Curriculum Sample: HS Math: Functions
Max. 8 Pages

Grade Level	High School (12th)	**Content Area**	Math
Course Title (grades 9-12 Only)	AP Calculus AB		
Length of Unit	Five 55-minute periods	**Time of Year**	Third Quarter
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	Students will have an understanding of what inverse functions are and how they are used. They will also have knowledge of algebraic properties of exponents and exponential graphs.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	The school's program of instruction stresses alignment with research-supported instructional techniques of Hunter's Essential Elements of Instruction. Instruction during this unit will include direct instruction of key points and examples, guided practice including worksheets and partner activities, independent practice, and daily formative assessments conducted at the end of each class period.		
Standard Number and Description *List the Number* and full description for the required Standard.*	F-BF.5 **Conceptual Category:** Functions **Domain:** Building Functions (F-BF) **Standard:** #5 – Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.		
Summative Assessment *Describe a cumulative and comprehensive activity, clearly separate from instruction and guided or independent practice, which allows each student to individually demonstrate mastery of the required Standard. A copy of the summative assessment must be attached to the curriculum sample.*	Students will complete a 10 question multiple-choice summative to assess their ability at understanding the relationship between logarithms and exponents. They will also use this understanding to solve problems involving logarithms and exponents.		
Scoring Scale and Mastery Level *Explain how the assessment is scored, to include points per question, how points are awarded, total points possible, criteria necessary to demonstrate mastery, and grading scale. A copy of the answer key and*	The 10 multiple-choice questions will be scored on an absolute scale with an answer key provided for the correct answers. Credit will only be awarded for answers that completely match the answer key, and no partial credit will be awarded. Students must get at least 8 of the 10 questions completely correct to master the standard.		

scoring rubric (whichever applicable) must be attached to the curriculum sample.	
Materials/Resources Needed	Poster board, construction paper, white boards, markers.

* ***Standard Number****: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

Lesson (add as needed	**Instruction**	**Student Activities**
1	SWBAT find the inverse of an exponential function Key Points: • The general form for an exponential equation is $y = ab^x$ • A function is written using $f(x)$ and the inverse of a function uses $f^{-1}(x)$ • Given the exponential function $f(x) = x^m$ the inverse function is $f^{-1}(x) = x^{1/m}$ • To find the inverse of an exponential function, flip the exponent and rewrite the new function (ie: the inverse of the function $f(x) = x^2$ is $f^{-1}(x) = x^{1/2}$)	Do Now: Students will review basic concepts of functions and inverse functions. Guided Practice: Students will participate in a matching game. They will be given note cards with different functions and inverse functions. Students will then have to stand up and find other students with the corresponding function or inverse functions. Students will then write their answers on a worksheet. Independent Practice: Students will create a poster that explains how to find the inverse of an exponential function. Exit Ticket: Students will participate in a gallery walk and comment on other students' posters.
2	SWBAT understand the inverse relationship between logarithms and exponents Key Points: • A logarithm is the inverse of an exponential function • A logarithm is said to have a base, b, and is denoted as $\log_b y = x$ • Since a logarithm is the inverse of an exponential function, $\log_b y = x$ is the same as $b^x = y$ • The logarithm with base 10 is referred to as the common logarithm and is often written without the base (ie: $\log y$)	Do Now: Students will review basic concepts of exponential functions and their inverses. Guided Practice: Students will receive a worksheet with multiple example problems. Each student will complete a problem and then check their answers with a partner. Independent Practice: Students will be given white boards and markers. The teacher will put a problem on the board and the students will solve it independently. Each student will receive one point for getting the problem correct. Exit Ticket: Students will answer the following questions: What is the relationship between logarithms and exponents? What's an example of a logarithm? What's an example of an exponential function?
3	SWBAT evaluate logarithmic expressions Key Points:	Do Now: Students will review perfect squares and complete a table that will be used during today's lesson.

