



GeoGebra Institute of Southern Connecticut
The Fourth Annual GeoGebra Conference of Southern Connecticut
Tuesday, August 16, 2016
Southern Connecticut State University – New Haven, CT

ABSTRACTS

KEYNOTE PRESENTATION: *Digging Deeper using GeoGebra: An Exploration of Quadratics and More*

Dr. Doug Kuhlman – Former teacher at Andover Philips Academy, MA

Using GeoGebra students can explore in far more depth topics that have until recently been given a 'standard' treatment. One example is the exploration of the vertex of a quadratic function. By exploring how the vertex moves when the coefficients of the quadratic function change, various topics can be introduced. Some of these are specific to GeoGebra—dynamic graphing and sliders, for example. But we can also introduce students to parametric equations, eliminating the parameter and even graphing functions of two variables in 3-space. Other examples for possible exploration are given at the end.

PRESENTATION A1: *"Messing around" in GeoGebra: Online Inquiry Through Applets and Games*

Dr. Forest Fisher - Guttman Community College, NY

This article explores a problem solving strategy called "messing around" that's particularly apt for online course work in GeoGebra. While traditional math problems may require students to search deliberately for a specific solution, "messing around" employs a more fortuitous approach. We dissect this approach and examine multiple GeoGebra applets that support "messing around" by providing students with a sandbox for mathematical experimentation.

PRESENTATION A2: *GeoGebra Tools for the Poincare Disk*

Dr. Joseph Manthey - Saint Joseph University, CT; Dr. Kim Ward - Eastern Connecticut State University, CT; Dr. Ekaterina Lioutikova - Saint Joseph University, CT; Dr. Hong Zhou - Saint Joseph University, CT

The Poincaré disk model played an important role in the acceptance and development of hyperbolic geometry. Although exceptionally useful, the pedagogical value of the model can be further enhanced via experimentation in a dynamic geometry environment. The focus of this article is on the creation of custom tools in GeoGebra for constructing hyperbolic lines and circles in the Poincaré disk. In an effort to make this material accessible to a wider audience, the necessary mathematics is also included.

PRESENTATION A3: *Using the tail of a sequence to explore its limit*

Dr. James Quinlan - University of New England, ME

Graphing sequences is a common approach to explore limits both conceptually and computationally. In the traditional approach, the first terms of the sequence are the primary focus; however, we

present a GeoGebra applet that facilitates the determination and understanding of limits by illustrating an inverted perspective that emphasizes the tail of the sequence instead. Additionally, two robust and valuable GeoGebra topics/commands will be highlighted in the applet: Lists and Sequences. Finally, we conclude with a discussion of several issues surrounding limits and GeoGebra.

PRESENTATION A4: A Geometric Interpretation of Complex Zeros of Quadratic Functions

Dr. Joe Pastore - CUNY Queens, NY

Most high school mathematics students encounter a quadratic function whose zeros are imaginary or complex-valued. Since the graphs of such functions do not intersect the x -axis in the xy -plane, students may be left with the impression that complex-valued zeros of quadratics cannot be visualized. The main purpose of this paper is to show that if the zeros of a quadratic function with real-valued coefficients are imaginary, the zeros can be seen if we use an appropriate coordinate system. For illustrative purposes, we have used the software program GeoGebra, which allows us to create a three-dimensional Cartesian coordinate system where imaginary zeros can be viewed.

PRESENTATION A5: Complex Functions

Mr. Albert Navetta - University of New Haven, CT

This paper explores the use of GeoGebra to enhance understanding of complex numbers and functions of complex variables for students in a course such as College Algebra or Pre-calculus, where complex numbers are introduced as potential solutions to polynomial equations, or students starting out in an undergraduate Complex Variables course. The paper introduces methods to create interactive worksheets for students seeing complex numbers and functions for the first time and for those who have some experience with them but struggle to visualize their meaning. Acknowledging limitations of GeoGebra concerning complex functions, we create new learning opportunities as we develop workarounds.

PRESENTATION A6: Surviving on Mars with GeoGebra

Ms. Lindsey States & Ms. Genna Odom - Miami University, OH

In this paper, the authors describe an interdisciplinary lesson focused on determining how long an astronaut can survive on Mars. The lesson utilizes resources provided by NASA within an inquiry-based context and is aligned to CCSSM modeling standards. The authors detail the use of a GeoGebra applet that encourages students to explore their own questions. Students work in small groups to explore questions and visualize the problem scenario with the applet.

