1. You decide to make a body fat measurement. In this procedure your weight is determined in air and then you exhale to expel (all?) the air from your lungs, and determine your apparent weight while completely submerged under water. Suppose your weight (in mass units) in air is $m_a = 80$ kg and your apparent weight underwater is $m_w = 3.23$ kg.

(a) What is your volume? (2 points)

(b) What is your density? (1 point)

Rewrite and sign the Honor Pledge: *I pledge my honor that I have not violated the Honor Code during this examination.*

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Signature
2. Water fills a reservoir, open to the atmosphere, to height $H = 3\text{ m}$ above the centerline of a horizontal exit pipe at the bottom of the reservoir. The first section of the pipe has radius $r_1 = 1\text{ cm}$, the unknown velocity there is $v_1$ and this section of the pipe has a manometer in which the water rises to an unknown height $h$ above the centerline of the pipe. The second section of the pipe has radius $r_2 = 0.5\text{ cm}$ and the water has unknown velocity $v_2$ in this section of the pipe. This is also the speed with which the water leaves the pipe. Assume the flow is incompressible, frictionless, irrotational, and steady. Also, assume the reservoir is so large compared to the pipe, that the water level in the reservoir is constant, even though water is flowing out the exit pipe.

(a) What is the speed, $v_2$, of the water leaving the exit pipe? (2 points)

(b) What is the speed, $v_1$, in the first section of the pipe? (1 point)

(c) What is the height, $h$, of the water in the manometer? (3 points)

(d) What is the volume flow rate of the water flowing through the exit pipe? (1 point)