Exercise 35

Solve the Blasius problem of an unsteady boundary layer flow in a semi-infinite body of viscous fluid enclosed by an infinite horizontal disk at $z = 0$. The governing equation and the boundary and initial conditions are

$$\begin{aligned}
\frac{\partial u}{\partial t} &= \nu \frac{\partial^2 u}{\partial z^2}, \quad z > 0,\ t > 0, \\
u(z,t) &= Ut \quad \text{on } z = 0,\ t > 0, \\
u(z,t) &\to 0 \quad \text{as } z \to \infty,\ t > 0, \\
u(z,t) &= 0 \quad \text{at } t \leq 0,\ z > 0.
\end{aligned}$$

Explain the significance of the solution.