TOPICS: Domains of influence and dependence.
    Causality and uniqueness. Allowed boundary conditions.
    Examples.

Domain of definition and domain of dependence: where is the solution defined.
Implications for where conditions must be given:
    \( u_t + c(x)u_x = 0 \) in an interval \( a < x < b \).
Causality:
    If \( c(a) > 0 \), BC's needed at \( x = a \), and only then.
    If \( c(b) < 0 \), BC's needed at \( x = b \), and only then.
    Draw characteristics for various example \( c = c(x) \).
Generalize method of characteristics to other first order scalar eqn.:
--- Semilinear.
--- Quasilinear.

Domain of definition of solution does not depend on data for linear.
Semilinear
    Do example: \( xu_x + yu_y = u^2 \), with \( u(x, 1) = F(x) \)
    Domain of definition depends on \( F \) [solution blows up along characteristics when \( F \) not zero].
    Do example \( u_t + cu_x = u^2 \), with \( u(x, 0) = F(x) \).
    Solution not defined for all \( t > 0 \) along characteristics where \( F > 0 \).
Quasilinear
    Characteristics may cross, leading to multiple values.
    Start with \( u_t + c(u)u_x = 0 \) and \( u(x, 0) = F(x) \).
    Solutions by characteristics.
    Implicit form of the solutions.
    Crossing of characteristics.