

**2019 Anja S. Greer Conference on Mathematics & Technology**  
**Full Course Listing**

**01 - Beginning Math Teacher Workshop**

**Leader: Nils Ahbel, Deerfield Academy, Deerfield, MA**

This course is designed for teachers in their first 5 years of teaching; all are welcome. Nils will share insights from 40 years of working as an engineer, teaching, writing curriculum & speaking at conferences. Three areas will be explored: 1) Classroom management—engaging all students, dealing with challenging students, and making class enjoyable while retaining control. 2) Curriculum management—planning lessons, creating assessments, and seeing the big picture. 3) The art of teaching—including differentiated learning styles and creating a mistake-friendly/growth mindset learning environment.

**02 - Alternative to Precalculus**

**Co-Leaders: Nils Ahbel, Deerfield Academy, Deerfield, MA, Jessica Schenkel, Porter-Gaud School**

What does your school offer for students who struggled through Algebra 2? An Alternate to Precalculus gives you a free, full-year course that is built around problems that engage teenagers. You can teach the entire course at your school or choose parts to supplement an existing course. The curriculum offers a study of univariate statistics, modeling with functions, trigonometry, exponential & log functions, recursion, a personal finance unit where students learn the basics of Excel, & the normal distribution. Participants must bring a laptop. See [deerfield.instructure.com/courses/1703/](http://deerfield.instructure.com/courses/1703/).

**03 - Using Both Computer and Hands-On Activities that Enhance Exeter's Math 1, 2 & 3 Problem Sets**

**Leader: Eric Bergofsky, Phillips Exeter Academy, Exeter, NH**

This course will feature both computer/tablet activities with Desmos, Geometer's Sketchpad and/or GeoGebra, as well as complimentary or similar hands-on classroom activities for motivating students and enhancing their understanding of various problems in Exeter's Math 1, Math 2, and Math 3 problem sets. Activities and problems will be selected based on the interests of the participants. The selected problems will be at the level of algebra, geometry, and precalculus, and can be integrated into a problem-based learning setting or a non-PBL curriculum.

**04 - Just a Bunch of Good Geometry Labs**

**Leader: Dan Butler, Mounds View High School, Arden Hills, MN**

By the time students get to precalculus, a great deal of their geometry know-how has gone the way of the slide rule. Let's bring some excitement back into geometry through great problems and great explorations, and rediscover how geometry really lies at the heart of all mathematics. In this course we will explore some interesting geometry problems that will excite both the students and the teacher. We will make use of GeoGebra, calculators, straw, plexiglass, soap bubbles, and, of course, our creativity.

**05 - Just Five Good Precalculus Labs**

**Leader: Dan Butler, Mounds View High School, Arden Hills, MN**

Let's spice up our precalculus curriculum with some amazing labs. We will use Excel, The Geometer's Sketchpad, GeoGebra, the TI-84, hands-on materials and anything else we decide we need to explore some of the concepts of precalculus through great problems and interesting constructions. We will also take some time to discuss what needs to be in a precalculus course in light of the current state of mathematics education.

## **06 - Teaching a Discussion-Based Math Course**

**Leader: Diana Davis, Swarthmore College, Swarthmore, PA**

Discussion-based courses are so wonderful for student engagement and understanding, but they're challenging to teach well, especially the first time. In this course, you'll learn to create a classroom environment that fosters student discussions, first through the experience of being a student yourself, then by watching videos of successful classes in action, and finally by practicing leading the class and getting feedback. We'll also discuss ways to adapt the method to all kinds of classes -- big, small, basic, advanced, full-class, small groups, etc.

## **08 - Writing a Problem-Based Curriculum**

**Leader: Diana Davis, Swarthmore College, Swarthmore, PA**

Exeter's problem-based curriculum works very well for Exeter students. Your students, with their background and in your school environment, likely need something different. We will do two things in parallel: (1) We will carefully study how the Exeter materials are constructed, with exploratory problems that build day by day. (2) You will write your own curriculum, and we will discuss and revise it as a group. All are welcome, whether this is your first experience with a problem-based curriculum, or whether you've already written something and want to refine it.

