Test 1. Solutions: Main Sitting

Problem 1 (6 pts)**.** Consider the first order equation:

$$(t^2+1)\frac{\partial u}{\partial t} - 2tx\frac{\partial u}{\partial x} = 4tx^2, \qquad -\infty < x < \infty,\ -\infty < t < \infty \tag{1.1}$$

(a) Find and sketch the characteristic curves for this equation.

(b) Find the general solution.

(c) Solve IVP for this equation

$$u|_{t=0} = 0 \qquad -\infty < x < \infty. \tag{1.2}$$

Where solution is uniquely defined?

(d) If (1.1) and (1.2) are satisfied only for $1 < x < \infty$, $-\infty < t < \infty$, where solution is uniquely defined?–Draw domain.