

- 1) Mathematically describe the shock structure (i.e. when, where, speed) of the following nonlinear Burger's equation with the given initial condition. [100 pts]

$$\frac{du}{dt} + \frac{d}{dx} \left(\frac{1}{2} u^2 \right) = 0$$

$$u(x, 0) = \begin{cases} 2 & x \leq -2 \\ -x & -2 < x < 1 \\ -1 & x \geq 1 \end{cases}$$