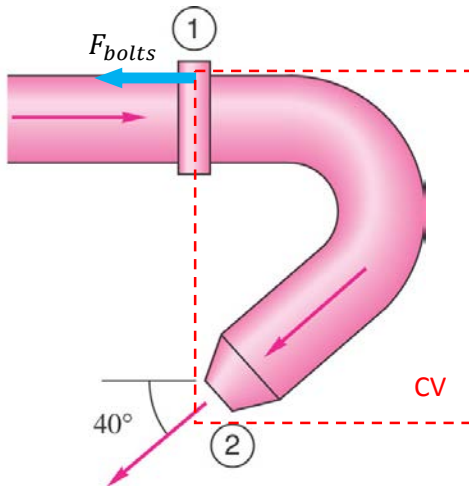NAME

Fluids-ID

Quiz 7. Water at 20°C flows through an elbow and exits to the atmosphere (p_2 = 0 gage). The pipe diameter is D_1 = 10 cm, while D_2 = 3 cm. At a mass flow rate $\dot{m}$ of 15.3 kg/s, the pressure p_1 = 2.3 atm (gage). Neglecting the weight of water and elbow, estimate the <u>horizontal force</u> on the flange bolts F_{bolts} at section 1. (Hint: ρ_{water} = 998 Kg/m³, 1 atm = 101,350 N/m²)

For steady incompressible flow (uniform flow over CS),

Continuity equation:

$$\dot{m} = \rho Q = constant$$

Momentum equation:

$$\Sigma \underline{F} = \sum_{CS} \rho \underline{V}\, \underline{V} \cdot \underline{A}$$

Note: Attendance (+2 points), format (+1 point)