SHORT PRESENTATIONS

SHORT PRESENTATION B1: *Volume of Solids with Known Cross Sections*

Ms. Rasha Tarek - Staples High School, CT

Students often struggle with visualizing solids in 3D. This presentation will walk you through the process of creating 3D solids with known cross sections to help your students visualize them. We will start by creating the base of our solid using any two continuous functions, then we will construct infinitely many square or triangular cross sections that are perpendicular to the x-axis to form the solid.

SHORT PRESENTATION B2: *Dynamic Illustrations and validations of Geometric Theorems*

Mr. Tim Brzezinski - Berlin High School, CT

In this session, participants will have the opportunity to interact with several GeoGebra applets that dynamically illustrate many definitions, concept(s), theorem(s) without words, segment lengths, and angle measures. Each applet contains a figure that the user can modify at any time. The main tool that controls all dynamics in each applet is the slider tool. These illustrations provide teachers with a powerful tool to foster student discovery and meaningful reinforcement of concepts.

SHORT PRESENTATION B3: *Real problems with real pictures*

Ms. Ali Heery & Mr. Rob Belevich - Southern Connecticut State University, CT

In this presentation, we will showcase how we used real pictures to illustrate real -life problems. The activities that we propose allow students to interact with the problem and try different strategies. Other problems can be created using the same strategies and making the context of the problem more real and meaningful to students.

SHORT PRESENTATION B4: *Geometric Constructions with Automatic Feedback*

Mr. Jason Wofsey - Professional Children's School, NY

I will present several applets that ask students to perform Euclidean constructions. The applets incorporate JavaScript with added listeners to check for the correct object and then provide affirmative feedback to students. I will explain how teachers can create their own such exercises and how to best make use of them in the classroom. I will also show how they can be used with the Moodle GeoGebra Quiz plugin to make automatically graded quizzes.

SHORT PRESENTATION B5: *Pythagoras in Converse*

Mr. Hunter Smith - ESUMS, New Haven, CT

In this presentation, we will look at multiple applets to explore the Converse of the Pythagorean Theorem in a HS Geometry class. The applets will offer hands-on demonstrations and ways to visualize the inequality.

SHORT PRESENTATION B6: Graphing Surfaces with Polygon Cross Sections In GeoGebra

Dr. Doug Hoffmann - Northwestern Community College, CT

The purpose of this presentation is to provide a method of graphing surfaces in GeoGebra with parameterizable cross-sections. Specifically, we will focus on surfaces that do not have circular cross-sections. For a relatively small number of sides, the coordinate functions are easy to code, but when the number of sides gets bigger, the piecewise functions get troublesome to code by hand. One way around coding the coordinate functions by hand is to use a Sequence command. For each coordinate function, a Sequence command creates a list of all the functions needed to define a coordinate function.

SHORT PRESENTATION B7: Constructing meaning in Geometry with GeoGebra

Dr. Doug Kuhlman – Former teacher at Andover Philips Academy, MA

The short talk would be showing how to teach the tangent function using GeoGebra: attaching a tangent line ($x=1$) to the unit circle and then draw a line through $(0,0)$ and $W(t)$, where W is the wrapping function. $\tan(t)$ is the second coordinate of the point of intersection of that line and the line $x=1$.

SHORT PRESENTATION B8: Constructing meaning in Geometry with GeoGebra

Sandra Ollerhead - Mansfield High School, MA

GeoGebra can serve as a powerful tool to developing a deeper understanding of geometric concepts behind straightedge and compass constructions. This presentation will show the benefits of using GeoGebra versus pencil and paper to teach students constructions.

SHORT PRESENTATION B9: Parallel /Perpendicular game

Matthew Krebs - Boston Public Schools, MA

This Applet gives students the opportunity to 1) position a line so that it is either parallel or perpendicular to a given line; 2) position that line so that it (also) intersects a specific point on the coordinate plane; 3) write an equation for the line they have just positioned. After doing this, the student presses the “Check Answer” button to see if the line has been positioned properly and the equation is written correctly. The Applet provides students with positive feedback indicating they completed the task properly or gives indication of the errors made.

INTERACTIVE POSTERS

P1: Triangle Similarity Shortcuts

Rasha Tarek - Staples High School, CT

This is an interactive activity in which students utilize their knowledge of Similar Polygons to verify the validity of several Triangle Similarity Shortcuts. Students will be presented with 5 different scenarios that they will investigate. They also have the opportunity to check their understanding at the end of the activity.

P2: Slopes Field Generator

Rasha Tarek - Staples High School, CT

Generate any slope field and graph particular solutions with ease using this Slope Fields Generator. Students can use this worksheet to visualize solutions to certain differential equations or simply to check their work.

