

# How Many Licks Does It Take to Get to the Center of a Tootsie® Roll Pop?

In 1931, the famous Tootsie Pop was born. This pop that contains the chewy Tootsie Center was revolutionary because it was the first soft centered lollipop. Over the years Tootsie Pop has itself become part of American history. Enjoyed by kids of all ages, the brand received extra exposure in the 1970's with Telly Savalas, as Kojak, eating Tootsie Pops as he solved crimes.

Tootsie Pops may best be remembered today by consumers trying to answer that question... "Mr. Owl, how many licks does it take to get to the Tootsie Roll center of a Tootsie Pop?" To date, we at Tootsie Roll have answered more than 25,000 letters, each with a response unique to the author. The real answer may never be known...

In this activity we will determine the rate of change of volume of a Tootsie® Roll Pop as you consume it.

## Part 1

- Step 1 Determine the initial radius of the Tootsie® Roll Pop. Assume that it is a perfect sphere.
- Step 2 Place it in your mouth and carefully suck for 30 seconds.
- Step 3 Measure the radius and record your data.
- Step 4 Repeat steps 2 and 3 as many times as possible.

## Part 2

From your data, we want to determine the rate of change in the radius of the Tootsie® Roll Pop for your "mouth power". This may or may not be a constant rate. If it is not constant, model it with some function of time.

Plot L1 as time and put the radius in L2. Plot your data with L1 as the Xlist and L2 as the Ylist. Is your graph almost a straight line? A parabola? Some other function?

## Part 3

Using your answer in Part 2, calculate how fast the volume of the Tootsie® Roll Pop is decreasing when the radius is  $\frac{3}{4}$  its original value.

In your report, include a description of your procedure, including how you measured the radius and any difficulties you had. Include your data and calculations.

- 1 • How much of the Tootsie® Roll Pop is removed per second (in  $\text{cm}^3$ )?
- 2 • If a lick lasts  $\frac{1}{4}$  of a second, how much does each lick remove?
- 3 • How many licks will it take to get to the center of the Tootsie® Roll Pop?
- 4 • A calculus text states that when sucked a Tootsie® Roll Pop gives up volume at the rate of 0.08 milliliters per minute. Based on your experiment, is this estimate reasonable?