**Curriculum Sample Template**
Max.8Pages

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| **Grade Level** | 12 | **Content Area** | Mathematics |
| **Course Title** (grades9-12Only) | Pre-Calculus/Trigonometry | | |
| **Expected Prior Knowledge**<br>*The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.* | Students are expected to be able to find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. | | |
| **Alignment to Program of Instruction**<br>*Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.* | As project based learning is a key feature in the school's mission, students will apply knowledge gained in math to complete projects and solve real world issues, and some may even be cross curricular. Lessons are aligned to both the program of instruction and common core standards by scaffolding knowledge, engaging students and requiring them to use higher depths of knowledge to demonstrate mastery and solve real world problems. | | |
| **Standard Number and Description**<br>*List the Number* and full description for the required Standard.* | F.LE.4<br>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** | All required class worksheets and tests, TI-83 calculator, poster board. | | |

****StandardNumber**:ForEnglishLanguageArts(ReadingandWriting),useGrade,Strand,Standard(e.g.,3.RI.2).ForK-8Math,useGrade,Domain,Standard(e.g.,6.EE.7).ForHSMath,useConceptualCategory-Domain,Standard(e.g.,A-REI.6).ForScience,useGrade,Strand,Concept,PO(e.g.,4.1.3.1).*

| **Lesson** (add as needed | **Instruction** | **Student Activities** |
|---|---|---|
| **1** | **Objective: SWBAT express an exponential function 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.**<br>Teacher introduces the standard and explains it can be used to measure exponential growth or decay. Teacher leads brainstorming activity in which students brainstorm for two minutes as many possible uses as they can. Teacher then writes these on the board and discusses possible applications. Teacher completes 5 example problems on the board and instructs students to take notes in math notebook, and graph solution on graphing calculator. Teacher then facilitates guided practice, as students complete practice problems and are guided by teacher as needed. | Students will brainstorm for two minutes as many applications as possible for using an exponential logarithm, and participate in a web drawn on the board. Student will take notes as teacher shows how to express an exponential function as a logarithm, and then follow along with teacher and class to graph the function on a calculator. Students take notes in their math notebooks.<br>Students will complete practice problems and request assistance as needed. |
| **2** | **Objective: SWBAT 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.**<br>Teacher instructs to recall the steps of expressing an exponential logarithm, students share their answers. Teacher assigns first summative assessment, distributing assignment instructions and rubric, in which students complete an extended writing response explaining in detail what an exponential logarithm is, how it can be applied, and how one would express the logarithm both mathematically and using a calculator. Teacher will remind students to write out step by step instructions. | Students will participate in the recollection of how to express an exponential logarithm. Students will complete the first summative assessment, an extended writing response, during the entire class period. Students will explain in detail what an exponential logarithm is, how it can be applied, and how one would express the logarithm both mathematically and using a calculator, describing this in step by step detail. Students will compare their work to the rubric before turning in assessment. |

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| **3** | **Objective: SWBAT Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.**<br>Teacher will assign students the second summative assessment in which students will complete a project and create a poster board detailing their data and graph. Teacher will distribute assessment instructions and rubric in which they will choose one source to collect data (either mortgage interest from a parent/relative, loan interest data, population increase of a region data, radioactive decay data of a specific location such as Chernobyl, or earthquake magnitude data.) Teacher will instruct students express as an exponential logarithm and graph it, and then demonstrate this on a poster board. | Students begin their second summative assessment, in which they will collect data and create a poster. Students will choose from several different data sources (either mortgage interest from a parent/relative, loan interest data, population increase of a region data, radioactive decay data of a specific location such as Chernobyl, or earthquake magnitude data.) Students will express this data as an exponential logarithm, graph it, and then display this knowledge on a poster board. |
| **4** | **Objective: SWBAT 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.**<br>Teacher will distribute third summative assessment, a written comprehensive assessment. | Students will complete a written comprehensive summative assessment during the entire class period. |

