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 $y = \log_b x$. 

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:

- Khan Academy: https://www.khanacademy.org/math/algebra2/exponential_and_logarithmic_functions
- Purple Math: http://www.purplemath.com/modules/graphlog.htm
Sample Practice Problems

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

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

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

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

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

   $x = 0.417$

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

   $x = 160.49$

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

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

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

   $y = 6x$

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?

   $V(t) = 24,900(0.90)^t; \text{ about 6.58 years}$

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

   $\$5,676.27$