Exploring Geometric Sequences

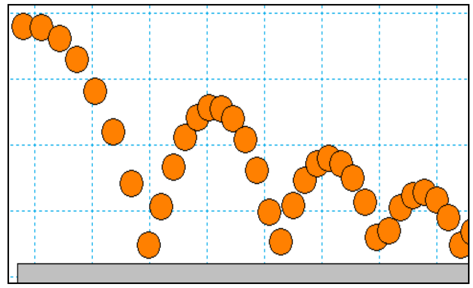
ExploringGeomSequences.tns

Name ______________________

Class ______________________

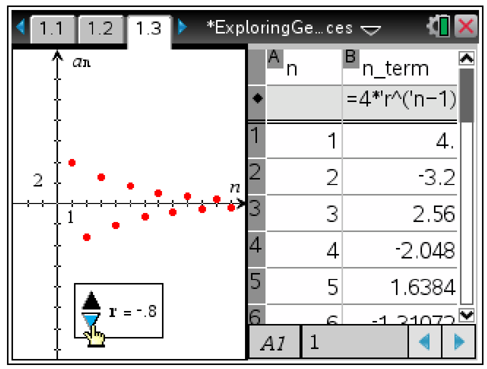
Example of Geometric Sequence

The height that a ball rebounds to after repeated bounces is an example of a geometric sequence. The top of the ball appears to be about 4.0, 2.8, 2.0, and 1.4 units. If the ratios of consecutive terms of a sequence are the same then it is a geometric sequence. The common ratio *r* for these values is about 0.7.



Changing the Common Ratio

Open *ExploringGeomSequences.tns*. On page 1.2, click the up or down arrows next to the value for *r*. Explore what happens when the common ratio changes.



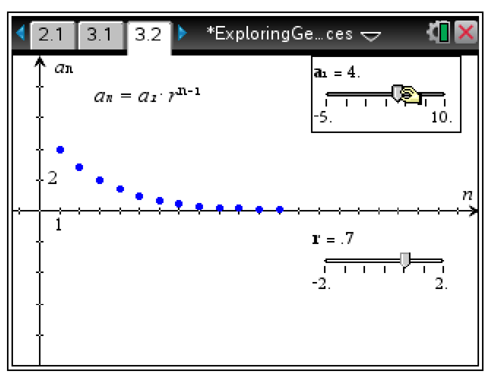
1. What did you observe happens when you change the common ratio from positive to negative? Explain why this happens.

2. When the common ratio is larger than 1, explain what happens to the graph and values of a_n.

3. What *r*-values could model the heights of a ball bounce? Explain your reasoning.

Changing the Initial Value Common Ratio

On page 3.1, use the sliders to explore what happens as a_1 and the common ratio *r* are changed. To make numerical observations, look at the spreadsheet on page 3.3.



4. Explain your observations of what happens when a_1 changes. What is a_1 also known as?

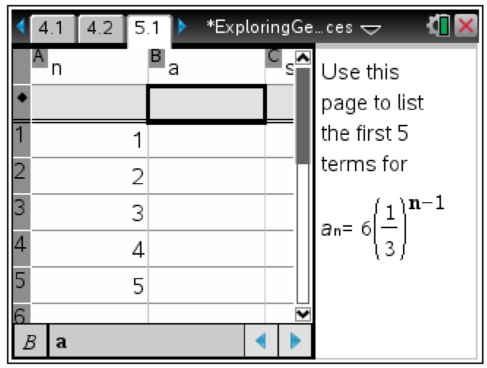
5. If the common ratio is less than –1, describe what occurs to the terms of the sequence.

Deriving and Applying the Partial Sum Formula

Carefully read pages 4.1 and 4.2 about the sum of the finite geometric series.

6. Use the derived formula, $S_n = a_1 \frac{1-r^n}{1-r}$, to find the sum of the example given on page 4.1, $S_6 = 4 + 8 + 16 + 32 + 64 + 128$. Show your work.

On page 5.1, find the first 5 terms of $6\left(\frac{1}{3}\right)^{n-1}$. Arrow over to Column B and up to the grey box under variable *a*. Select **MENU > Data > Generate Sequence**. A dialog box titled "Sequence" will appear asking for a function *u*(*n*).

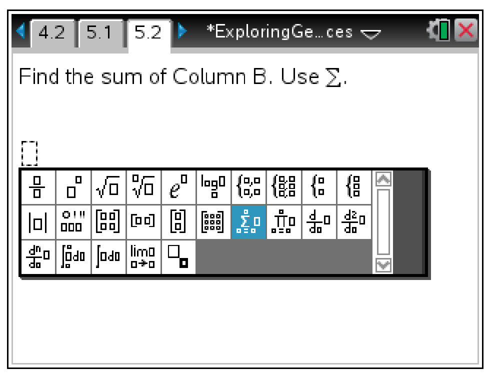


Be sure to include the parentheses around the exponent.

7. The first term occurs when *n* = 1. What should the first term be?

Find the sum a few different ways on the calculator on page 5.2. Use the sigma notation found with the templates ( ). Once the sigma appears use tab to move to the next box. It should appear as $\sum_{n=1}^{5} 6\left(\frac{1}{3}\right)^{n-1}$.

To find the approximate, decimal equivalent, answer, immediately press ctrl + enter.



Finally, use the formula that was derived on page 4.2. Show the formula with the correct values entered in for the variable.

8. What is the sum? Did all your answers agree?

Apply What Was Learned

Use the formula to find the sum of the following finite geometric series AND use at least one other method to confirm your answer. Show work using the formula and write the summation notation.

9. $\frac{1}{7}+\frac{1}{7^2}+\frac{1}{7^3}+\frac{1}{7^4}+\frac{1}{7^5}+\frac{1}{7^6}=$

10. Find S_{25} for $a_n = 2(1.01)^{n-1}$.

11. $64-32+16-8+4-2+1-\frac{1}{2}+\frac{1}{4}-\frac{1}{8}+\frac{1}{16}-\frac{1}{32}+\frac{1}{64}-\frac{1}{128}+\frac{1}{256}=$

Conclusion

Complete the three self-check multiple choice matching questions found on pages 7.2, 8.1, and 9.1.

12. Summarize what you learned about the geometric sequence for varying values of the common ratio.

13. Write out the formula for the sum of a finite geometric series. Explain the variables.