

- Page header (page number and date)
- Project title
- Goal or Purpose
- Preliminary Information (calculations, equipment description, proposed procedure)
- Procedure & tabulation of the data
- Data Reduction (Analysis)

Measure C/D ratio Oct. 10, 2017

Investigation of the relation between the circumference and the diameter of a circle

Goal: Determine the relation between the circumference,  $C$ , and the diameter,  $D$ , of a circle.

Specifically test the hypothesis that

$$C = \pi D.$$

circular

Equipment: Five <sup>circular</sup> objects of different sizes, vernier calipers, plastic ruler, and a long strip of paper.

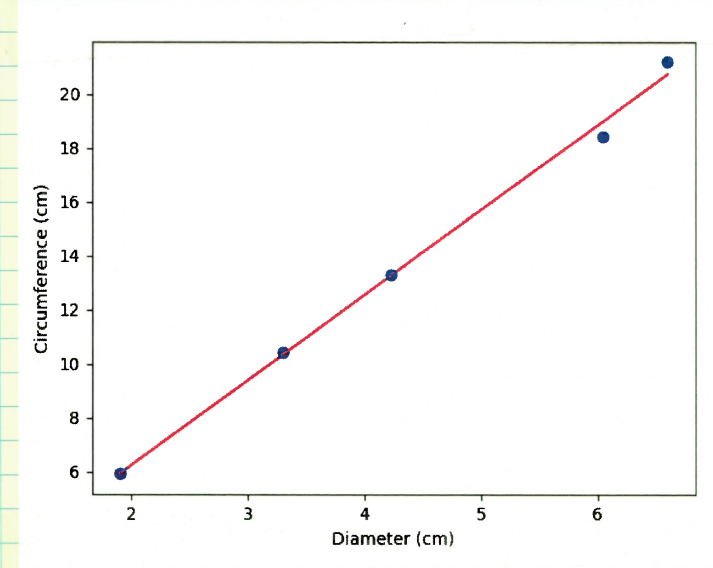
Proposed Procedure: Measure the smaller objects with the vernier calipers and larger objects with the ruler. Measure the circumference by wrapping the paper around the object, marking the circumference on the paper, and measure the distance to the mark by flattening <sup>the distance to the mark</sup> out the paper and measuring <sup>the distance to the mark</sup> with either the calipers or the ruler.

Record of Measurements

Object	D(cm)	C (cm)	Measuring Device
Penny	1.90	5.93	Vornier caliper, paper
"D" cell battery	3.30	10.45	" "
PVC pipe A	4.23	13.30	" "
PVC pipe B	6.04	18.45	Plastic ruler, paper
Soup can	6.6	21.2	" "

Analysis ← Correction: This should be  $C/D$   
 Average  $\text{C/D} = 3.14 \pm 0.03$  The uncertainty was computed by taking the standard deviation of the mean (standard error) of the five ratios.

- Page header (page number and date - every page)
- Data Reduction (Analysis continued)
- Interpretation and results (Summary)



$$\text{Fit slope} = 3.15 \pm 0.11$$

$$\text{Fit intercept} = (0.0 \pm 0.5) \text{ cm}$$

Python  
The program used  
to create the plot  
and do the fit  
is on page 15

### Summary

Both the average C/D ratio and the graphical analysis with the fit confirm the hypothesis that  $c = \pi D$  or  $C/D = \pi = 3.14159\dots$

The calculation of the average C/D ratio also agrees with the result of the graphical analysis.