## **09 - Your Next Math Textbook - Authored by You!**

**Leader: Anthony DiLaura, Zeeland Public Schools, Zeeland, MI**

Longing for more from your textbook? Writing your own curriculum already? Join the movement of teachers authoring the future of math textbooks and transforming the learning experience by creating personalized, media-rich, interactive iBooks for their students. This course gets you using iBooks Author (free Mac software) to create your own multi-touch interactive math iBook (viewable on iPad and Mac). Attendees will learn about instructional design as they create their interactive math iBook or ePub for their technology equipped classrooms. If possible, bring your own Mac laptop.

## **10 - Adding Technology to the Math Equation**

**Leader: Anthony DiLaura, Zeeland Public Schools, Zeeland, MI**

Technology integration in learning is being called education's "new operating system". This course will have teachers thoughtfully redesigning their curriculum through the lens of intentional technology integration. Teachers will learn to create instructional videos that support anytime learning. They will design interactive web-based lessons that promote curiosity and dialogue. Attendees will build online formative assessments that give instructors real-time data, and finally they will explore options for creating digital artifacts that archive student learning. (BYO laptop and tablet)

## **11 - Exeter Math 1: A Student-Centered Problem-Based Approach to Algebra 1**

**Leader: Stephanie Girard, Phillips Exeter Academy**

Use the Exeter Math 1 materials to explore problem solving through a discussion format to build content with students, rather than for them. Empower students to discover, develop and apply general principles and transferable techniques through accessible and contextual problems. Content spans Algebra 1 topics, to include linear relationships, absolute value, quadratics and some typical and atypical "word" problems. We will use technology (tablet graphing applications) to supplement learning in this dynamic classroom format. Come see what Exeter Math is all about, at this introductory level!

## **12 - Enhanced Calculus**

**Leader: Julie Graves, North Carolina School of Science and Mathematics, Durham, NC**

Do you have the sense that your calculus course has become a head-down march through the AP Calculus syllabus? Do your students imitate techniques without understanding the power of calculus to model the world we live in? If so, please join us as we explore new applications to enhance your calculus course. We will explore modeling problems that involve probability (distribution functions for random variables), economics (marginal utility and elasticity of demand), and differential equations (modeling combat and chaotic logistic growth).

## **13 - Math Modeling in Calculus**

**Leader: Maria Hernandez, The North Carolina School of Science and Mathematics, Durham, NC**

Math Modeling can engage students as active learners in Calculus. We will explore problems that give students a chance to develop their own voice in the classroom. Some of these include physical geometric models or analyzing data collected from videos and sensors where students explore the motion of a cycloid or water flowing from a tank. We will also explore Calculus concepts that are tied to the distribution of income. Connecting our work to the components of the modeling cycle, we will discuss strategies that help students deepen their understanding and become better mathematical modelers.

## **14 - Math Modeling in Algebra and Precalculus**

**Leader: Maria Hernandez, The North Carolina School of Science and Mathematics, Durham, NC**

Mathematical modeling can help us engage our students as active problem-solvers and foster mathematical curiosity. We will explore ways to help our students navigate the modeling process through a variety of real-world problems. The problems include exploring CO<sub>2</sub> levels in the atmosphere, the path of a playground swing, ball bounce data and the satiation rates of the praying mantis. The math topics span from advanced algebra to precalculus. We will collect data using videos and calculator probes, and then build models using TI calculators, spreadsheets, Desmos, GeoGebra and LoggerPro.

