Accelerated Geometry B/Algebra II
Unit 8: Exponential & Logarithmic Functions

References

Textbook Connection:
HMH Georgia Analytic Geometry B/Advanced Algebra Text:
Unit 8: Modules 15 & 16

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/ExponentialAndLogarithms/index.html
- ☐ Logarithmic Functions: http://mathbitsnotebook.com/Algebra2/Exponential/EXLogFunctions.html
- ☐ Khan Academy: https://www.khanacademy.org/math/algebra2/exponential_and_logarithmic_func
- ☐ Purple Math: http://www.purplemath.com/modules/graphlog.htm
- ☐ The Math Page: http://www.themathpage.com/aprecalc/logarithmic-exponential-functions.htm

Dear Parents,

Students extend their work with exponential functions to include solving exponential equations with logarithms. They analyze the relationship between these two functions.
In this unit students will:

- Review exponential functions and their graphs
- Explore exponential growth
- Develop the concept of a logarithm as an exponent along with the inverse relationship with exponents
- Define logarithms and natural logarithms
- Develop the change of base formula
- Develop the concept of logarithmic function
- Solving problems relating to exponential functions and logarithms

Concepts Students will Use & Understand

- The concept of a function
- Various representations of functions
- Exponential functions and characteristics of their graphs
- The solution of linear equations using algebra and graphing approaches
- Familiarity with graphing technology
- Use patterns to write a function to model a situation

Vocabulary

- **Asymptote:** An asymptote is a line or curve that approaches a given curve arbitrarily closely. A graph never crosses a vertical asymptote, but it may cross a horizontal or oblique asymptote.
- **Common logarithm:** A logarithm with a base of 10. A common logarithm is the exponent, *a*, such that $10^a = b$. The common logarithm of *x* is written *log x*. For example, *log 100* = 2 because $10^2 = 100$.
- **Continuously compounded interest:** Interest that is, theoretically, computed and added to the balance of an account each instant. The formula is $A = Pe^{rt}$, where *A* is the ending amount, *P* is the principal or initial amount, *r* is the annual interest rate, and *t* is the time in years.
- **Compounded interest:** A method of computing the interest, after a specified time, and adding the interest to the balance of the account. Interest can be computed as little as once a year to as many times as one would like. The formula is $A = P\left(1 + \frac{r}{n}\right)^{nt}$ where *A* is the ending amount, *P* is the principal or initial amount, *r* is the annual interest rate, *n* is the number of times compounded per year, and *t* is the number of years.
- **Exponential functions:** A function of the form $y = a^x$ where $a > 0$ and $a \neq 1$.
- **Logarithmic functions:** A function of the form $y = \log_b x$ with $b \neq 1$ and *b* and *x* both positive. A logarithmic function is the inverse of an exponential function. The inverse of $y = b^x$ is $y = \log_b x$.

- **Logarithm:** The logarithm base *b* of a number *x*, $\log_b x$, is the exponent to which *b* must be raised to equal *x*.
- **Natural exponential:** Exponential expressions or functions with a base of *e*; i.e., $y = e^x$.
- **Natural logarithm:** A logarithm with a base of *e*. $\ln b$ is the exponent, *a*, such that $e^a = b$. The natural logarithm of *x* is written *ln x* and represents $\log_e x$. For example, *ln 8 = 2.0794415…* because $e^{2.0794415\ldots} = 8$.

For further help:

http://intermath.coe.uga.edu/dictnary/homepg.asp

http://www.amathsdictionaryforkids.com/

Sample Practice Problems

1) State the domain and range for $f(x) = -2^x + 4$

D: all real numbers; R: $y < 4$

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2) State the domain and range for $3\log_5 x$

D: $x > 0$; R: all real numbers

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3) Solve $2(3)^{2x} = 5$

$x = 0.417$

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4) Solve $5\log(x-2) = 11$

$x = 160.49$

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5) Identify asymptotes, y-intercept and point of maximum growth: $y = \dfrac{2}{1+e^{-2x}}$

Asymptotes: x-axis and y=2; y-intercept (0,1); maximum growth is at (0,1)

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6) Find the inverse of the function $y = \log_6 x$

$y = 6x$

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7) The value of a new car purchased for $24,900 decreases by 10% per year. Write an exponential decay model for the value of the car. After about how many years will the car be worth half its purchase price?

$V(t) = 24{,}9000(0.90)t$; about 6.58 years

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8) You deposit $4,000 in an account that pays 7% annual interest compounded continuously. Find the balance at the end of five years.

$5,676.27