Curriculum Sample Template

Max. 8 Pages

Grade Level	12	**Content Area**	Math
Course Title (grades 9-12 Only)	AP Calculus		
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	Prior to the lesson, students should be able to factor polynomial expressions, have experience with natural logarithmic and exponential functions, and be able to use the inverse relationship of exponents and logarithms to solve equations and inequalities.		
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.*	Within this Calculus unit plan, a heavy emphasis is placed upon Blended Learning using videos. These blended activities have been carefully considered and many come directly from the acclaimed website Khan Academy. These Blended Learning techniques apply to Tier 1 instruction but can further be applied to Tier 2. As an calculus unit, the content itself is aligned to STEM. Kagan cooperative strategies (individual whiteboards, centers, gallery walks) and Marzano high yield instruction strategies (objective driven vocabulary) are also built into these lessons.		
Standard Number and Description *List the Number* and the full description for the Required Standard or Science Performance Objective listed in section A.6.*	F-LE.4 For exponential models, express as a logarithm the solution to $ab^{ct}=d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.		
Materials/Resources Needed	Mimeo board. Students will need access to the internet for blended learning lessons. Individual Whiteboards. Expo Markers for students.		

* ***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)	**Instructional Strategies**	**Student Activities**

1	**Objective:** Simplify logarithmic expressions using their properties. **Key Points:** • If $n^x = a$, the logarithm of a, with n as the base, is x. • Symbolically, $\log_n a = x$. **Flipped Classroom/Blended Learning:** https://www.khanacademy.org/math/algebra/logarithms-tutorial/logarithm_basics/e/logarithms_1 **Activation of Prior Knowledge:** Teacher will ("TW") ask students to discern the differences between a linear chart and a logarithmic chart I**ntroduction to New Material ("INM")/Modeling**: TW illustrate the key points with example problems on the Mimeo board. TW reference the key points when introducing examples. **Guided Practice**: TW pass out whiteboard to students. TW put 10 equations on the board, SW simplify the logarithmic expressions on their individual whiteboards. If less than 80% of the classroom answer correctly, TW model the correct method for simplifying the logarithm. **Independent Practice:** TW introduce 10 example problems on the board. SW complete the activity, simplifying each logarithm in their interactive notebook. SW must achieve 80% correct or better to master the objective. TW monitor student progress and answer and clarifying questions. **Assessment:** TW pass out a simplifying logarithms quiz. 10 questions worth 1 point each. SW must correctly answer 8/10 questions to master the objective.	Students will ("SW") open their interactive notebooks to a new page and write the objective and key points. SW look up any unknown vocabulary in their math glossary, write the definitions, and rewrite the definitions in their own words. SW participate in the blended learning activity, write down all examples, and prepare questions for class. SW actively listen while their classmates discern the differences between linear and logarithmic charts. SW actively listen while the teacher introduces logarithms. SW engage in the whiteboard activity, answer all teacher questions, and make reference the key points in their answers. . SW participate in the independent practice activity and justify answers while referencing the key points. SW complete the assessment activity and justify the answers using key points.
2	**Objective:** Identify, write & evaluate logarithmic functions (as inverse exponential functions). **Key Points:** • The inverse function is the natural logarithm: ln(x) **Flipped Classroom/Blended Learning:** http://www.youtube.com/watch?v=uQpZZPGcNNs **Activation of Prior Knowledge:** TW ask students to simplify logarithmic expressions. I**NM/Modeling**: TW illustrate the key points with example problems on the Mimeo board. TW reference the key points when introducing	SW open their interactive notebooks to a new page and write the objective and key points. SW look up any unknown vocabulary in their math glossary, write the definitions, and rewrite the definitions in their own words. SW participate in the blended learning activity. SW take notes from the video and copy down all example problems. SW simplify logarithmic expressions in their interactive notebooks. SW actively listen while the teacher introduces writing and evaluating logarithmic functions as inverse exponential functions.

