Handout 8: An Experimental Test of the Chain Rule

Figure 1 shows a (roughly) spherical lollipop. The relationship between the volume, V, and the radius, r, is also given.

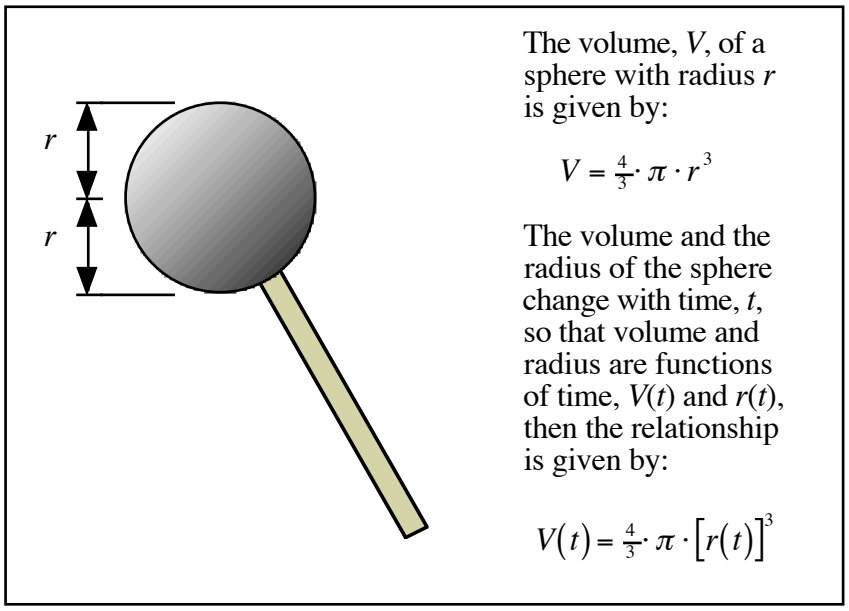

Figure 1: Lollipop and volume formulas.

1. If you were to eat an lollipop like the one shown in Figure 1, you would expect both the radius and the volume of the lollipop to decrease the longer that you sucked. In this situation, the volume could be thought of as a function of time, $V(t)$, and the radius could also be thought of as a function of time, $r(t)$. Find a relationship between the functions $V(t)$ and $r(t)$.

2. Based on the relationship that you have found, how would the derivatives $V'(t)$ and $r'(t)$ be related?

3. Now, you are going to put this theoretical prediction to the test. With the help of a few of your classmates, measure the radius of your lollipop at various times and record the results in the table provided below.

Time sucked (seconds)	Radius of lollipop (mm)	Rate of change of radius (mm/second)	$4\pi r(t)^2 \cdot r'(t)$

4. Use the results that you have recorded to fill in the table given below.

Time sucked (seconds)	Volume of lollipop (cubic mm)	Rate of change of volume (cubic mm/second)

5. Compare the right columns of the two tables. Do the numbers in these columns support the theoretical prediction? Explain why or why not.