## **15 - Number Theory for Teachers**

**Leader: Jeff Ibbotson, Phillips Exeter Academy**

Number theory is currently a hot topic in the news. Its uses in cryptography are well known and this topic can open the door for many students to explore some deep math involving simple curves. We will explore Pythagorean triples and their construction through simple circle geometry. We will also look at elliptic curves and solve for rational points on those curves. The instructor has written a problem-based approach to the subject and has taught such a course for high school students. We will use Desmos, Excel and the graphing calculator to assist in solving diophantine equations.

## **16 - The Exeter Math Program - A Problems Oriented Approach**

**Leader: Jeff Ibbotson, Phillips Exeter Academy**

The Exeter Math Curriculum consists of a number of problem collections that have been organized in such a way as to emphasize learning through discussion. We will dive into the problems for Math 2, Math 3, and some additional ones from Math 4 if time allows (all Exeter Math books are available on-line). We will work some of these problems in order to get a hands-on idea of how it all fits together, in particular, vector approaches to geometry, parametric equations, geometric dissections, three dimensional geometry, and combinatorics and probability problems (including Markov Chains).

### **17 - Recreational Mathematics - Inspiration, Engagement, and Enrichment**

**Co-Leaders: Ron Lancaster, University of Toronto Ken Collins, Charlotte Latin School, Charlotte, NC**

Recreational mathematics involves patterns, games, mathematical magic tricks, origami and mathematical curiosities. In this course we will demonstrate a variety of ways to use recreational mathematics in the classroom; for example, as a class warm-up; a link to applications; an enrichment activity and a way to encourage collaborative learning and the development of mathematical imagination. Making mathematics engaging and interesting in this way will show students that mathematics is a pleasurable activity that can be enjoyed throughout their lives.

### **18 - Mathematics in Art, Architecture and Design**

**Co-Leaders: Ron Lancaster, University of Toronto Ken Collins, Charlotte Latin School, Charlotte, NC**

Art, architecture, and design incorporate a wide range of mathematics including geometry, algebra, and trigonometry in an imaginative and engaging environment. These fields offer interesting applications that can be used in many courses as well as the foundation for cross curriculum classes. We will explore many examples that appeal to students and can be used in a variety of classes.

### **19 - Origami for the Classroom**

**Leader: Philip Mallinson, Phillips Exeter Academy, Exeter, NH, Retired**

Origami is a powerful tool for making mathematical concepts come alive in two and three dimensions. Research confirms that learning a concept first through the fingertips can help internalize it more securely than watching it on a screen or by memorizing properties from the page. Origami lends itself to building polyhedra, especially using multiple copies of a single unit. Its life in two dimensions allows students to explore, for example, regular polygons, limits, permutations, and conic sections. Square paper, wax paper, A4 paper all have their unique properties which we will explore.

### **20 - An Intro to Visualization, GeoGebra with a Touch of Desmos**

**Leader: Mike May, Saint Louis University, St. Louis, MO**

This course looks at two free tools for visualization and experimentation, GeoGebra and Desmos. We explore the comparative strengths of both programs. No experience with either application is assumed. With GeoGebra the emphasis will be on finding and using materials already available from online archives of over 1,000,000 activities. Course participants will finish the week with a GeoGebraBook of activities for their classes. With Desmos the emphasis will be on learning to find and make on the fly demonstrations.

### **21 - Trigonometry, Redesigned: Collaboration, Discourse, and Modeling**

**Leader: Greta Mills, Oxbridge Academy**

Whether you teach trigonometry as a stand-alone course or as part of an Algebra 2 / Precalculus sequence, the topics are perfect for reinforcing the modeling process through collaboration, discussion, and projects. Participants will learn how to introduce and scaffold trigonometry concepts, and how to use questioning and inquiry in a discussion-based lesson. We will use trigonometry (and other ancillary functions) to model a wide range of phenomena, including the path of a bungee jumper, the sound of a plucked ukulele string, the timing of a seconds pendulum, and more!

