

Equinox Program

Course Title: Algebra II and Trigonometry Honors

Course Description

Algebra II & Trigonometry Honors is an advanced instructor-led algebra course focusing on topics of systems, equations, polynomial arithmetic, complex numbers, solutions of quadratic equations, exponential and logarithmic functions, sequences, series, graphs of polynomial functions, conic sections, and concepts in trigonometry including trigonometric identities. Students completing this accelerated course are prepared for future coursework in math, physics, and engineering.

Essential Questions

- How can we use mathematics to describe and understand the world around us?
- Which is better: a graph, table, equation or a statistic?

Outcomes

Upon successful completion of this course, students will:

- Analyze mathematical information, whether graphical, numerical, or descriptive, to accurately describe the behavior of a function or system.
- Construct a wide variety of mathematical and statistical models to describe a variety of observed phenomena.
- Evaluate the suitability of various mathematical models to describe observed data.
- Describe the role of complex numbers in understanding the behavior of a function or system.

Instructional Strategies

Throughout this course, students should be prepared to engage in deep and detailed discussions of their mathematical ideas, and to respond to and respectfully challenge the ideas of their fellow students in a positive and collaborative way. While lecture, demonstration and exercise of mathematical proficiencies will be part of the course, considerable time will also be spent in exploration, experimentation and discussion (including self-facilitated small groups). Students should also expect to engage in peer-coaching, comparing and commenting upon paths that each student has taken to reach their mathematical conclusions.

Resources and Materials

- **Books**
 - a. Kamischke, Ellen, Kamischke, Eric and Murdock, Jerald. (2004). *Discovering Advanced Algebra (1st Edition)*. Emeryville, CA: Key Curriculum Press. ISBN 1-55953-606-3
- **Web sites**
 - a. www.ilabcentral.org : Students will submit experiments to a real Geigercounter in Queensland, Australia, and construct a mathematical model of radiation load as a function of distance from a radioactive source.
- **Materials**
 - a. Notebook or 3-ring binder with paper. May be lined, graph, or blank paper.

- b. Students must have a handheld graphing device (this may be a graphing calculator, or a multi-purpose device with a graphing application, such as a music-player or phone). Students must be able to use their device to create a table from an equation, create a graph including multiple functions, and find points of intersection.

Student Assessment

- **Pre-Assessment**

Students will begin the course with a comprehensive examination on the course topics, including both multiple-choice and free-response questions.

- **CTD Grading Scale**

A+	100-97%	A	96-93%	A-	92-90%
B+	89-87%	B	86-83%	B-	82-80%
C+	79-77%	C	76-73%	C-	72-70%
D+	69-67%	D	66-63%	D-	62-60%
F	below 60%				

- **Breakdown of Final Grade**

30%: In-class projects and exercises
 15%: Homework (including review)
 30%: Quizzes and in-term exams
 25%: Comprehensive final exam

- **Post-Assessment**

To allow for comparison and to see growth over time, students will conclude the course with the same comprehensive examination that was used to begin the course.

Schedule

Date	Topics	In-class Activities	Assignments/Assessments
Mon AM	Sequences and mathematical cryptography	<ul style="list-style-type: none"> • Pre-Assessment • Introductions • Policies and Procedures • Sequences discussion and reflection • Cryptography lab 	<ul style="list-style-type: none"> • Pre-assessment • Original cipher (HW)
Mon PM	Polynomial arithmetic, by sorting and combining	<ul style="list-style-type: none"> • Lecture and notes: Polynomial arithmetic (including polynomial multiplication and factoring) • Exercises using student-written problems 	<ul style="list-style-type: none"> • Polynomial arithmetic exercises (HW)
Tue AM	Solving versus simplifying; Multiple paths to solutions	<ul style="list-style-type: none"> • Homework questions and scoring • Small group problem analysis • “Jigsaw” on ancient algorithms 	<ul style="list-style-type: none"> • Problem analysis presentations • Solutions of the Ancients (HW)
Tue PM	Systems of equations: Keeping balance	<ul style="list-style-type: none"> • Quiz on Sequences and polynomial arithmetic • Lecture and notes: Solving systems of equations • Discussion and reflection 	<ul style="list-style-type: none"> • Quiz 1 • Solving systems in context • In Your Own Words: Solutions and Systems
Wed AM	Rule of 4 (and solving by graphs and tables)	<ul style="list-style-type: none"> • Homework questions and scoring • Multiple representations: discussion and reflection • Lecture and notes: Function analysis • Exercises: Function building 	<ul style="list-style-type: none"> • Story solutions: Graphs, tables, equations and situations (HW) • Function building exercises

