

## Khan's Sequences

**WebQuest Description:** This web quest will allow students to explore natural patterns in our world and students will be able to predict how the pattern continues using sequences.

**Grade Level:** 9-12

**Curriculum:** Math

**Keywords:** Arithmetic sequences, Exponential Growth, Geometric Sequences, Fibonacci Sequence

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### Introduction

Today you will be exploring natural patterns as they occur around us and will be explaining the mathematics behind the patterns. Your focus will be to determine patterns as they occur in different situations and you will be introduced to sequences as a tool to help you analyze the problem. You will then be able to graph exponential growth on a (x,y) plane.&nbsp;

### Tasks

During this Web Quest you will be exploring Three different types of patterns natural worl's. You will first start off by exploring how the population of bacteria grows&nbsp; by tracking the data. You will then&nbsp; be experimenting with finding the bounce ratio of different types of balls to determine the one hundredth bounce height in a closed setting. Lastly you will be introduce to Fibonacci sequence which occurs in the natural world and will map it on different images to show the observable sequence.

### Process

Phase 1: In this portion you and a partner will be observing a video which is titled Bacteria Growth. The video is scaled from 20 minutes to one second so each second in the video is roughly 20 seconds in real life. We will be creating a t chart to organize the growth of the bacteria with one side of the graph being time in seconds and the other side&nbsp; the number of bacteria. After the table has been created you will be going to Desmos.com to create a table by clicking on the "add items" button in the top left corner and clicking on the table.&nbsp; You and your partner will then copy your data on to your chart with x being time and y the bacteria growth as you do this desmos will be graphing your data on an x,y plane.After watching a video on "Writing Exponential Functions from a Table" next you will write the formula generated from your data into desmos and match the results from your table to you exponential equation.You will then predict the growth of the bacteria after 100 seconds both by looking at the graph and algebraically by using the equation you and your partner have found.Phase 2:&nbsp;Many games depend on how a ball bounces. For example, if different basketballs rebounded differently, one basketball would bounce differently off of a backboard than another would, and this could cause basketball players to miss their shots. For this reason, manufacturers have to make ballsâ€™ bounciness conform to specific standards. In this lesson, you will investigate the relationship between the height from which you drop a ball and the height to which it rebounds.Today you and your partner will be joining another group of two to make your group&nbsp; of four people. You will have a recorder, a ball dropper and two spotters to help track the bounce height.&nbsp;First you must find the bounce ratio of the ball you have chosen. After dropping the ball from a height of one meter determine the height after the first bounce. Divide the first bounce height with the initial release height of one meter, this will give a bounce ratio.Imagine that you drop the ball you used&nbsp; from a height of 200 cm, but this time you let it bounce repeatedly.Two students doing exercise. As a team, discuss this situation. Then sketch a picture showing what this situation would look like. Your sketch should show a minimum of 6 bounces after you release the ball. Predict your ballâ€™s rebound height after each successive bounce if its starting height is 200 cm. Create a table on Desmos with these predicted heights. Next watch&nbsp; "Exponential Decay Intro" from Khan Academy and find an equation representing the bounce height.&nbsp;With your equation find the bounce height of the ball on its hundredth bounce if it was released from 500 meters and kept on bouncing regardless of gravity and the release of energy.Phase 3: After watching the "intro to sequences" from Khan Academy you will work with your partner from phase 1 to come up with the sequence for (1,1,2,3,5,8,13,21,34,...)This is the Fibonacci Sequence.Using the Fibonacci Sequence your next task will be to draw a Fibonacci Spiral. After watching the tutorial on how to draw it you must map out the spiral in the natural world. Images will be provided so that you can find the the sequence shoring up in place that you might not have thought about before.

### Evaluation

This is how your work will be graded.

Category and Score	1 Point	5 Points	8 points	10	Score
Completed Project	Did less than half of the project Only did one phase	Completed two phases or needed more work on all three phases	Completed all three phases standard met	All pieces of the project were done to show mastery of the material	10
Math	minimal amount of work was done and equations made no sense	Data entered into Desmos and data was collected	Exponential equations were written and used to find appropriate values	Used their equation to find all of the values and all work was shown	10
Neatness and Organization	Work is messy and incoherent	Project was somewhat organized	All pieces of the project are easy to access and writing is readable	Every aspect of the project is neatly organized and easy to follow	10
Followed direction	Did not follow direction or participate in project	Followed some direction but needed many reminders about behavior	Followed most instruction but was off task less than three times	Followed all direction and was a positive character in class	10
				Total Score	40

## Conclusion

In this lesson you have taken upon yourself to observe how bacteria grows, how a ball will bounce and found the Fibonacci Sequence and then used it. You were able to find patterns in nature, write them mathematically and were able predict future values. You also have developed the skills of rewriting sequences in its explicit form to help determine any n-term of the sequence. We have just worked with three different types of sequences but these skills can be utilized for many more sequences. With more practice you can take your understanding of sequences to the next level.

## Teacher Page

More practice should be provided for students to better grasp sequences.&nbsp;

### Standards

N&#x2013;Q.2, F&#x2013;LE.1cF&#x2013;IF.7eF&#x2013;BF.2 F&#x2013;LE.2

### Credits

### Other