## **22 - Logic and Coding and Arduinos (Ohm My!): An Introduction to Circuits**

**Leader: Greta Mills, Oxbridge Academy**

Coding might be one of the most important skills we can teach our students, and Arduinos are a fun and inexpensive way to start! This course will focus on the use of Arduinos (open-source microcontroller) and simple code to introduce participants to circuits, logic, and coding. No prior background is needed; participants will need to preload the open source software on their computer, which should have a USB port for uploading code to the Arduino. We will code a musical keyboard, program traffic signals, program sensor-controlled motors, create simple electronic games, and more!

## **23 - Use Puzzles to Study Math – Use Math to Solve Puzzles**

**Leader: Stuart Moskowitz, Humboldt State University, Arcata, CA**

Nothing's more hands-on for getting kids & teachers to learn & love math! From Tangrams, Pentominos & Sudoku, to disappearing rabbits, trick locks, & pencils threaded thru your buttonhole, puzzles enhance number sense & strengthen spatial & problem solving skills. We'll use Algebra to explain how bunnies disappear. We'll use (and build) wood, wire, & string puzzles to study elementary concepts in geometry, topology, and graph theory. We'll explore how Lewis Carroll and Fibonacci explain the  $64=65$  Vanishing Area puzzle. By week's end, you will be puzzle solvers, builders & collectors.

## **25 - Math across Cultures and Through the Ages**

**Leader: Stuart Moskowitz, Humboldt State University, Arcata, CA**

Traditional school math leads students to think math is not relevant. Bringing real math from around the world into the classroom naturally integrates math across the curriculum. When students learn historical events & multicultural approaches for procedures, theorems, & concepts, the math becomes meaningful, interesting, & relevant. Embrace diversity among students by exploring math from all cultures while building pride for one's own heritage & respect for others. Topics include Native American gambling games, the Alhambra's influence on MC Escher, Stonehenge geometry, and much more.

## **26 - Stimulating Statistical Simulations**

**Co-Leaders: Paul Myers, The Paideia School, Atlanta, GA, Vicki Greenberg, The Lovett School, Atlanta, GA**

Stimulating Simulations will provide direct experience with hands-on and technology-based simulation activities designed to enhance students' conceptual understanding of probability, probability distributions and randomization-based inference. The learning activities involve using manipulatives, calculators, freely available applets, and software to explore concepts and analyze real data from genuine research studies and recently released AP Statistics Free-Response questions. We will also discuss implementation and assessment ideas based on our personal classroom experiences.

## **27 - The Mathematics & Statistics of Board Games**

**Co-Leaders: Paul Myers, The Paideia School, Atlanta, GA, Vicki Greenberg, The Lovett School, Atlanta, GA**

How long does it take to build a Cootie? What is the most profitable property in Monopoly? What's the chance of getting a Yahtzee? Why does a Double Leaning Jowler in Pass the Pigs earn so many points? Is there an association between the length of a word and the number of points earned in Scrabble? We will play and explore these games (and others) using functions, probability, statistics and simulation.

### **28 - Precalculus and Astronomy - A Match Made in the Heavens!**

**Leader: Ira Nirenberg, Benjamin Franklin High School, New Orleans, LA (retired)**

Where and when do you look for the moon? Can we model the motion of that “star?” Will that asteroid hit? How was the Earth's position in space determined over 2,500 years ago? Want to go to Mars? There’s prep to every trip! This class will explore these and other ideas. Why? Because they get students' attention! I’ve tried everything from temperature, to tides, to Ferris Wheels, and overall, the response was lackluster. Then I started using astronomical ideas and things changed. No more inputting arrays of data and forcing out context, rather, we observe and model!

### **29 - Simple Hands-on Activities for Ninth and Tenth Grade Math Students**

**Leader: Ira Nirenberg, Benjamin Franklin High School, New Orleans, LA (retired)**

Are you ready to try something different? In this workshop, rather than beginning with definitions, formulas, and equations, we begin with hands-on activities that inspire those definitions, formulas, and equations. Let’s stop putting the cart before the horse. Most middle and high school mathematics begins with an abstraction; let’s begin concretely, instead. If the typical textbook approach hasn’t been as effective as you’ve wished, join us for something a bit different that is easily implemented, and cheaply achieved. Please bring a tablet, computer, or graphing calculator.

