**Algebra 2/Pre-Calculus 2-year plan**

Note: *Italicized* things (in the “students will know..., students will have the skills to…” and assessment sections) will be introduced in 11th grade, **bold** things will be introduced in 12th grade. The classes will spiral so that topics will be revisited in more depth as students progress.

**UbD Curriculum Template 2.0  
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| **Stage 1 Desired Results** | | | |
| **Directions:** Choose multiple CCSS (or other standards), copy and paste them here, and unpack them for big ideas and assessment verbs by highlighting.  **Common Core State Standards (**[**www.corestandards.org**](http:///h)**), Next Generation Science Standards (**[**http://www.nextgenscience.org**](http:///h)**), Indigenous Standards (found in Course Sites).**  COMMON CORE STATE STANDARDS  **Standards and Benchmarks Common Core State Standards (CCSS)**  **Mathematical Practices for Algebra:**  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. | | | |
| Other than the big ideas explicitly in the standards you chose, what big ideas might frame this yearlong curriculum?   1. Patterns repeat 2. Transforming Parents creates Functional Families 3. Life is full of cycles 4. Breaking someone else’s rules is sometimes necessary in order to move forward. 5. Brains grow and change | | | |
| CHOSEN BIG IDEAS(S): | ***Transfer*** | | |
| *I want my students to be* **fluent in mathematics***, so that in the long-run, on their own, they will be able to* **use it to solve problems and communicate to other people about the strategies and solutions in order to open as many doors as possible in terms of college, career and life.** | | |
| ***Meaning*** | | |
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|  | UNDERSTANDINGS  *Students will understand that…*   * Patterns are everywhere, and math describes them * Math symbols are internationally recognized shorthand for complex ideas * They have a plethora of strategies already, and just need to get better at picking an appropriate strategy for a given problem * It’s all the same * Practicing anything enough allows you to improve and excel at it | | ESSENTIAL QUESTIONS   * What kind of function could model a given pattern? * How can I write math so anyone, anywhere in the world, can understand what I mean? * What strategy would make this as easy as possible? * How is this like other things I know? |
|  | ***Acquisition*** | | |
|  | *Students will know…*  **Note: Italicized things will be introduced in 11th grade, Bold things will be introduced in 12th grade**  *Overarching: Equivalent expressions*   * + *There are different ways to write expressions that highlight different properties of the function in question* * Unit 1: Linear Functions:   + *linear patterns and arithmetic sequences*   + *representations of linear functions*   + **solutions of systems of linear equations in 2 and 3 dimensions**   + **arithmetic series** * Unit 2: Quadratic Functions   + *Zero product property*   + *Solutions (roots) of quadratic functions*   + *Transformations of parabolas*   + *Lots of real world stuff can be modeled with a parabola.* * Unit 3: Exponential Functions   + *Rules of exponents, including negative and fractional exponents*   + *Exponential growth and geometric sequences*   + *Representations of exponential functions*   + *Contexts for exponential growth and decay*   + *Logarithms*   + **Geometric series** * Unit 4: Polynomial Functions   + **Imaginary and complex numbers, their properties, and how they are related to graphs that do not have real intersections.**   + *The basic shapes of polynomial graphs with a given degree*   + *The parts of a graph that relate directly to its equation, and vice versa*   + **Division of polynomials by binomials** * Unit 5: Cyclic Functions   + *The Unit Circle, and how it relates to the sin, cos and tan functions*   + *Radian angle measurement*   + *What basic cyclic functions look like when graphed*   + **Transformations of cyclic functions**   + **The reciprocal trig functions**   + **Inverse trig functions**   + **Some basic trig identities** * Unit 6: Problem Solving   + *Specific problem solving strategies*   + *That more than one strategy may be used in any given situation* * Unit 7: Statistics and Probability   + **How data are used**   + **How to use data for one’s own ends**   + **Basic statistical measures and representations**   + **Basic probability concepts** | | *Students will have the skills to …*    **Note: Italicized things will be introduced in 11th grade, Bold things will be introduced in 12th grade**   * *Equivalence*   + *Solve any equation for a given variable*   + *Find an equivalent expression that works strategically to solve a given problem* * Unit 1:   + *Recognize and continue linear patterns and arithmetic sequences*   + *Move fluently among graphs, tables, equations and situations*   + **Plot points, lines and planes in 3-D space**   + **Solve systems of linear equations in 2 or 3 dimensions**   + **Find the sum of an arithmetic series** * Unit 2:   + *Change quadratic equations from standard to factored form in order to solve them for their roots*   + *Transform parabolas by changing parameters in the functions.