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| Diocese of Wheeling-Charleston  |
| CASE Math Unit Planner |
| **Name of Teacher:** Mrs. Mary Dailey | **Grade Level:** 10th-12th  |
| **Domain**: Exponential and Logarithmic Functions |
| **Estimated Duration of Unit:** 3 Weeks |
| Specific **Clusters** Addressed: Analyze functions using different representations; Build new functions from existing functions. |
| **Teaching Strategies:** lecture, interaction, problem-solving, inquiry |
| **Catholic Identity Connections:** As students solve exponential and logarithmic problems, they learn that models using these types of equations can lead to an understanding of real-world issues. For example, recent medical research suggests that the relative risk of having a car accident after drinking can be modeled by an exponential equation which relates risk to blood-alcohol concentration. God has truly given us tools to understand the world better. **Cross Curricular Opportunities:** Economics: Financial Models. Exponential functions are used in financial models. Students will learn these definitions and use them in financial calculations: principal, rate of interest, compounded interest, future value, present value, effective rate of interest. |
| **Assessment (authentic/published - summative/formative):** Feedback during lectures, board work, quizzes, final unit test. |
| **Standards Addressed** |
| **S/O****Number** | **Standards/Objectives** |
|  M.S.PC.2 | Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will* Demonstrate understanding of patterns, relations, and functions,
* Represent and analyze mathematical situations and structures using algebraic symbols
* Use mathematical models to represent and understand quantitative relationships, and
* Analyze change in various contexts.
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|  M.O.PC.2.4 | establish and explain the inverse relationship between exponential and logarithmic functions; graph related functions and include their domain and range using interval notation. |
| M.O.PC.2.5 | compare laws of exponents to properties of logarithms; solve equations and practical problems involving exponential and logarithmic expressions, including natural and common logarithms; confirm solutions graphically and numerically |
|  M.O.PC.3.1 | Graph functions using transformations. |
| **Description of Activity** | Resources  | Date of Completion |
| Form a composite function. Find the domain of a composite function. Exercises showing that two composite functions are equal. |  Teacher, textbook, smartboard, chalkboard, TI-84 Smartview. |  Day 1 |
| Determine whether a function is one-to-one (evaluating values in tables, and graphical determination . . . does it pass the horizontal line test?). Determine the inverse of a function defined by a map or a set or ordered pairs. Obtain the graph of the inverse function from the graph of the function. Find the inverse of a function determined by an equation.  |  Same as above. | Days 2-3  |
| Exponential functions. Evaluate and graph exponential functions. Define the number e. Solve exponential equations.  |  Same as above. |  Days 4-5 |
| Logarithmic Functions. Change exponential statements to logarithmic statements and logarithmic statements to exponential statements. Evaluate logarithmic expressions. Determine the domain of a logarithmic function. Graph logarithmic functions. Solve logarithmic equations. Have students prepare for quiz by working through problems on the board. Quiz.  |  Same as above. |  Days 6-8 |
| Properties of logarithms. Work with the properties. Write a logarithmic expression as a sum or difference of logarithms. Write a logarithmic expression as a single logarithm. Evaluate logarithms whose base is neither 10 nor e (use the change of base formula). |  Same as above.  |  Days 9-10 |
| Solve logarithmic and exponential equations with and without a graphing calculator. ­­­­­­­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Financial models. Determine future value of a lump sum. Calculate effective rates of return. Determine the present value of a lump sum. Determine the rate of interest or time required to double a lump sum of money.Find equations of populations that obey the law of uninhibited growth and populations that obey the law of uninhibited decay. Present practical examples that illustrate Newton’s Law of Cooling. Use logistic models to present examples where growth or decay is limited. Review entire chapter and assess with chapter test. | \_\_Same as above\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ “ |  Days 11-12\_Day 13\_\_\_\_\_\_Days 14-15 |
| **Differentiated Instruction Opportunities/Overview:** Hands-on activities primarily using graphing calculators. This will enable students to clearly recognize the appearances of different types of functions and to become adept at visual analysis. |
| **Cross Curricular Opportunities:** When students use Newton’s Law of Cooling, which states that the temperature of a heated object decreases exponentially over time toward the temperature of the surrounding medium, they are solving problems that introduce them to principles covered in Physics and Calculus. |
| **Standard Number** | **Standard Description** | **Resources** | Date |
|  M.C.5 | Physics/Calculus | Investigate and apply the definition of the derivative graphically, numerically, and analytically at a point, conceptually interpreting the derivative as an instantaneous rate of change and the slope of the tangent line. |  Teacher, Smartboard |  Days 14-15 |
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| **Mathematical Practice Standards - 8 Progressions** | **Check all the Apply** |
| **1** | **Make sense of problems and persevere in solving them.** | **√** |
| **2** | **Reason abstractly and quantitatively.** | **√** |
| **3** | **Construct viable arguments and critique the reasoning of others.** | **√** |
| **4** | **Model with mathematics.** | **√** |
| **5** | **Use appropriate tools strategically.** | **√** |
| **6** | **Attend to precision.** | **√** |
| **7** | **Look for and make use of structure.** | **√** |
| **8** | **Look for and express regularity in repeated reasoning** | **√** |
| **Summary of unit upon completion** |
| Students have looked at two general classes of functions (exponential and logarithmic functions) and have examined their properties. Exponential and Logarithmic functions are often used as models in the financial world and in the world of physical science. Students have mastered the analysis of these transcendental functions (functions that go beyond algebraic functions). |
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