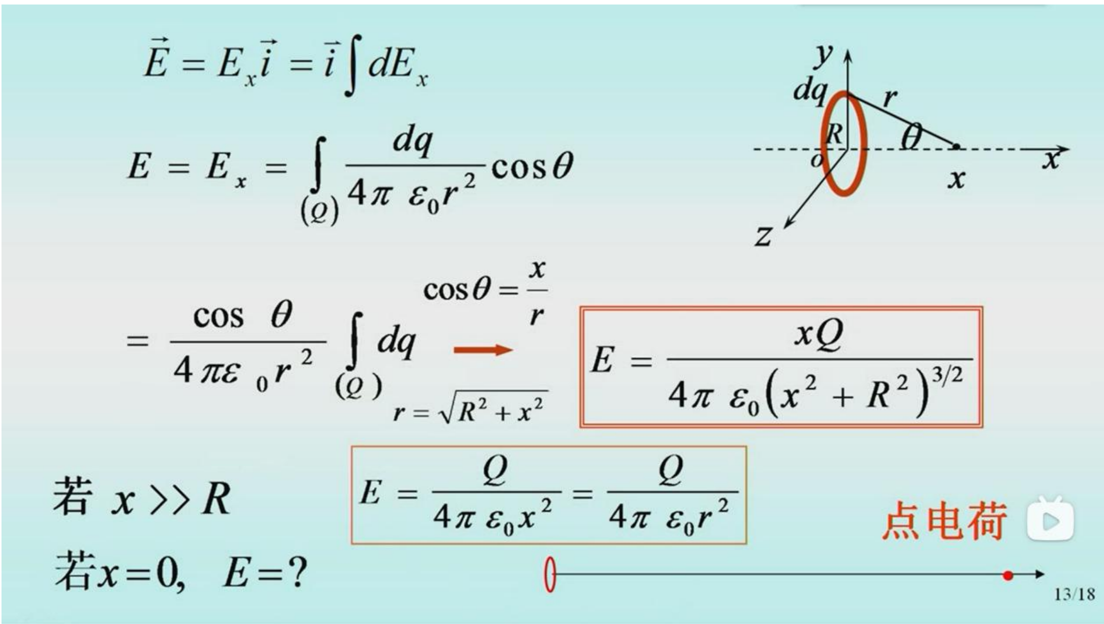
求电场强度的几种方法

对于线、面、体积分求电场：

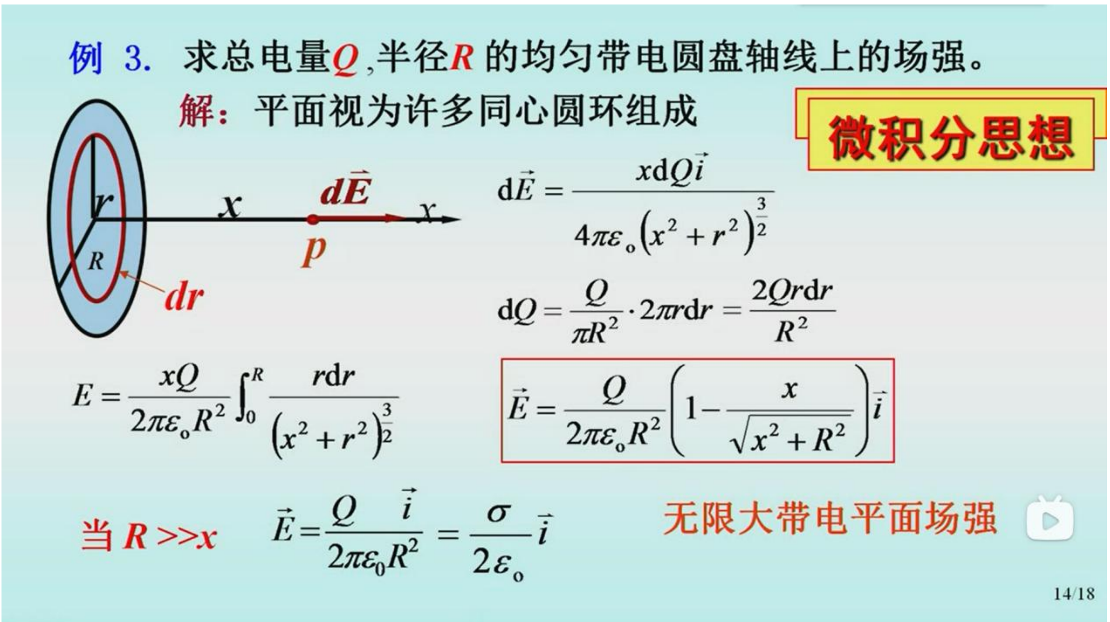


求圆环场强：

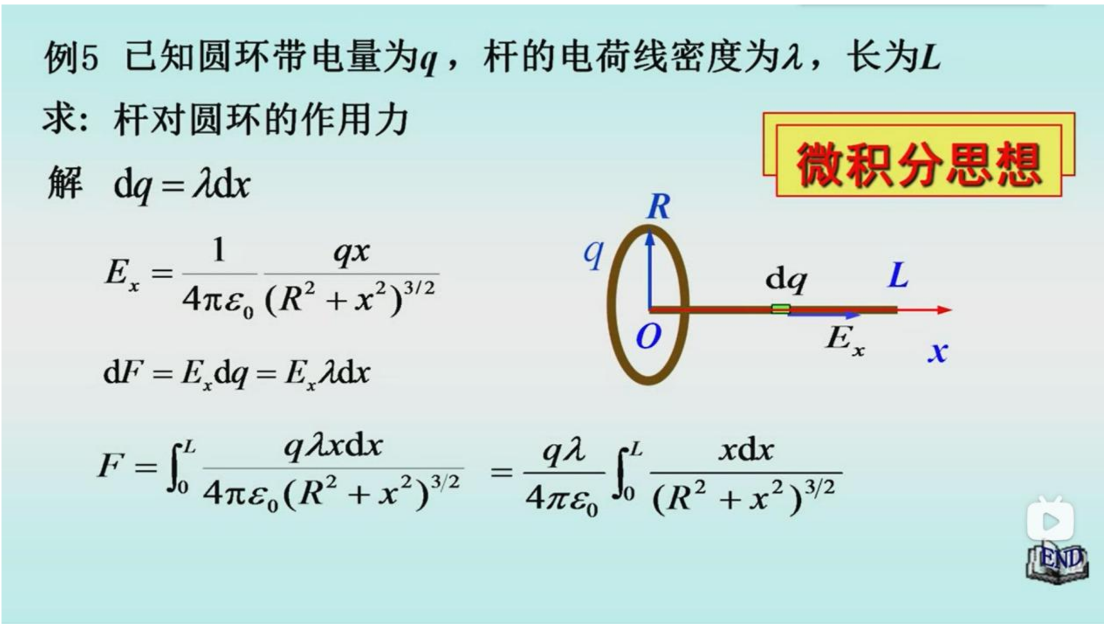




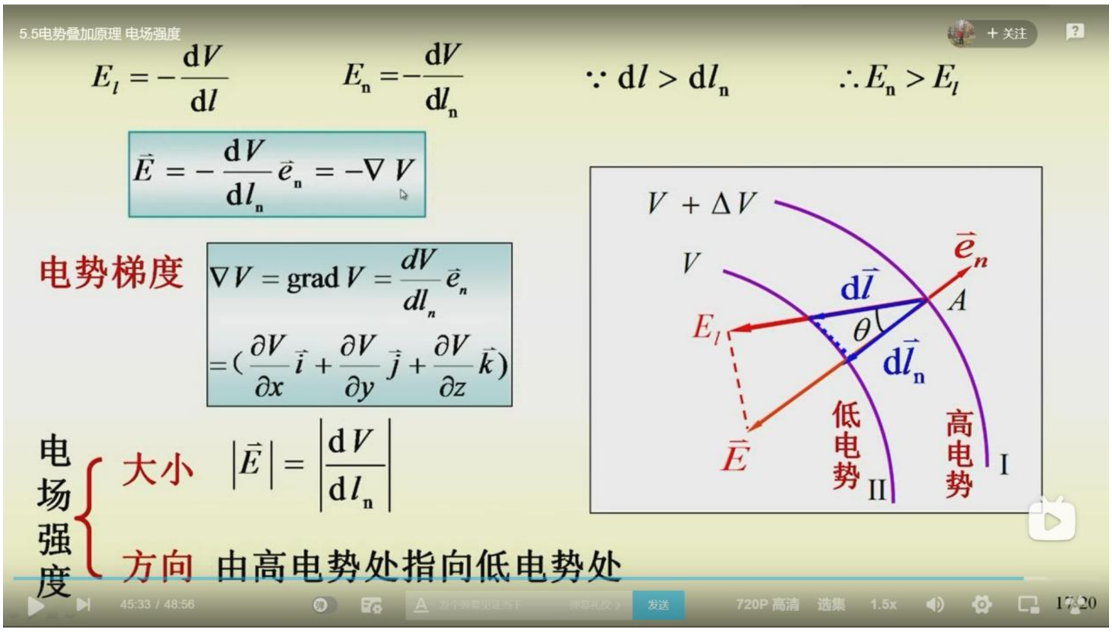
求圆盘场强：



求圆环与杆结合的场强：


例5 已知圆环带电量为q，杆的电荷线密度为λ，长为L
求：杆对圆环的作用力
微积分思想
解 $\mathrm{d}q = \lambda \mathrm{d}x$
$E_x = \frac{1}{4\pi\varepsilon_0}\frac{qx}{(R^2+x^2)^{3/2}}$
$\mathrm{d}F = E_x \mathrm{d}q = E_x \lambda \mathrm{d}x$
$F = \int_0^L \frac{q\lambda x \mathrm{d}x}{4\pi\varepsilon_0 (R^2+x^2)^{3/2}} = \frac{q\lambda}{4\pi\varepsilon_0}\int_0^L \frac{x\mathrm{d}x}{(R^2+x^2)^{3/2}}$
q
R
O
$\mathrm{d}q$
L
E_x
x
END

用电势求电场：


5.5电势叠加原理 电场强度
+ 关注
$E_l = -\frac{\mathrm{d}V}{\mathrm{d}l}$
$E_n = -\frac{\mathrm{d}V}{\mathrm{d}l_n}$
$\because \mathrm{d}l > \mathrm{d}l_n$
$\therefore E_n > E_l$
$\vec{E} = -\frac{\mathrm{d}V}{\mathrm{d}l_n}\vec{e}_n = -\nabla V$
电势梯度
$\nabla V = \mathrm{grad}\, V = \frac{dV}{dl_n}\vec{e}_n = (\frac{\partial V}{\partial x}\vec{i} + \frac{\partial V}{\partial y}\vec{j} + \frac{\partial V}{\partial z}\vec{k})$
电场强度
大小 $|\vec{E}| = \left|\frac{\mathrm{d}V}{\mathrm{d}l_n}\right|$
方向 由高电势处指向低电势处
$V + \Delta V$
V
$\vec{e}_n$
A
$\mathrm{d}\vec{l}$
E_l
θ
$\mathrm{d}\vec{l}_n$
$\vec{E}$
低电势
II
高电势
I
45:33 / 48:56
发送
720P 高清
选集
1.5x