Solutions to Flow of Fluids Problems

1. **Problem 1:** A pipe carrying water has a diameter of 0.3 m at section 1 and 0.2 m at section 2. If the velocity at section 1 is 3 m/s, determine the velocity at section 2 using the continuity equation.

   Solution: The continuity equation states that for an incompressible fluid, the product of cross-sectional area and velocity remains constant. Therefore, $A_1 v_1 = A_2 v_2$. Given the diameters, calculate the areas A_1 and A_2, then solve for v_2.

   Video Solution: `https://www.youtube.com/watch?v=wykn-JTnacE`

2. **Problem 2:** A water pipeline reduces in diameter from 0.4 m to 0.2 m. If the initial velocity is 2.5 m/s, determine the velocity at the smaller section.

   Solution: Similar to Problem 1, apply the continuity equation $A_1 v_1 = A_2 v_2$. Calculate the areas based on the given diameters and solve for the unknown velocity v_2.

   Video Solution: `https://www.youtube.com/watch?v=DxX6XLEdcAw`

3. **Problem 3:** Water flows in a horizontal pipe with a velocity of 4 m/s and a pressure of 150 kPa. At a constriction, the velocity increases to 6 m/s. Determine the pressure at the constriction using Bernoulli's equation.

   Solution: Bernoulli's equation relates pressure and velocity in a flowing fluid: $P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$. Rearrange to solve for P_2, the pressure at the constriction.

   Video Solution: `https://www.youtube.com/watch?v=xlJYYM5TWoA`

4. **Problem 4:** A reservoir supplies water to a pipe at a height of 15 m. If the pipe discharges freely at ground level, determine the velocity of the exiting water using Bernoulli's equation.

   Solution: Apply Bernoulli's equation between the reservoir surface and the pipe exit. Considering the height difference and assuming negligible initial velocity, solve for the exit velocity v.

   Video Solution: `https://www.youtube.com/watch?v=DagcUlWQTLQ`

5. **Problem 5:** A pipeline carries oil (specific gravity = 0.85). The velocity at point A is 2 m/s with a pressure of 200 kPa, and at point B, the velocity is 5 m/s. Determine the pressure at point B using Bernoulli's equation.

   Solution: Using Bernoulli's equation, account for the change in velocity and the specific gravity of oil to find the pressure difference between points A and B.

   Video Solution: `https://www.youtube.com/watch?v=91LIMdja-bs`