The horizontal pipe shown in the figure has a cross-sectional area of 40.0 cm$^2$ at the wider portions and 10.0 cm$^2$ at the constriction. Water is flowing in the pipe and the discharge from the pipe is $6.00 \times 10^{-3}$ m$^3$/s. The darker fluid in the U-shaped tube is mercury. The density of mercury is $\rho_{Hg} = 13.6 \times 10^3$ kg/m$^3$ and the density of water is $\rho_w = 1.00 \times 10^3$ kg/m$^3$.

a) Find the flow speed at the wide portion of the pipe.

b) Find the flow speed at the constriction.

c) What is the pressure difference between these portions of the pipe?

d) What is the difference in height between the mercury columns in the U-shaped tube?