Date	Topics	In-class Activities	Assignments/Assessments
Wed PM	Principles of mathematical models: linear models lab	<ul style="list-style-type: none"> Quiz on systems of equations Linear models lab Lab reports: expectations and assignment 	<ul style="list-style-type: none"> Quiz 2 Linear models lab reports
Thurs AM	Modeling by regression and best-fit	<ul style="list-style-type: none"> Homework questions and scoring Fitting to three points: exercise and demonstration Regression on lab data 	<ul style="list-style-type: none"> Regression analysis of lab reports
Thurs PM	Data sets, populations and descriptive statistics	<ul style="list-style-type: none"> “Spare time” survey and discussion Complete regressions on lab data Review for Exam 1 Reflection on data and population 	<ul style="list-style-type: none"> Construct a survey and survey fellow students (HW)
Fri AM	Function notation and simple transforms	<ul style="list-style-type: none"> Homework questions and scoring Lecture and notes: transformations Exam 1: Systems and models, in simplest forms 	<ul style="list-style-type: none"> Exercises on function transformations (HW) Exam
Fri PM	Statistical models and generalization to families	<ul style="list-style-type: none"> Small groups develop “library of functions” for visual/graphical analysis Visual identification of statistical models (with confirmation) 	<ul style="list-style-type: none"> Group presentations on function families In Your Own Words: Families and Functions
Mon AM	Quadratic functions and their solutions	<ul style="list-style-type: none"> Homework questions and scoring Lecture and notes: Quadratic functions and their solutions. 	<ul style="list-style-type: none"> Quadratic solutions (HW)
Mon PM	Complex numbers	<ul style="list-style-type: none"> Exploration: non-real roots to Quadratics Lecture, notes and exercises Discussion and reflections 	<ul style="list-style-type: none"> Exercises on complex numbers
Tue AM	Polynomial functions	<ul style="list-style-type: none"> Homework questions and scoring Lecture and notes: properties of higher-order polynomial functions 	<ul style="list-style-type: none"> Polynomial functions (HW)
Tue PM	Polynomial functions, slopes and derivatives	<ul style="list-style-type: none"> Quiz on polynomial functions: modeling and analysis Class discussion: interpreting rates of change of functions Exercises and applications 	<ul style="list-style-type: none"> Quiz 3 Rates of change exercises
Wed AM	Polynomial functions: Making sense of models (iLab)	<ul style="list-style-type: none"> Homework questions and scoring Radioactivity iLab 	<ul style="list-style-type: none"> iLab report Interpolation exercises (HW)
Wed PM	Polynomial functions, concavity analysis	<ul style="list-style-type: none"> Quiz on quadratic functions Group project on analysis and interpretation of polynomial functions and optimal solutions 	<ul style="list-style-type: none"> Quiz 4 Group presentations
Thurs AM	Conic Sections: Slices out of clay: Open figures	<ul style="list-style-type: none"> Homework questions and scoring Slicing cones lab I Lecture and notes: Functions modeling open conic sections Exercises 	<ul style="list-style-type: none"> Slicing cones lab report (HW)
Thurs PM	Conic Sections: Closed figures	<ul style="list-style-type: none"> Slicing cones lab II Lecture and notes: Functions modeling closed conic sections Practice exercises on conic sections Review for Exam 	<ul style="list-style-type: none"> Exercises comparing conic sections (HW)

Date	Topics	In-class Activities	Assignments/Assessments
Fri AM	Conic sections in combinations and transformations	<ul style="list-style-type: none"> Homework questions and scoring Exam on polynomial functions and models Discussion and reflection: Transformations of conic sections 	<ul style="list-style-type: none"> Exam 2 Exercises translating conic sections (HW)
Fri PM	Parametric functions I	<ul style="list-style-type: none"> Lecture and notes: defining parametric functions Group activity: expressing closed conic sections as parametric functions 	<ul style="list-style-type: none"> Group presentations “What goes around comes around” (HW)
Mon AM	Exponential and Logarithmic functions	<ul style="list-style-type: none"> Homework questions and scoring Discussion: exponential situations Lecture and notes: Defining logarithmic functions. Constructing, analyzing and interpreting exponential functions 	<ul style="list-style-type: none"> “Half Life 3 vs. Alice in Wonderland” (HW)
Mon PM	Modeling exponential and logarithmic growth & decay	<ul style="list-style-type: none"> Discussion: Connecting exponents and logs to science Exercises on modeling exponential and logarithmic functions 	<ul style="list-style-type: none"> Exercises with exponential and logarithmic functions
Tue AM	Periodic Functions: From right triangles to circles to sines	<ul style="list-style-type: none"> Homework questions and scoring Demonstration, lecture and notes: from sine and cosine to periodic functions Transforms and parameters for periodic functions 	<ul style="list-style-type: none"> Exercises on periodic function parameters
Tue PM	Modeling periodic phenomena	<ul style="list-style-type: none"> Quiz on conic sections and parametric functions Exercises on modeling with periodic functions Group project on modeling with periodic functions 	<ul style="list-style-type: none"> Quiz 5 Exercises with periodic functions Group presentations Periodic phenomenon models (HW)
Wed AM	Modeling periodic phenomena	<ul style="list-style-type: none"> Homework questions and scoring Quiz on periodic, exponential and logarithmic functions Sound waves lab Discussion and reflection 	<ul style="list-style-type: none"> Sound waves lab report (HW) Quiz 6
Wed PM	Parametric functions II: Periodic parametrics	<ul style="list-style-type: none"> Lecture and notes: parametric functions applied to periodic functions Exercises with periodic parametric functions 	<ul style="list-style-type: none"> Exercises with periodic parametric functions
Thurs AM	Trigonometric Identities	<ul style="list-style-type: none"> Homework questions and scoring Triangles lab: Law of Sines and Law of Cosines Demonstration: proving trig identities Group investigation: Pythagorean periodics and other trig identities 	<ul style="list-style-type: none"> Triangles lab report Group presentations of proofs of trig identities
Thurs PM	Sequences II: Divergence and convergence	<ul style="list-style-type: none"> Homework questions and scoring Exercises on sequences and sums Discussion: sequences and sums Review for Final Exam 	<ul style="list-style-type: none"> Exercises on sequences and sums
Fri AM	Final Exam	<ul style="list-style-type: none"> Last call for questions Final Exam Course reflections 	<ul style="list-style-type: none"> Final Exam

CTD Statement on Third-Party Web Sites

Instructors are required to thoroughly review any third-party web sites they intend to use in their courses for inappropriate content. However, because web content continuously changes, CTD disclaims any responsibility for any of the content contained on third-party web sites used in course materials. If you become aware of anything that may be inappropriate, please notify CTD staff immediately.

SAMPLE