Homework #1

Reading Assignment: Chapters 1.1-1.6 and 2.1-2.7

Problems: 1.13, 1.18, 1.27, 2.1, 2.17, 2.34, and 2.62 (HINT: \( \tan \theta \approx \theta \) for small angles)

Answers: 1.27 no, \( ^{\circ}R^{1/2} \cdot \text{in}^2 \cdot \text{s} / \text{ft}^3 \), 0.04 K

2.1 (1) 2-D, unsteady, (2) 2-D, steady, (3) 1-D, steady, (4) 1-D, steady

2.17 \( y = 9/x \ m^2 \), no, \( u = 45 \ m/s \), \( v = -45 \ m/s \), yes

2.34 -4.56 N/m², acts in +x-direction

2.62 dilatant, \( k = 0.0449 \), \( n = 1.21 \), 0.191 N·s/m², 0.195 N·s/m²

Objectives:

1. Define the following terms:
   a. Fluid
   b. Closed system
   c. Control volume or open system
   d. Lagrangian frame of reference
   e. Eulerian frame of reference
   f. Surface forces
   g. Body forces
   i. Shear stress
   j. Normal stress
   k. Viscosity
   l. Non-Newtonian fluids
   m. Surface tension

2. Understand how to use the SI and British Gravitational systems of units.
3. Understand the continuum model for a fluid.
4. Be able to classify a velocity field as one-, two-, or three-dimensional and steady or unsteady.
5. Understand the differences between a pathline, streakline, and streamline and know how to calculate and plot streamlines.
6. Understand the notation for identifying stresses.
7. Know the relationship between density, Specific Gravity, and Specific Weight.
8. Know the relationship between viscosity and shear stress in Newtonian and non-Newtonian fluids.