### **31 - "Beyond Riemann Sums & Euler" - An Intro to Numerical Methods**

**Leader: Philip Rash, North Carolina School of Science and Mathematics, Durham, NC**

Left-hand sums, right-hand sums, and Euler's method are great, but wouldn't it be even better to know some more powerful ways to approximate integrals and solutions to differential equations? And just how does your calculator approximate values of the transcendentals (e.g. sine)? (Spoiler alert - it's not Taylor Polynomials!) In this course we'll learn more about popular numerical methods, carefully quantify their error, and implement them in various computing environments. Some prior computer programming experience is helpful, but not required.

### **32 - Mathematically Model Real-World Data with Social Implications – Opioids, Climate, Payday Loans, More**

**Leader: Tom Reardon, Austintown Fitch High School & Youngstown State University, Youngstown, OH**

Analyze, model, interpret real data, create social awareness for important current issues. Use modeling equations to interpolate, extrapolate, calculate percent inc/dec/error, interpret the data and its consequences, normal curves, and more. Issues to investigate include Opioid Overdoses, Gerrymandering, Hot Car Temperature Deaths. Obtain plenty of Climate Change data from the training I received with Al Gore. See how to create your own modeling activities, how to share solutions using a detailed blog, website. Graphing calculators are provided but participants can use any graphing technology.

### **33 - Creative Activities, Strategies, Ideas to Make Students More Successful on the Revised ACT/SAT Exams**

**Leader: Tom Reardon, Austintown Fitch High School & Youngstown State University, Youngstown, OH**

Obtain interactive activities that align directly to the types of questions that are on the newly revised exams and promote conceptual understanding and de-emphasize memorizing procedures/formulas. Get proven test-taking strategies that encourage multiple solution paths including time management. We will integrate graphing technology to achieve our goal: students learn and retain the math better, not just score better on the exams! Learn to integrate these ideas into your daily lessons and to word your questions more like these exams do. Obtain the topics and helpful materials for these exams.

### **34 - Statistics through Simulations**

**Leader: Paul Rodriguez, Troy High School, Fullerton, CA**

Statistics is the science of learning from data. Statistics offers essential insight in determining which data and conclusions are trustworthy when statistical principles are correctly applied. This course will explore statistical topics that can be incorporated into all levels of mathematics. Focus will be on using technology (TI calculators and internet applets) to develop statistical models and simulate complex problems. We will attempt to answer questions like: How many times does a Hershey's Kiss land point up? Can I make money in Vegas? Who happened in the election? and many more.

### **35 - A Closer Look into AP Statistics**

**Leader: Paul Rodriguez, Troy High School, Fullerton, CA**

Do you and your students struggle with degrees of freedom or why we divide by  $n - 1$  when calculating sample standard deviation? Do your students just list preconditions without understanding the reason behind them? Does the concept of power make you feel powerless? If so, please join us as we explore applications to enhance and deepen your AP statistics course. We will explore the new curriculum framework and do activities that involve probability, simulations, and hands-on manipulatives to explain all the things you have always wanted to know about statistics but were too afraid to ask.

### **36 - VIIP - Vertically Integrated Inquiry Problems**

**Leader: Annalee Salcedo, Cate School, Carpinteria, CA**

Each day, we will take great problems and look at them vertically, teasing out content and skills appropriate to algebra, precalc, and calculus. We'll use the 4E model of inquiry based learning (Engage, Explore, Explain, Extend), discuss ways the problems evoke the Common Core Standards of Mathematical Practice, share techniques that prompt reflection and assessment, and show how Desmos can enrich students' interaction with these problems. Main emphasis is vertical integration, teaching methods, assessment, and sharing practical, ready-to-go or easy-to-tweak material for your classes.

