

## PHYS2063 Wave Physics Homework #14 Due Thursday 13 Oct 2022

*This homework assignment is due at the start of class on the date shown. You may submit a PDF of your solutions to the Canvas page for the course, or bring a paper copy to class.*

A long straight thin wire runs along the  $z$ -axis and carries a charge  $\lambda$  per unit length. Find the magnitude and direction of the electric field  $\vec{E}$  at a distance  $r = \sqrt{x^2 + y^2}$  from the wire. Take advantage of symmetries to identify the easiest “Gaussian surface”  $S$ , and then apply Gauss’ Law in integral form. Express your answer for  $\vec{E}(x, y)$  in terms of  $x$ ,  $y$ , and their unit vectors.

Then take the divergence  $\vec{\nabla} \cdot \vec{E}(x, y)$  of your result and show that you get the answer you expect, at least so long as you stay away from the  $z$ -axis.