*   + *Solve problems that can be modeled with quadratic functions or systems that include quadratic functions.* * Unit 3:   + *Simplify exponential and radical expressions*   + *Recognize and continue exponential patterns and geometric sequences*   + *Move fluently among graphs, tables, equations and situations*   + *Set up and solve an exponential equation for a percentage increase or decrease*   + *Write an exponential expression in its equivalent logarithmic form, and vice versa.*   + **Use log properties to solve exponential equations.**   + **Find the sum of a geometric series** * Unit 4:   + *Sketch* **complete** *graphs of polynomial functions.*   + **Divide one polynomial expression by another.**   + **Solve some equations they could not solve earlier by expanding the set of numbers they use.**   + **Find solutions for factorable polynomial equations of one variable.**   + **Write polynomial equations given their graphs**   + **Use polynomial functions to represent some situations.** * Unit 5:   + *Graph functions of the family whose parents are y = sin ɵ and y = cos ɵ*   + *Use radians instead of degrees to measure lengths of arcs and angles.*   + **Determine the period of a cycle from a graph, a situation or an equation**   + **Name the characteristics of a cyclic function given its graph.**   + **Use cyclic functions to solve problems** * Unit 6   + *Solve using a picture, diagram or model.*   + *Solve by making a systematic list*   + *Solve by guessing and checking*   + *Estimate a reasonable range of solutions*   + *Solve by extending patterns*   + *Break problems into smaller subproblems*   + *Correctly apply dimensional analysis for problems with units* * Unit 7   + **Interpret categorical and quantitative data**   + **Make inferences and justify conclusions**   + **Use probability to make decisions** |
| **Stage 2 - Evidence** | | | |
| **Evaluative Criteria** | | **Assessment Evidence** | |
| Standards-based A+ Rubric in Student-friendly Language   |  |  |  | | --- | --- | --- | | Performance Assessment Criteria and Standard Alignment | Complete | Needs Revision | | Transform a non-linear equation and show how the graph changes as a result |  |  | | Solve a system of equations and describe the significance of the solution |  |  | | Demonstrate at least two distinct strategies to solve a non-routine problem |  |  | | Articulate the reasons why a statistical finding is or is not true or useful |  |  | | | PERFORMANCE TASK(S):  What (cognitive verb + big idea): Use the math. Know when to use what kind of math strategies to solve a variety of problems. Produce a math textbook that demonstrates the learning that you have done all year.  Why (copied and pasted EUs from Stage 1):  They need to be able to *recognize*, **transform**, *solve* and *move among various representations of linear, quadratic, exponential*, **polynomial and cyclic functions** **and their inverses**, including *solving systems of equations*. They also need to have a toolbox of problem solving strategies for complex, non-routine problems in and out of the context of a math class. They need to be numerate: be able to understand how math is used and misused in the society around them.  How (GRASPS, written to and for students):  **Goal: To be fluent enough in mathematics to be able to use it to solve problems and communicate to other people about the strategies and solutions in order to open as many doors as possible in terms of college and career.**  **Role: You are teaching this math to yourselves and each other**  **Audience: Your future self and your fellow students.**  **Situation: You’re leaving high school and going off to college, where they will expect you to be able to do and use the math.**  **Product, Performance, and Purpose:**  Math textbook, created as we go throughout the year. Teach each other in groups. Give a whole class lesson on a selected topic or strategy. AND/OR Demonstration of a project for math class or for another class that uses math, and includes a detailed explanation of the mathematics involved.  **Standards and Criteria for Success:** Outside evaluators’ corroboration that the student is proficient. | |
| <type here> | | OTHER EVIDENCE: | |