***1. Extended Writing Assessment***

Directions: Complete an extended writing assessment in which you explain what and exponential logarithm is, types of applications exponential logarithms can be used for and also how you solve them. This should be step by step instructions that can be applied to all types of exponential logarithms.

| Category | Level 4:<br>Achieves Standards at a<br>High Level | Level 3:<br>Performance at Standard | Level 2:<br>Performance below<br>Standard | Level 1:<br>Demonstrates<br>Minimal Success |
|---|---|---|---|---|
| Mathematical Concepts | Explanation shows complete understanding of the mathematical concepts used to solve the problem(s). 25 points. | Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s). 20 points | Explanation shows some understanding of the mathematical concepts needed to solve the problem(s). 15 points | Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written. 10 points |
| Explanation | Explanation is detailed and clear. 25 points | Explanation is clear. 20 points | Explanation is a little difficult to understand, but includes critical components. 15 points | Explanation is difficult to understand and is missing several components OR was not included. 10 points |
| Strategy/ Procedures | Typically, uses an efficient and effective strategy to solve the problem(s). 25 points | Typically, uses an effective strategy to solve the problem(s). 20 points | Sometimes uses an effective strategy to solve problems, but does not do it consistently. 15 points | Rarely uses an effective strategy to solve problems. 10 points |
| Mathematical Terminology and Notation | Correct terminology and notation are always used, making it easy to understand what was done. 25 points | Correct terminology and notation are usually used, making it fairly easy to understand what was done. 20 points | Correct terminology and notation are used, but it is sometimes not easy to understand what was done. 15 points | There is little use, or a lot of inappropriate use, of terminology and notation. 10 points |

***2. Extended Writing Summative Assessment***

You will be designing you own application of an exponential logarithm project. You will first collect data (either mortgage interest from a parent/relative, loan interest data, population increase of a region data, radioactive decay data of a specific location such as Chernobyl, or earthquake magnitude data) then express and graph this data as an exponential logarithm. You will then display the data, exponential logarithm, and graph on a poster board. This should be able to be easily understood by someone not familiar with exponential logarithms.

| **Category** | **Level 4: Achieves Standards at a High Level** | **Level 3: Performance at Standard** | **Level 2: Performance below Standard** | **Level 1: Demonstrates Minimal Success** |
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| **Question/ Purpose** | The purpose of the question to be answered during the lab is clearly identified and stated. 10 points. | The purpose of the question to be answered during the lab is identified, but is stated in a somewhat unclear manner. 8 points. | The purpose of the question to be answered during the lab is partially identified, and is stated in a somewhat unclear manner. 6 points. | The purpose of the question to be answered during the lab is erroneous or irrelevant. 4 points. |
| **Data** | Professional looking and accurate representation of the data is tables and/or graphs. Graphs and tables are labeled and titled. 20 points. | Essay addresses the prompt; however evidence may be inaccurate in places.16 points. | Accurate representation of the data in written form, but no graphs or tables are presented. 12 points. | Data are not shown OR are inaccurate. 8 points. |
| **Strategies/ Procedures** | Typically, uses an efficient and effective strategy to solve the problem(s). 30 points. | Typically, uses an effective strategy to solve the problem(s). 22 points. | Sometimes uses an effective strategy to solve problems, but does not do it consistently. 14 points. | Rarely uses an effective strategy to solve problems. 8 points. |
| **Replicability** | Procedures appear to be replicable. Steps are outlines sequentially and are adequately detailed. 10 points. | Procedures appear to be replicable. Steps are outlines and are adequately detailed. 8 points. | All steps are outlined, but there is not enough detail to replicate procedures. 6 points. | Several steps are not outlined AND there is not enough detail to replicate procedures. 4 points. |
| **Poster** | The poster includes all required elements as well as additional information. 30 points. | All required elements are included on the poster. 22 points. | All but 1 of the required elements are included on the poster. 14 points. | Several required elements were missing. 8 points. |

