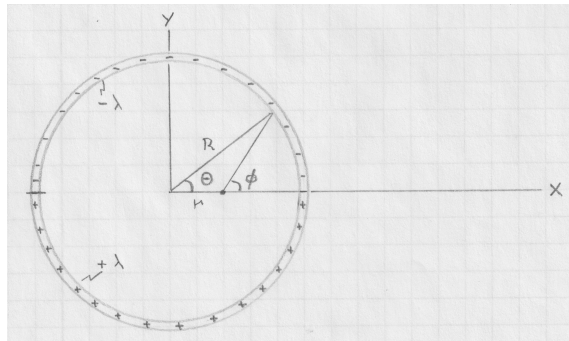


### [lex188] Oppositely charged semicircles

Consider two semicircles with uniform charge density  $\pm\lambda$  joined into a full circle of radius  $R$  as shown.

- Find the electric field  $\mathbf{E}$  at the center of the circle.
- Find the electric dipole moment  $\mathbf{p}$  of this charge configuration.
- Find the electric field  $\mathbf{E}$  for positions along the  $x$ -axis at  $0 \leq x \leq R$ .
- Find the electric field  $\mathbf{E}$  for positions along the  $x$ -axis at  $x \geq R$ .
- Extract from the last expression the leading term of an asymptotic expansion for large  $r$  and show that it is the field generated by the electric dipole  $\mathbf{p}$ .



**Solution:**