Title: “BoxProblemReport” Author: “Ayushi Bisaria” Date: “2025-11-12” Format: pdf —

Plotting a Mathematical Function: Box Problem

Starting with a rectangular piece of paper, we can create an open-top box by cutting out equal squares from each of the four corners and folding up the sides. The size of the cut-out squares determines the dimensions and volume of the resulting box. We can explore how the volume changes with different square side lengths by plotting the volume as a function of the cut-out size.

Problem Overview

The original sheet of paper has dimensions of 36 inches by 48 inches. When squares of side length x are removed from each corner, the height of the box becomes x, and the base dimensions become (36 – 2x) by (48 – 2x). This allows us to express the volume as a function of x.

Purpose of the Analysis

The goal is to understand how the volume changes as the side length of the cut-out squares increases. By plotting the volume function, we can determine the side length that produces the maximum box volume and gain insight into the relationship between dimensions and capacity.

What We Can Learn

From this model, we observe that the volume increases up to a certain point before decreasing as x becomes too large, since the base dimensions shrink. This demonstrates the concept of maximizing a function and highlights how mathematical modeling can inform practical design decisions.

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Running Code

```
# Following the Tidyverse Style Guide

volumeOfBox <- function(x){
  #In the problem description, we are asked to assume that we have a standard           #

  volume = 0
  LENGTH = 36
  WIDTH = 48

  volume <- x*(LENGTH-2*x)*(WIDTH-2*x)

  if(runif(volume)<0){
    return("Value of Side Length(x) is too large.")
  }

  return(volume)

}
```