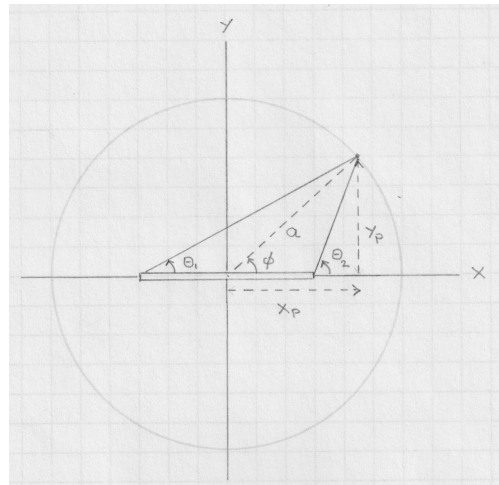


### [lex6] Electric field of a charged rod III

Here we apply the general expressions for the electric field generated by a uniformly charged rod derived in [lex5] to a specific purpose. We place the rod (of length  $L$  and line charge density  $\lambda$ ) on the  $x$  axis with its center at the origin. We pick field point along a circle of radius  $a > L/2$  in the  $xy$ -plane.

- Find analytic expressions for the functions  $E_x(\phi)$  and  $E_y(\phi)$ , where the angle  $\phi$  trace the field point on the circle starting on the positive  $x$ -axis and moving counterclockwise.
- Plot  $E_x$  and  $E_y$  versus  $\phi$  in the same diagram and comment on the symmetries of both curves.
- Plot the magnitude  $E = \sqrt{E_x^2 + E_y^2}$  versus  $\phi$  and again comment on the symmetry of the curve.
- The electric field is, in general, not radial. We can write  $\tan \phi = y/x$  for the radial direction at a given field point on the circle and  $\tan \psi = E_y/E_x$  for the direction of the electric field at that field point. Plot the deviation from the radial orientation,  $\psi - \phi$ , versus  $\phi$  and comment on the symmetry of the result.



**Solution:**