**3**. [6 points] Sarah is making a bowl on a pottery wheel with a fixed amount of clay. The height of the bowl and the thickness of the walls are related by the following equation:

$$25 = w^2(h^2 + 9),$$

where $h$ is the height of the bowl in inches and $w$ is the thickness of the walls of the bowl in inches. When the bowl is 4 inches tall, the height is increasing at a rate of 0.5 inches per second. How fast is the thickness of the walls changing? Is the thickness increasing or decreasing? **Include units.**

*Solution:* We want to find $\frac{dw}{dt}$. We know that $h = 4$ and $\frac{dh}{dt} = 0.5$. Plugging in $h$ to our initial equation we get:

$$25 = w^2(4^2 + 9) = 25w^2,$$

so $w^2 = 1$, which gives us $w = 1$. We now take the derivative with respect to $t$ on both sides:

$$\frac{d}{dt}(25) = \frac{d}{dt}(w^2(h^2 + 9))$$

Using the product rule, this gives us:

$$0 = 2w\frac{dw}{dt}(h^2 + 9) + w^2 2h\frac{dh}{dt}.$$

Plugging in the values of $w$, $h$, and $\frac{dh}{dt}$ and solving for $\frac{dw}{dt}$:

$$0 = 2(25)\frac{dw}{dt} + 8(0.5)$$

$$\frac{dw}{dt} = \frac{-2}{25}.$$

Since $\frac{dw}{dt}$ is negative, this means the width is decreasing.

**Answer:** (circle one) INCREASING DECREASING at a rate of $\frac{2}{25}$ **in/sec**