ABSTRACT: The two dimensional Navier-Stokes equations are used to explain the motion of viscous fluids, and their use extends to many areas from blood flow to ocean currents. The Navier-Stokes equations, however, are extremely difficult to solve due to their nonlinear nature. This thesis is an investigation into nonclassical symmetries of this nonlinear system with the hopes that these symmetries could lead to new exact solutions of the Navier-Stokes equation.