P3: Graphing polynomials using zeros and their multiplicities

Janet Zupkus - Naugatuck Valley Community College, CT

This activity uses an existing geogebra applet to direct the student's exploration of polynomial functions and graphs. The activity explores polynomial end behavior and x intercept behavior related to the multiplicity of factors. The activity does lend itself to a flipped classroom environment as an independent exploration prior to a classroom lecture.

P4: Characteristics of quadratic graphs

Thevaraja Mathiyalagan, Rayigam - Tamil Vidyalayam, Sri Lanka

The applet is designed to help student investigate the characteristics of the graphs of Quadratic functions.

P5: Pythagorean Theorem Game

Matthew Krebs - Boston Public Schools, MA

This Applet gives students the opportunity to 1) create a right triangle with the red side as the hypotenuse 2) Click on the sides and use Pythagorean Theorem to arrive at the length of the side that is not given. . . Students can opt to click on the Square Root symbol to begin their work or after they have written everything else.

P6: Distance Game

Matthew Krebs - Boston Public Schools, MA

This Applet gives students the opportunity to become comfortable with unbalanced Axes. With each problem the X and Y axes change and as a result students must be careful to create either a vertical line or a horizontal line to make the appropriate length of segment. Or they must identify the length of a given segment according to the Axes.

P7: Proportions Game

Matthew Krebs - Boston Public Schools, MA

This Applet gives students the opportunity to interpret problems using proportions through the creation of right triangles. Students make a right triangle based on the first situation. Then make a Similar right triangle which coincides with the second situation.

P8: Jeopardy

Matthew Krebs - Boston Public Schools, MA

Every time a student plays this game, there will be a random 5 categories and another 5 in double Jeopardy and another one for the final Jeopardy. The applet updates every time it is being played, so the problems will not be the same. Users get a new experience every time.

P9: Interior angles of polygons

Ali Heery – Bridgeport Public Schools, CT

The applet is designed to help students make conjectures about the sum of interior angles of polygons, based on the number of triangles that can be built inside the polygon.

P10: The ambiguous case

Ella Sayin – Southern Connecticut State University, CT

The applet is designed to help students learn about the ambiguous case of law of sines and the use of the Law of Sines. By manipulating segments and angles students will create different triangles.

P11: Non-Coplanar “Quad” Midpoints

Tim Brzezinski - Berlin High School, CT

*Many geometry teachers and students are familiar with the theorem that states that the midpoints of consecutive segments of any quadrilateral always form vertices of a parallelogram. Yet the four points of any quadrilateral are always coplanar. **However, did you know this statement also holds true for any 4 non-coplanar points?** That is, if segments are consecutively connected among 4 non-coplanar points, consecutive midpoints of these segments will always be vertices of a parallelogram!*

P12: 9-point Circle Action (Part 1)

Tim Brzezinski - Berlin High School, CT

For any triangle, there are 9 special points that all lie on a circle (The midpoints of the triangle's 3 sides, the points at which the triangle's 3 altitudes meet the lines containing the triangle's 3 sides, the midpoints of the segments that connect the triangle's orthocenter to each of its 3 vertices). This applet dynamically illustrates, without words, segment lengths, and angle measures. The center of this 9-Point Circle is midpoint of the segment that connects the triangle's circumcenter and orthocenter.

P13: Hexagonal Napoleon Theorem?
Tim Brzezinski - Berlin High School, CT

*If equilateral triangles are constructed off the 6 sides of **any hexagon** (convex or concave), then the midpoints of the segments that connect the centroids of an "opposite pair" of equilateral triangles will always form vertices of yet another equilateral triangle. (There are 3 such segments, seeing that there are 6 equilateral triangles.) Would you consider this to be a version of Napoleon's Theorem for a hexagon? You be the judge!*

P14: Numerical Integration
Albert Navetta – University of New Haven

This applet shows the visualization of 3 numerical integration techniques; Midpoint Rule, Trapezoid Rule, and Simpson's Rule. You can change the function, the number of divisions, and the limits of integration. To get the results for Simpson's Rule, the box must be checked. Simpson's rule takes a lot of processing, so be patient after checking the Simpson's Rule box. Your browser may even indicate that the script has stopped, but it is working, just wait. If you have a relatively new computer, it should not be a problem. Once Simpson's rule is displayed, you can cycle through the parabolas that make up the estimate.

P15: Exploring rotations
Sandra Ollerhead - Mansfield High School, MA

This applet and accompanying worksheet provide students the opportunity to develop a formal definition of rotations as well as to explore rotations on the coordinate plane

P16: Exploring reflections
Sandra Ollerhead - Mansfield High School, MA

This applet and accompanying worksheet provide students the opportunity to develop a formal definition of reflections as well as to explore reflections on the coordinate plane.
