

Algebra 2

Module 4, Inverse Relations & Functions Assignment

Functions are in the world all around us. You have used functions to model phenomena and to make predictions. Mathematically, you can add, subtract, multiply, and divide functions, and you can also create a composition of functions.

A composition of functions occurs when you evaluate one function using another function, or even with the same function. A composition of functions is useful when a change in one function will create a change in another function, which, in turn, affects a third function. For example, suppose that humans build a housing development on land that was previously used as a corn field. This change in land usage causes the number of birds in the area to decrease, which causes the number of mosquitos to increase. You could model the increase in the number of mosquitoes as a function of the number of birds in the area, which is a function of the number of humans that live on that land.

You can also use the composition of functions to show that one function is the inverse of another function. Recall that the graphs of inverse functions are reflections of each other over the line . Think about these ideas as you read through the scenario below.

Last night it started raining as Hibah was closing up the store where she works. By 3 am, the roof of the store developed a small hole and water began to leak onto the sales floor. The water created a circular puddle on the floor. At any time, t , in minutes, the radius of the puddle increases by 0.1 cm. The rain continued through the night, but stopped by the time the morning shift arrived at the store at 7 am.



When the employees arrived at work, the leak and water puddle were discovered. The employees cleaned up the water puddle and placed a tall circular bucket underneath the leak, which was still slowly dripping. The capacity of the bucket can be expressed as $f(x) = 8x^3 + 4x^2 - 6x + 5$. By 10 am, the

amount of water in the bucket is $g(x) = 2x^3 + x^2 - 4x + 7$.

Use the information given to explore some of the mathematical concepts you have practiced so far by answering the questions below.

1. Write a function that describes the area of the water puddle on the floor as a function of its radius. Use function notation.

2. Write a function that represents the radius of the puddle at time t . Use function notation.

3. What is the area of the puddle on the floor when the employees arrive at work at 7 am? Write a composition of functions to help you, and round your answer to the nearest whole number. Explain how you found your answer.

4. What function represents how much more water can be added to the bucket before it overflows? Explain how you solved this problem.

5. At around noon the store roof appears to have stopped leaking, so an employee removes the bucket that was catching the water and does not replace it. Overnight it begins to rain again, and water starts leaking from the ceiling onto the floor, again creating a circular puddle. The hole in the roof is larger this time, so at each time, t , in minutes, the radius of the puddle increases by 0.25 cm. Write a composition of functions to represent the area of the puddle as a function of time.

6. Look at the function you wrote for question 5. Does this function have an inverse? If so, what is it? Is the inverse a function? Show your work and explain your reasoning.