### **37 - Harkness for Thirty - Creating Materials for a Discussion-Based Classroom**

**Leader: Johnathon Sauer, William Mason High School, Mason, OH**

Transitioning your math classes with 25-30 students each to a discussion-based format may seem like an impossible task, but you can make it happen. In this course, we will begin to create the syllabus, grading policy, and discussion exercises needed to successfully teach your math class through the Harkness Method. Throughout the week, you will create your own materials, and edit those created by others, with the goal being to leave at the end of the week with the skills necessary to continue the creation of your course at home. The journey to a discussion-based classroom begins here!

### **38 - Mathematical Miscellany**

**Leader: Johnathon Sauer, William Mason High School, Mason, OH**

How long has it been since you had the chance to learn some mathematics? In this course we will take an introductory look at a few of the ignored (but highly entertaining) topics in the mathematical landscape: fractal geometry, graph theory, transformational geometry, and knot theory. After playing with the topics, we will discuss ways in which each topic could be introduced to high-school students, and create discovery questions that could be used to do this. Come join the fun!

#### **40 - Python Programming for Math Modeling and Stats**

**Leader: Lauren Shareshian, Oregon Episcopal School**

You'll learn the basics of Python and how to use it for simulation activities. These activities will include simulating the game of craps, modeling the spread of an infectious disease, plotting regression models, optimizing customer service, and scraping ESPN and Twitter data. You'll leave the workshop with a full course's worth of self-paced modules and problem sets for learning Python yourself or for assigning to students. This course moves quickly, so a previous course in any programming language (even long ago) is helpful. True beginners may prefer "Python Programming for Beginners."

#### **41 - Python Programming for Beginners**

**Leader: Lauren Shareshian, Oregon Episcopal School**

Python is a wonderful teaching language for math because its syntax is easy to learn. We'll learn programming basics including logic and looping and then plot lines of best fit, generate the Fibonacci sequence, explore prime numbers, and model the spread of an infectious disease. You'll leave the workshop with a full course's worth of self-paced modules and problem sets for learning Python yourself or for assigning to students. This course is for true beginners so those with some prior coding experience might prefer the other Python workshop.

#### **42 - Iteration as a Mathematical Theme in Algebra and Precalculus**

**Leader: Nat White, Groton School**

Explicitly or otherwise, iteration permeates mathematics. This course will take you through activities accessible at the algebra 2 and precalculus level to help students see the theme of iteration in sequences and series, exponential and logarithmic functions, the logistic function, matrices, and fractals. We'll model the quantity of a drug in a patient's body, investment and loan repayment options, spreading rumors, the movement of water in a watershed, and the measurement of complicated coastlines and borders.

#### **43 - Counting and Probability: Building a More Meaningful Understanding**

**Leader: Nat White, Groton School**

Chances are, unless your school has a dress code, students don't care about how many outfits Al Gebra can make from 5 pairs of pants and 7 shirts. They do, however, know how to categorize their fellow students as jocks, nerds, gamers, etc. This course will start from categorizing students and build skills from there to look at conditional probability (and medical testing), expected value (and playing the lottery), and the binomial and geometric distributions (looking for a qualified candidate...). Tools will include spreadsheets, Venn diagrams, histograms, and natural frequencies.

#### **44 - Computational Thinking Problems in Math**

**Co-Leaders: Tobin White, Cate School, Annalee Salcedo, Cate School, Carpinteria, CA**

Each day we will take great problems, work together to solve them, and then explore how to use them to introduce students to the fundamentals of computational thinking. Examples include Archimedes' method for approximating pi, Riemann sums and geometric transformations. These problems lend themselves to recursion, abstraction and pattern finding, and thus can motivate computing concepts like Loops, Conditionals and Arrays. We will work in several coding platforms readily available to high school teachers interested in bringing some coding concepts to courses from Geometry through Calculus.