

# Lab 08

## Calculus I

11 November 2024, College of the Atlantic

- Please work in groups of two or three
- Please write your answers on this sheet, make a scan of it as a pdf, and upload it google classroom at the end of lab.

Names: \_\_\_\_\_

It is Halloween and you are getting ready to go trick or treating. You have spent a long time on your costume, but you just realized that you don't have a bag into which you can place your trick-or-treating spoils. Plastic bags have been banned in Bar Harbor. Your supply of canvas tote bags has been raided by your friends.

Fortunately, you happen to have a paper plate, some scissors, and some tape. You realize that if you cut a wedge out of the paper plate and then join the newly-cut edges together, the paper plate will turn into a cone, which could be use to hold candy. Clearly, you want the resulting cone to have a large a volume as possible.

**What angle wedge should you cut out of the paper plate to maximize the volume of the cone?**

1. Working by hand (without a computer), figure out a formula for  $V(\theta)$ , the volume of the cone as a function of the angle  $\theta$ .
2. Use a computer to plot  $V(\theta)$ . (You'll need to choose a numerical value for the radius of the paper plate.) Does the plot make sense? Does it behave as expected for  $\theta = 0$  and  $\theta = 2\pi$ ?
3. Determine the value of  $\theta$  that maximizes  $V$ . Do this both by looking at the graph and also by finding the derivative, setting it equal to zero, and solving for  $\theta$ . You will likely want to use wolframalpha to help with this.
4. Build an optimal cone using the a paper plate, scissors, and tape.