Derivation of Bernoulli's Equation

We consider the energy contributions to a classical fluid by its kinetic energy, gravitational potential energy, and the pressure, where $m = \rho V$:

$$\begin{aligned} E &= E_{\text{kinetic}} + E_{\text{potential}} + E_{\text{pressure}} \\ &= \tfrac{1}{2} m v^2 + mgy + PV \\ &= \tfrac{1}{2} \rho V v^2 + \rho V g y + PV \\ &= V \left[\tfrac{1}{2} \rho v^2 + \rho g y + P \right] \end{aligned}$$

Now we assert that for a section of pipe:

$$E_{\text{in}} = E_{\text{out}}$$

Therefore, dividing out V, assuming $m_{\text{in}} = m_{\text{out}}$ and that the fluid is incompressible (ρ is constant):

$$\tfrac{1}{2} \rho v_{\text{in}}^2 + \rho g y_{\text{in}} + P_{\text{in}} = \tfrac{1}{2} \rho v_{\text{out}}^2 + \rho g y_{\text{out}} + P_{\text{out}}$$