



Accelerated Geometry B/Algebra II

Unit 9: Mathematical Modeling

References

Textbook Connection:
**HMH Analytic Geometry
B/Advanced Algebra Text:**
Unit 6: Module 12 & Unit 10:
Modules 19-22

Every student will receive a text copy and access to the online textbook resource:
<http://my.hrw.com/>

Helpful Links:

- GA Virtual:
<http://cms.gavirtualschool.org/Shared/Math/GSEAdvancedAlgebra/MathematicalModeling/index.html>
- Khan Academy:
<https://www.khanacademy.org/math/algebra2/functions-and-graphs/piecewise-functions-tutorial/v/graphs-of-absolute-value-functions>
- Math Bits Notebook:
<https://mathbitsnotebook.com/Algebra2/Sequences/SSGeometric.html>
- Math Bits Notebook:
<http://mathbitsnotebook.com/Algebra1/FunctionGraphs/FNGTypePiecewise.html>

Dear Parents,

In this unit students will:

- Synthesize and generalize what they have learned about a variety of function families
- derive the formula for the sum of a finite geometric series and use it to solve problems
- Explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying functions
- Identify appropriate types of functions to model a situation,
- Adjust parameters to improve the model,
- Compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit
- Determine whether it is best to model with multiple functions creating a piecewise function

Concepts Students will Use & Understand

- quantitative reasoning
- solving various functions (finding zeros) through factoring, using other algebraic processes, using geometry, or by graphing
- properties of exponents and the associated properties of logarithms
- a working knowledge of geometric vocabulary
- writing explicit and recursive formulas for geometric sequences
- the ability to recall and apply basic algebraic and geometric processes
- an ability to understand mathematics through a variety of representations
- familiarity with technology, particularly the graphing calculator
- prior knowledge and understanding of functions learned earlier in the course, as this is the culminating unit

Vocabulary

- **Geometric Sequence:** is a sequence with a constant ratio between successive terms
- **Geometric Series:** the expression formed by adding the terms of a geometric sequence
- **Recursive:** A type of sequence in which successive terms are generated by preceding terms in the sequence.
- **Sum of a finite geometric series:** The sum, S_n , of the first n terms of a geometric sequence is given by $S_n = \frac{a_1 - a_1 r^n}{1 - r} = \frac{a_1(1 - r^n)}{1 - r}$, where a_1 is the first term and r is the common ratio ($r \neq 1$).
- **Sum of an infinite geometric series:** The general formula for the sum S of an infinite geometric series $a_1 + a_2 + a_3 + \dots$ with common ratio r where $|r| < 1$ is $S = \frac{a_1}{1 - r}$. If an

☐ Wolfram Math World:
<http://mathworld.wolfram.com/GeometricSeries.html>

☐ Purple Math:
<http://www.purplemath.com/modules/series5.htm>

infinite geometric series has a sum, i.e. if $|r| < 1$, then the series is called a **convergent** geometric series. All other geometric (and arithmetic) series are **divergent**.

For further help:

<http://intermath.coe.uga.edu/dictionary/homepg.asp>

<http://www.amathsdictionaryforkids.com/>

Sample Practice Problems

1. The price of dance lesson depends upon the number of lessons that you select. If x is the number of lessons then the fee for the lessons (in dollars) can be found using the piecewise function

$$f(x) = \begin{cases} 40x & \text{if } 0 < x \leq 4 \\ 30x & \text{if } 4 < x \leq 8 \\ 25x & \text{if } x > 8 \end{cases}$$

The lessons are increasing by 10% per lesson with a \$5 processing fee for each student. What is the new function for the cost of lessons?

$$f(x) = \begin{cases} 44x + 5 & \text{if } 0 < x \leq 4 \\ 33x + 5 & \text{if } 4 < x \leq 8 \\ 27.5x + 5 & \text{if } x > 8 \end{cases}$$

2. Use the function $f(x) = \sqrt[3]{5x}$ to answer the following questions:
What is the domain & range?

Domain: all real numbers; Range: all real numbers

What is the inverse of $f(x)$?

$$f^{-1}(x) = \frac{x^3}{5}$$

What is the domain and range of the inverse function?

Domain: all real numbers; Range: all real numbers

Over what line does the function and its inverse reflect across on the coordinate plane?

$y = x$

3. Identify the axis of symmetry, vertex, intercepts, domain, range, slope, and max/min of the following absolute value function:

$$f(x) = |x| + 3$$

A.O.S: $x = 0$; Vertex: $(0, 3)$; x -intercept: none; y -intercept: 3; Domain: all real numbers; Range: $y \geq 3$; Left Slope: - 1; Right Slope: 1; Minimum: 3