

# Composite Functions

## Summary

Students will analyze a composite function scenario and then produce a poster sheet to demonstrate their answers.

## Group Size

Small Groups

## Materials

Composition Worksheet (see attachment below)  
Graph paper

## Instructional Procedures

### Activating Background Knowledge:

The students will review their knowledge about functions and use proper symbolic notation. The students will need prior knowledge of tables and graphs. The teacher will prompt the students to discuss how functions may represent real life situations. For instance, the pitch of a roof can be described as a linear equation which is a function. The compound interest rate is a function.

### Anticipating Student Response:

The following responses are expected:

Students will make a proportional relationship and solve

Students will break out groups of 10,000 to determine number of doctors:

*44x16 plus the number at the addition years*

Students will chart time, population, number of doctors in a column

Students will graph each data separately and combine into a composite function.

In practice, students gave some unanticipated responses:

740 represented the number of doctors needed for year 0 and then wrote an exponential function.

Students wrote function equations

### Launch:

After the initial introduction of content objective, language objective, vocabulary, and reviewing background knowledge, the teacher will arrange 2-4 students in a group and distribute the Composition Worksheet found in the Materials section of this lesson.

The students will think, pair, and share their thoughts on the first 2 scenarios where they need to write as if they are talking on the telephone. Meanwhile the teacher circulates to hear the discussion and ask students to clarify, explain and elaborate if needed.

Specifically the teacher is looking to see that the students understand the variables and relationships not and don't just state an equation. The teacher is looking to see that students understand that 160,000 represents the number of people in Las Vegas in 1980 and that the equation represents an exponential growth pattern. They should discuss how they know this. The students should explain that the 1.05 represents a 5 % growth per year.

For the second equation the teacher is expecting the students to relate the population to the number of doctors.

### Explore:

The students will be able to spend about 10-15 minutes on each question on the first page during the launch.

The exploratory section will have the students develop a model to represent the scenario to explain how the number of years after 1980 relates to the number of doctors. We would like to learn how to

predict the required number of doctors so that the city is well prepared to handle its growing population.

Students are partnered so there are a different learning styles and level of skills in each group. It is particularly helpful to pair analytical learners with visual learners.

Monitoring student work:

The teacher may ask students to clarify, analyze, reason, and explain their thoughts and strategies to each other.

The teacher will have each student write their thoughts initially then think, pair, share prior to coming to some consensus for their poster paper as a group.

By allowing each group to develop their own strategy the teacher can determine how to compare and contrast the different representations.

If the teacher is concerned about everyone contributing she can give each student five chips. Each time a person speaks on topic they throw a chip into the middle of the table until all the chips are used. Everyone is expected to use all their chips.

Maintaining the level of cognitive demand:

This activity is a student driven activity and too much leading and guiding by the teacher will decrease the cognitive demand of this task.

We discovered an ebb and flow with the cognitive demand so rewriting the composite function to allow students to model instead of requiring a calculator answer for a prediction should help keep the cognitive demand high.

Discuss:

The teacher picks at least 3 very different approaches to the different scenarios for sharing out. The teacher may have one person from each approach present and others in the audience paraphrase or summarize. She can also ask leading questions of other students.

### Strategies for Diverse Learners

- Allow students to work with blocks or manipulatives.

- Use technology.

- Have one student in the group read the problem, then discuss the meaning of the problem and any academic vocabulary.

### Extensions

The teacher may provide another composite function scenario involving different functions.

For instance:

You work 40 hours a week at a furniture store. You receive a \$400 weekly salary, plus a 3% commission on sales over \$5000. Assume that you sell enough this week to get commission. How can you represent the amount of money you earned as a composition of functions?

### Assessment Plan

Formative Assessment:

If we hear the students explaining how changing time affects the population and thus the number of doctors required this would be important. We would also like to see the correct notation and variable letters.

Also see what predictions they may have with their model. What would happen in future years? Pick a date and compare the results from different groups. Do different models yield the same answer? Why or why not?

### Bibliography

This *Making Sense of Sense Making* lesson plan was created by Utah educators.

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