1. Develop a numerical solution, perhaps with Subroutine RUNGE and Eqs. (4-47), that will iterate the Blasius equation form an initial guess $f^*(0) = 0.3$ and converge to the exact value $f^*(0) = 0.4696$. 

(Ref: Frank M. White; Third Edition)

2. Consider a long flat plate emerging from a wall at velocity $U$, as in Figure below. There is no freestream. Show that the Blasius Eq. (4-45) holds for this case, with $f(0) = 0, f'(0) = 1$, and $f(\infty) = 0$. Solve the equation numerically and show that $C_f \approx 0.444 / \text{Re}^{1/2}$. Also evaluate $v(\infty)$ and discuss. [Hint: Note that $f^*(0)$ is negative.] (Ref: Frank M. White; Third Edition)

3. Consider the flow between two streams moving parallel to other with different velocities. Upstream of the origin ($x < 0$) the streams are separated by a partition. The partition terminates at the origin. Downstream of the origin the streams mix viscous effects changes the velocity profile to a smooth curve.

a) Show that the laminar flow in the mixing region is described by the boundary layer equations.

b) Consider similarity solution of the form $\Psi(x, y) = U' l(x)^y f(\eta), \quad \eta = \frac{y}{l(x)}$. Find $l(x)$ and the differential equation and boundary condition $f(\eta)$ must satisfy.

c) Write a FORTRAN program to solve the differential equation based on the subroutines RUNGE of problem 1. Explain the technique you use to satisfy the boundary conditions.