

# How Long

## Activity

7 8 9 10 11 12



## Problem Statement

Imagine two points randomly placed in a 1 x 1 square on the Cartesian plane. What would be the average length of the line connecting these two points?

## Investigation

### Question: 1.

Determine the range of lengths that would be possible.

### Question: 2.

Estimate the mean length of the line and justify your reasoning.

## Sampling

Load the HOWLONG program onto your calculator. The program provides three options:

- **Observe**

Watch as a series of line segments are generated and their length computed.

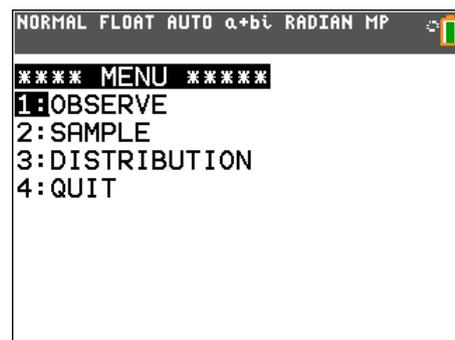
- **Sample**

Generate multiple line segments and record their lengths and compute the mean length.

- **Distribution**

Multiple samples are generated and the mean of each sample is recorded. The results are progressively graphed to show the distribution of the sample means.

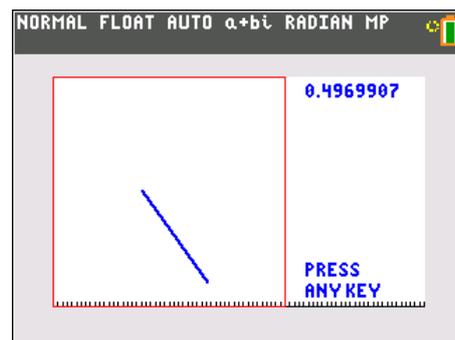
Run the HOWLONG program and select “observe” from the menu.



Generate and record the lengths of 10 line segments using the Observe menu option.

### Note:

The results are not recorded on the calculator. Results must be recorded manually for this section of the program. Press any key to generate the next sample, after all the samples have been generated the program will return to the main menu.



**Question: 3.**

Record the lengths of the 10 randomly generated line segments and calculate the mean.

**Question: 4.**

If more line segments were generated, would this produce a more reliable estimate of the mean?

From the main menu select: Sample

The sample will generate and record the results for the requested number of line segments, compute the sample mean and standard deviation accordingly. Use this menu option to complete the following questions.

```
NORMAL FLOAT AUTO a+b↓ RADIAN MP
SAMPLE SIZE: 10
CALCULATING...
{0.4480419762 0.486519359...
SAMPLE MEAN:
0.5685271761
SAMPLE ST.DEV:
0.2550210222
DATA IN L1
PRESS ANY KEY...
```

**Question: 5.**

Generate a sample of 10 line segments. Repeat this process 6 times and record the mean segment length for each sample.

Sample	1	2	3	4	5	6
Mean						

**Question: 6.**

Generate a sample of 100 line segments. Repeat this process 6 times and record the mean segment length for each sample.

Sample	1	2	3	4	5	6
Mean						

**Question: 7.**

Compare the distribution of the sample means in Questions 5 and 6.

**Question: 8.**

Daisy generates 50 samples and records the mean of the 10 line segments generated in each sample. Which sample distribution will most likely resemble Daisy's, the sample distribution from Question 5 or 6?

**Question: 9.**

Craig generates 50 samples each consisting of the mean of 10 lines segments. Chris generates 50 samples each consisting of the mean 50 line segments. Unfortunately both Chris and Craig were recording their results on scrap pieces of paper. A sample mean of 0.35 was recorded, who is most likely to have generated this sample mean?

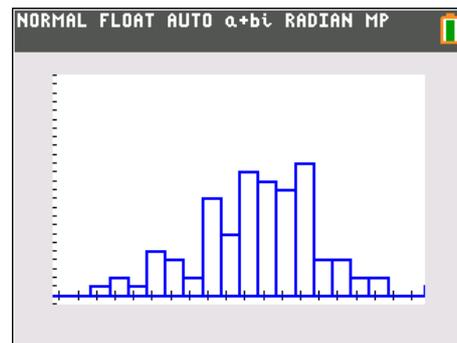
The HOWLONG calculator program can generate multiple samples and record the mean of each.

From the main menu select: Distribution

Multiple samples will be generated; the mean of each sample will be recorded in List 1 (L<sub>1</sub>) and plotted progressively. (Sample opposite)

**Note:**

This is a relatively slow procedure, depending on the quantity of line segments in each sample. For example generating 50 samples each consisting of 100 line segments will take approximately four minutes to generate. Remember that is 5000 line segments and 5000 length calculations for the 10,000 randomly generated points!



**Question: 10.**

Using the distribution option in the program, generate 100 samples each consisting of 10 line segments. Describe the approximate shape of the sampling distribution for the sample means.

Once the large sampling distribution from Question 10 is completed, select the option to exit the program.

Use the [Vars] key on the calculator and locate Y-Vars.

Select the option to switch the Y-Variables on. This will produce a graph to approximate the data.

