

Smoosh Depth vs Object Width - Linear - Lesson 1

#0 - Teacher hands out the following materials to each student

1 block of Play-Doh, 1 ruler, 1 index card, 1 copy of this handout, 1 calculator, 1 pencil

#1 - Teacher explains the information below

In this unit, you'll learn about smooshing in four different ways: through concrete examples, simulations, words, and math symbols. You'll be learning how to create each representation. You'll also learn how to translate from one representation to another.



In our study of smooshing, we are interested in two different numbers: the smoosh depth and the width of the object being smooshed. Here's how those two numbers appear in each of the representations.



CONCRETE

Starting at a *width* of 2.6 cm, the *width* of the object increases at a rate of 1.2 cm per cm of smoosh depth from 0 cm to 5 cm of *smoosh depth*.

SIMULATION

CONCRETE TO MATH



#2 - Teacher plays "Smoosh Math - Concrete to Math - How To" video for class

#3 - Student reads and completes task below

In this section, you'll smoosh some Play-Doh and make some measurements. Follow the instructions below:

- 1. Mold your Play-Doh into a cylinder that is 6 cm high and set it down on a table or desk.
- 2. Place a piece of cardboard on top of the cylinder and measure the distance from the table to the cardboard to ensure that the height is 6cm.
- 3. Measure the width of the cylinder, in cm.
- 4. Make two entries in your data table below. In the top entry of the Smoosh Depth column, enter 0 (since you haven't smooshed anything yet). As the top entry of the Object Width column, enter the width of the Play-Doh you just measured.
- 5. Now press your hand down on the cardboard and smoosh the Play-Doh down 1 cm. When you're finished, the height of the Play-Doh should be 5 cm. Verify this by measuring the distance between the surface and the cardboard.
- 6. Measure the width of the Play-Doh again in cm.
- 7. Make two entries in your data table. As the second entry of the Smoosh Depth column, enter 1 (since you've smooshed the Play-Doh down 1 cm). As the second entry of the Object Width column, enter the width of the Play-Doh you just measured.
- 8. Repeat steps 5-7 four more times, each time pressing the Play-Doh down an additional 1 cm and recording the new smoosh depth and width in the data table.

Smoosh Depth	Object Width
x	f(x)

#4 -Teacher models process below using Wolfram Alpha widget and site



Now it's time to write the function. Take the first pair of numbers in your table and the last pair **HARRY**O'MALLEY and ask WolframAlpha to write a function through those two pairs. If your first pair was (0,4) and your second pair was (5,7.5) you would enter this:



Wolfram Alpha will provide you with two different functions for the data (see below). We will be working with the linear one.

function through (0,4) and (5,7.5)		☆ 🗧
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Input interpretation:		
fit {{0, 4}, {5, 7.5}}		
Least-squares best fits:		
0.7 <i>x</i> +4 (linear) ◀	— Choose the linear one.	Open code / 🖨
$4 - 3.64992 \sin(x)$ (periodic)		
(periodic)		6

Two functions are given.

#5 -Student uses Wolfram Alpha Widget and site to generate function

#6 -Student completes the task below

Write your function below, beginning with "f(x) =". If we were using the function above, we would write f(x) = 0.7x + 4.

Your function: _____

#7 -Teacher explains and models task, then student finishes the task



Using your calculator, find the value of f(0), f(1), f(2), f(3), f(4), and f(5). Place your

answers in the table below. Verify that the values that the function gives are close to the actual values you measured. In other words, convince yourself that the function is reasonable.

Smoosh Depth	Object Width
x	f(x)
0	
1	
2	
3	
4	
5	

CONCRETE TO SIMULATION



#8 - Teacher plays "Smoosh Math - Simulation Introduction" video

#9 - Student completes the task below

In this section, you'll create a simulation of the smooshing you just created. Follow the instructions below:

- 1. Enter 6 as the initial height of the object. Press Enter.
- 2. Enter 5 as the Max Smoosh Depth since that's how much we smooshed it. Press Enter.
- 3. What is the widest that your Play-Doh got? Enter that number as the Max Width. Press Enter.
- 4. Enter your function in the "f(x)=" area. Press Enter.
- 5. Slide the slider back to the beginning, to a value of 0.
- 6. Enter a value of 0 in the "x=" area. Press Enter. This set's the smoosh depth to 0.
- 7. Look at the width of the object. It will appear below the object.
- 8. Record this information in the data table below by placing a 0 in the first row of the smoosh depth column and the corresponding object width in the Object Width column.
- 9. Repeat steps 6-9 for x values of 1, 2, 3, 4, and 5.
- 10. Verify that the data that the simulation produces matches your function's data from the previous page.
- 11. Press the play button to see the smooshing in action.
- 12. Press pause once you're done.

Smoosh Depth	Object Width
x	f(x)
0	
1	
2	
3	
4	
5	

CONCRETE TO WORDS

#10 - Teacher explains task below, then student completes the task

The following sentence shows precise and accurate language to use when describing the width of an object that is being smooshed according to the functions in this module. Fill in the blanks with your information. Then memorize the sentence until you can write it from memory. Then actually write it from memory below it. Only look if you really need to.

Starting at a width of _____ cm, the width of the object increases at a rate of _____ cm per cm of smoosh depth from 0 cm to 5 cm of smoosh depth.