	examples. **Guided Practice**: TW direct students through a gallery walk. TW put 5 questions at each location, SW solve in their interactive notebooks. TW model the correct method for solving the problems and participating in the gallery walk. **Independent Practice:** TW put 5 questions on the Mimeo board. SW answer to the best of their ability in their interactive notebooks. **Assessment:** TW pass out a logarithmic functions quiz. 10 questions worth 1 point each. SW must correctly answer 8/10 questions about finding the inverse of logarithmic functions to master the objective.	SW engage in the gallery walk activity, answer all teacher questions, and make reference the key points in their answers. . SW participate in the independent practice activity and justify answers while referencing the key points. SW complete the assessment activity and justify the answers using key points.
3	**Objective:** Solve exponential & logarithmic equations using technology **Key Points:** • If $n^x = a$, the logarithm of a, with n as the base, is x. • ($\log_n a = x$) • Inverse function is the natural logarithm: ln(x) **Activation of Prior Knowledge:** TW ask students to reference the key points from the last two lessons. I**NM/Modeling**: TW illustrate the key points with example problems on the Mimeo board. TW reference the key points when introducing examples. TW provide real work examples and use a think aloud activity to make the connection to previous lessons. **Guided Practice**: TW direct students through a centers activity. TW put 4 questions at each location, SW solve in their interactive notebooks using their graphing calculators. TW model the correct method for solving the problems and participating in the centers. **Independent Practice:** TW put 12 questions on the Mimeo board. SW answer to the best of their ability in their interactive notebooks. SW use their calculators and round accordingly. **Assessment:** TW pass out a quiz. 10 questions worth 2 points each. SW must correctly answer 8/10 questions to master the objective.	SW open their interactive notebooks to a new page and write the objective and key points. SW look up any unknown vocabulary in their math glossary, write the definitions, and rewrite the definitions in their own words. SW actively think about the key points from the last lesson. SW actively listen while the teacher introduces the key points and real world examples. SW engage in the centers activity, answer all teacher questions, and make reference the key points in their answers. . SW participate in the independent practice activity and justify answers while referencing the key points. SW complete the assessment activity and justify the answers using key points.
4	TW instruct students to complete the summative assessment.	SW complete the summative assessment.

Summative Assessment Items: *Attach here.* For each summative assessment item, include an answer key or scoring rubric describing how points are to be awarded.

Two Points Each

Simplify logarithmic expressions using their properties.

Write the following expressions as simple logarithms

1. $\log_3 4 - \log_3 2$

a. $\log_3 2$ b. log42 c. log2 d.log4

2. $5\log_\delta q + 2\log_\delta y$

a. $\log_\delta(q^5y^2)$ c. $\log_\delta\left(q^5 + y^2\right)$

b. $(5+2)\log_\delta\left(q+y\right)$ d. $\log_\delta\left(qy^{5+2}\right)$

Expand the logarithmic expression

3. $\log_3 11p^3$

a. $\log_3 11 \cdot 3\log_3 p$ c. $\log_3 11 + 3\log_3 p$

b. $\log_3 11 - 3\log_3 p$ d. $11\log_3 p^3$

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

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

b. $4^2 = 16$ d. $2^4 = 16$

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

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

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

b. $3\log_4 625 = 125$

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

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

7. Solve $\log 3x + \log 9 = 0$. Round to the nearest hundredth if necessary.

a. 0.33 b. 0.04 c. 3 d. 27

8. Solve $2\log 4 - \log 3 + 2\log x - 4 = 0$.

a. 12.3308 b. 43.3013 c. 86.6025 d. 1875

9. Solve $\ln(2x - 1) = 8$. Round to the nearest thousandth.

a. 1,489.979 b. 2,979.958 c. 2,981.458 d. 1,490.979

Answer Key:

Write the following expressions as simple logarithms

1. $\log_3 4 - \log_3 2$ (A)

a. $\log_3 2$ b. log42 c. log2 d.log4

2. $5\log_b q + 2\log_b y$ (A)

a. $\log_b(q^5 y^2)$

b. $(5 + 2)\log_b(q + y)$

c. $\log_b(q^5 + y^2)$

d. $\log_b(qy^{5+2})$

Expand the logarithmic expression

3. $\log_3 11p^3$ (C)

a. $\log_3 11 \cdot 3\log_3 p$
b. $\log_3 11 - 3\log_3 p$
c. $\log_3 11 + 3\log_3 p$
d. $11\log_3 p^3$

4. Write the logarithmic equation $\log_4 16 = 2$ in exponential from. (B)

a. $4^{16} = 2$
b. $4^2 = 16$
c. $2^{-4} = 16$
d. $2^4 = 16$

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

a. $\log_6 1,296 = 4$
b. $\log 1,296 = 4$
c. $\log 1,296 = 4 \cdot 6$
d. $\log_4 1,296 = 6$

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

a. $\log_{\frac{4}{3}} 625 = 125$
b. $3\log_4 625 = 125$
c. $\log_{125} 625 = \frac{4}{3}$
d. $\log_{625} 125 = \frac{3}{4}$

7. Solve $\log 3x + \log 9 = 0$. Round to the nearest hundredth if necessary. (B)

a. 0.33 b. 0.04 c. 3 d. 27

8. Solve $2\log 4 - \log 3 + 2\log x - 4 = 0$. (B)

a. 12.3308 b. 43.3013 c. 86.6025 d. 1875

9. Solve $\ln(2x-1) = 8$. Round to the nearest thousandth. (B)

a. 1,489.979 b. 2,979.958 c. 2,981.458 d. 1,490.979

Total: _____/18; Grading Scale: 0-13=Incomplete; 14=C; 15-16=B; 17-18=A. 80%=Mastery.