9. [10 points] Jennifer is designing a doorknob. The shape of the doorknob is the solid formed by rotating the region bounded by $y = 2 - \cos(2x)$, $y = \frac{1}{4}$, $x = \frac{\pi}{2}$, and the y-axis about the x-axis. Assume the units of x and y are inches.

a. [5 points] Write an integral which gives the volume of the doorknob. Do not evaluate your integral. Circle your answer.

Solution: $\int_0^{\pi/2} \pi[(2 - \cos(2x))^2 - (1/4)^2]\, dx$

b. [5 points] The doorknob is to be made out of a material with constant density δ. The y-coordinate of the center of mass of the doorknob is $\bar{y} = 0$. Write an expression involving integrals which gives the x-coordinate of the center of mass of the doorknob. Do not evaluate your expression. Circle your answer.

Solution: $\dfrac{\int_0^{\pi/2} \pi x[(2-\cos(2x))^2-(1/4)^2]\, dx}{\int_0^{\pi/2} \pi[(2-\cos(2x))^2-(1/4)^2]\, dx}$