| |  | | --- | | **Stage 3 – Learning Plan** *What units will you teach, and what skills will students master, as a result of this yearlong curriculum?* |   **2015-2016 Academic Year Curriculum Map Template**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Unit Big Idea (Title)** | **Unit Essential Question(s)** | **Unit Standard(s)** | **Assessment(s)** | **Time Frame** | | **What big idea anchors this unit?** | **What EQ will anchor conceptual, critical thinking related to the big idea?** | **What core standard(s) anchors this unit, and therefore what observable skills will you evaluate ?** | **What summative assessment will provide you evidence of skills and understanding?** | **What is the approximate time frame for the teaching and learning in this unit?** | | **0. Equivalence** | **How can I rewrite this to make it more useful for solving the problem at hand?** | **A-SSE Seeing Structure in Expressions.**  Use the appropriate form of an equation to highlight a given aspect of the function. | Quiz: rewriting equations | 1 month for intro; never-ending... | | **1. Linear Functions** | **How can I use a system of lines to model regular growth in order to solve a problem? What is a “dimension”?** | **A-CED Creating Equations**  Create a system of linear equations and solve for their intersection.  **F-BF Building Functions**  Build an appropriate function to model a situation with a constant rate of change. and express it in graph, table and equation form.  **F-LE Linear,Quadratic and Exponential Models**  Recognize a situation that is best modeled with a linear model and be able to explain how it works and what its limitations are. | Individual project requiring systems of equations to solve.  Model moving from 2-3 dimensions | Ongoing; first pass will take 3-4 weeks (in Algebra 2), second pass will take another 3-4 weeks in Pre-Calculus | | **2. Quadratic Functions** | **How can I model projectile motion?** | **F-BF Building Functions**  Build and solve a system of quadratic functions to solve a problem involving projectile motion.  **F-LE Linear,Quadratic and Exponential Models**  Recognize a situation that is best modeled with a quadratic model, know what is represented by each variable, and use the most appropriate equivalent equation to solve for the missing variable. | Group project: creating an appropriate model for a projectile situation and solving it. | 6 weeks, including an in-depth intro to quadratic functions | | **3.Exponential/Logarithmic Functions** | **What does it mean when something grows or decays exponentially?** | **F-IF Interpreting Functions**  Recognize what each part of an exponential function represents, and be able to use it to solve problems of exponential graph and decay.  **F-LE Linear,Quadratic and Exponential Models**  Model a situation that seems to be growing or decaying exponentially with an appropriate function, and be able to explain the limitations of the model. | Using a model to predict behavior in an exponential situation. | 4 weeks in each grade level at different levels of complexity | | **4. Polynomial Functions** | **How can I extend patterns and structures into realms I can’t see physically?** | **A-APR Arithmetic with Polynomials and Rational Expressions**  Perform arithmetic operations on polynomials and rational expressions to simplify them.  **N-CN The Complex Number System**  Know what complex and imaginary numbers are, solve problems with complex solutions and know what they represent. | Project: Demonstrate imaginary numbers  Quiz: solve a problem with complex solutions | 4-6 weeks | | **5. Cyclic Functions** | **When a pattern cycles, how can I know where in the cycle I am and tell where I’m going?** | **F-TF Trigonometric Functions**  Understand the connection between right triangle trig and the unit circle, and be able to use trig functions to predict change. | Quiz: move between graphs and equations of cyclic functions | 4 weeks in Algebra 2, 4-6 weeks more in Pre-Calculus | | **6. Problem Solving** | **What strategy could I use here?** | **Modeling In Mathematics (this CC standard is overarching).**  **N-Q Quantities**  Reason quantitatively and use units appropriately  **A-CED Creating Equations**  Create and solve an equation or a system of equations that is an appropriate model of a situation.  **A-REI Reasoning with Equalities and Inequalities**  Use reasonable approximations to get an appropriately precise solution or set of solutions to a given problem.  **F-IF Interpreting Functions**  Choose an appropriate domain to the situation at hand.  **F-BF Building Functions**  Determine an explicit expression, a recursive process or steps for calculation from a context.  **G-SRT Similarity, Right Triangles, and Trigonometry**  Use proportions, trig functions and the Pythagorean theorem to solve contextual problems.  **G-GPE Expressing Geometric Properties with Equations**  Use coordinates and expressions such as the distance formula to compute perimeters and areas.  **G-MG Modeling with Geometry**  Apply geometric concepts in modelling situations. | Project: Create a book or presentation demonstrating an array of problem-solving strategies. | Ongoing. Forever. | | **7. Statistics and Probability** | **What do I need to prove or disprove?**  **How can I choose the most likely outcome?** | **S-ID Interpreting Quantitative and Categorical Data**  **S-IC Making Inferences and Justifying Conclusions**  **S-MD Using Probability to Make Decisions** | Debate: prove or disprove something using or challenging statistics. | 4-6 weeks | | | | |