

	Line charge	Ring of charge	Uniformly charged disk
Figure			
(2) Express dq in terms of charge density	$dq = \lambda dx'$	$dq = \lambda d\ell$	$dq = \sigma dA$
(3) Write down dE	$dE = k_e \frac{\lambda dx'}{r'^2}$	$dE = k_e \frac{\lambda d\ell}{r^2}$	$dE = k_e \frac{\sigma dA}{r^2}$

(4) Rewrite r and the differential element in terms of the appropriate coordinates	dx' $\cos \theta = \frac{y}{r'}$ $r' = \sqrt{x'^2 + y^2}$	$d\ell = R d\phi'$ $\cos \theta = \frac{z}{r}$ $r = \sqrt{R^2 + z^2}$	$dA = 2\pi r' dr'$ $\cos \theta = \frac{z}{r}$ $r = \sqrt{r'^2 + z^2}$
(5) Apply symmetry argument to identify non-vanishing component(s) of dE	$dE_y = dE \cos \theta$ $= k_e \frac{\lambda y dx'}{(x'^2 + y^2)^{3/2}}$	$dE_z = dE \cos \theta$ $= k_e \frac{\lambda R z d\phi'}{(R^2 + z^2)^{3/2}}$	$dE_z = dE \cos \theta$ $= k_e \frac{2\pi \sigma z r' dr'}{(r'^2 + z^2)^{3/2}}$
(6) Integrate to get E	$E_y = k_e \lambda y \int_{-\ell/2}^{+\ell/2} \frac{dx}{(x^2 + y^2)^{3/2}}$ $= \frac{2k_e \lambda}{y} \frac{\ell/2}{\sqrt{(\ell/2)^2 + y^2}}$	$E_z = k_e \frac{R\lambda z}{(R^2 + z^2)^{3/2}} \int d\phi'$ $= k_e \frac{(2\pi R\lambda)z}{(R^2 + z^2)^{3/2}}$ $= k_e \frac{Qz}{(R^2 + z^2)^{3/2}}$	$E_z = 2\pi \sigma k_e z \int_0^R \frac{r' dr'}{(r'^2 + z^2)^{3/2}}$ $= 2\pi \sigma k_e \left(\frac{z}{ z } - \frac{z}{\sqrt{z^2 + R^2}} \right)$