### 3. *Comprehensive Written Assessment*

**Solve each question and select the best answer. 4 points each. 100 points total.**

- 1. Which of the following is NOT exponential function

A) $f(x)=1^x$
B) $f(x)=e^x$
C) $f(x)=2^x$
D) $f(x)=(0.5)^x$

- 2. The logarithmic form of this exponential equation $2=5^{3x}$

A) $3x=e^2$
B) $3^x=5$
C) $2=\log_3 x$
D) $\log_5 2 = 3x$

- 3. Solve the equation $e^{x-3}=1$

A) x=1
B) x=3
C) x=0
D) x=e

- 4. Evaluate $\ln e^{-3}$

A) $e^{-3}$
B) 3
C) -3
D) ln (-3)

- 5. Write the expression $(2\log_3 x + \log_3 5 - \log_3 8)$ as a single logarithm

A) $\log_3 x^5-8$
B) $\log_3 5x^2 -8$
C) $\log_3 (5x^2 / 8)$
D) $\log_3 (x^2 / 8)$

- 6. Solve log (x-3)=2

A) x=1
B) x=5
C) x=103
D) x=-1

- 7. Evaluate $\log_2 0.5$

A) 1
B) -1
C) 0
D) 0.5

- 8. Find log 47 to four decimal places

A) 1.6722
B) 1.6721
C) 1.6720
D) 1.6729

- 9. For what values of b will the function $f(x)=b^x$ represent exponential Growth

A) All b < 1
B) All b > 1
C) All b < 0
D) All values of b

- 10. The Asymptote line of the graph of $f(x)=b^x$ is

A) Both x and y axis
B) y-axis

C) x-axis
D) It has No asymptotes

- 11. The range of f(x)=log x is

A) All real numbers
B) Only positive Numbers
C) Only negative numbers
D) y=10

- 12. What does the "b" represent in the general form of an exponential function $f(x)=b^x$?

A) Factor of Growth or Decay
B) Natural Base
C) Change Of Base Formula
D) y- intercept

- 13. A logarithm of base "e" is called

A) Natural Base
B) Natural exponential function
C) The common logarithm
D) Natural logarithm

- 14. A logarithm of base "10" is called

A) Natural exponential function
B) The common logarithm
C) Natural logarithm
D) Natural Base

- 15. "ln x" represents

A) The logarithm of base "1"
B) The logarithm of base "10"
C) The logarithm of base "e"
D) The logarithm of base "0"

- 16. "log x " represents

A) The logarithm of base "1"
B) The logarithm of base "e"
C) The logarithm of base "10"
D) The logarithm of base "0"

- 17. For what values of " b" will the function $f(x)=b^x$ represent exponential Decay

A) All b > 1
B) All b < 1
C) All values of b
D) All b < 0

- 18. The exponential form of this logarithmic equation x=ln 2

A) $e=x^2$
B) x=ln 2
C) $2=10^x$
D) $2=e^x$

- 19. The exponential form of this logarithm equation 2=log x

A) $x=10^2$
B) $x^2=10$
C) $x=2^{10}$
D) $2=10^x$

- 20. Evaluate $e^{\ln 3}$

A) 3
B) ln 3
C) $e^3$
D) -3

- 21. Given that $\log_7 10 = 1.18$, find $\log_7 1000$

A) 3.18
B) 3.54
C) 7000
D) 1.64

- 22. Solve $\log_3 (x + 4) - \log_3 (x - 2) = \log_3 2$

A) 4
B) 8
C) 2
D) 6

- 23. The y-intercept of the function y=log x is

A) 1
B) It has no y-intercept
C) -1
D) 0

- 24. The y-intercept of the function $y=b^x$ is

A) -1
B) 1
C) 0
D) It has no y-intercept

- 25. Solve $\ln(2x-3) > 1$

A) $x<2.859$
B) $x > 1.5$
C) $x > 2.859$
D) $x>3$

Answer Key
1.A 2.D 3.B 4.C 5.C 6.C 7.B 8.B 9.B 10.C
11.A 12.A 13.D 14.B 15.C 16.C 17.B 18.D 19.A 20.A
21.B 22.B 23.B 24.B 25.C