Consider the one-dimensional flow of traffic described by the equation
\[ \frac{\partial \rho}{\partial t} + \frac{\partial f}{\partial x} = 0 \]
where \( \rho \) is the density of cars per unit length of road and \( f \) is the flux of cars at a given \( x \) location. According to Greenberg (1959), data for the Lincoln Tunnel in New York are well described by
\[ f = a \rho \ln \frac{\rho_c}{\rho} \]
where \( a = 17.2 \) mph and \( \rho_c = 228 \) vehicles/mile. This flux function is shown in Figure 1 below.

(a) Provide expressions for the flow velocity, \( V \), and the wave propagation velocity, \( c \). What is the velocity of waves relative to the driver, \( V - c \)?

(b) Classify this equation.

(c) Describe appropriate boundary conditions for this problem.

(d) Sketch how the initial density profile shown in Figure 2 will evolve in time. Will shock(s) form? If so, where?

(e) Construct a stable finite-difference method to solve this equation on a uniform spatial grid.

(f) What is the order of accuracy of your method? Under what conditions is it stable?

(g) How would you extend your method to higher order spatial accuracy?