	• When evaluating a logarithmic expression, first put it in exponential form (ie: $\log_2 \frac{1}{4}$ becomes $2^x = \frac{1}{4}$) • Then, use problem-solving skills and multiplication to discover the answer (think about what value x needs to be so that 2^x equals $\frac{1}{4}$. In this case, $x = -2$) • Rewrite in both logarithmic and exponential form (ie: $\log_2 \frac{1}{4} = -2$ and $2^{-2} = \frac{1}{4}$)	Guided Practice: Students will receive a worksheet with multiple example problems. Each student will complete a problem and then check their answers with a partner. Independent Practice: Students will create a brochure outlining the steps needed to evaluate logarithmic expressions. Students will create and solve example problems for the brochure. Exit Ticket: Students will be asked to complete 3 problems correctly before leaving the classroom. Teacher will stamp their exit tickets.
4	SWBAT evaluate logarithmic expressions and simplify using properties of logarithms Key Points: • This is a continuation of yesterday's lesson along with some additional new material • New properties: 1. Logarithm of 1: $\log_b 1 = 0$ 2. Logarithm of the base: $\log_b b = 1$ 3. Inverse Property: $\log_b b^x = x$	Do Now: Students will review their homework and check their answers with a partner. Guided Practice: Students will receive a worksheet with multiple example problems. Each student will complete a problem and then check their answers with a partner. Independent Practice: Students will create a 10 question multiple-choice quiz that reviews the material covered up to this point. Once completed, they will trade quizzes with another student and check each other's answers. Exit Ticket: No exit ticket today.
5	SWBAT understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. Key Points: • This is a continuation of yesterday's lesson and reviews the key concepts learned so far in the unit	Do Now: Students will complete a brief review worksheet that summarizes everything learned thus far. Guided Practice: Students will share their answers from their quizzes and ask any remaining questions. Independent Practice: Student assessment. Exit Ticket: Summative assessment.

Paste Summative Assessment Here:

1. Find a formula for the inverse function $f^{-1}(x)$ of the given function $f(x) = x^9$

   a. $f^{-1}(x) = x^3$

   b. $f^{-1}(x) = x^{1/9}$

   c. $f^{-1}(x) = x^{9/1}$

   d. $f^{-1}(x) = x^{1/3}$

2. Which of the below is the general form of an exponential function?

   a. y = abx

   b. a = b^{xy}

   c. y = ab^x

   d. b = ya^x

3. Write the logarithmic equation $\log_4 16 = 2$ in exponential from.

   a. $4^{16} = 2$

   b. $4^2 = 16$

   c. $2^{-4} = 16$

   d. $2^4 = 16$

4. Write the equation $\log_{32} 8 = \frac{3}{5}$ in exponential form.

   a. $32^{\frac{3}{5}} = 8$

   b. $8^{\frac{3}{5}} = 32$

   c. $\left(\frac{3}{5}\right)^{32} = 8$

   d. $8^{\frac{5}{3}} = 32$

5. Write the equation in logarithmic form. $6^4 = 1,296$

   a. $\log_6 1,296 = 4$

   c. $\log 1,296 = 4 \cdot 6$

b. $\log 1,296 = 4$

d. $\log_4 1,296 = 6$

6. Write the equation in logarithmic form. $125^{\frac{4}{3}} = 625$

a. $\log_{\frac{4}{3}} 625 = 125$

c. $\log_{125} 625 = \frac{4}{3}$

b. $3\log_4 625 = 125$

d. $\log_{625} 125 = \frac{3}{4}$

7. Write the exponential equation $2^3 = 8$ in logarithmic form.

a. $\log_3 8 = 2$

c. $\log_2 3 = 8$

b. $\log_2 8 = 3$

d. $\log_8 2 = 3$

Evaluate the logarithm.

8. $\log_5 \frac{1}{625}$

a. –3 b. 5 c. –4 d. 4

9. $\log_3 243$

a. 5 b. –5 c. 4 d. 3

10. Describe the relationship between logarithms and exponents.

Paste Answer Key/Scoring Rubric Here:

1. b
2. c
3. b
4. a
5. a
6. c
7. b
8. c
9. a
10. Logarithms and exponents are inverses.