

High School Course Description for Honors Math Analysis

Course Title: Honors Math Analysis

Curricular Area: Mathematics

Course Number: MTH461/462

Length: One year

Grade Level: 10-12

Prerequisites: Completed Algebra 1 and Geometry and passed Algebra 2 with a C or better

Meets a UC a-g Requirement: Pending

Meets NCAA Requirement: Pending

Meets High School Graduation Requirement for: Mathematics

Course Description

Honors Math Analysis is a year-long course consisting of math analysis, trigonometry, additional math analysis topics in preparation for BC calculus, and an introduction to differential calculus. The first semester will emphasize the study of functions and their transformations: linear, quadratic, rational, exponential, and logarithmic. The first semester will end with the development of the unit circle. The second semester will include trigonometric functions followed by the study of polar coordinates and graphs. We will then introduce the additional math analysis topics in preparation for BC calculus such as vectors, partial fractions, systems of inequalities, parametric equations, sequences and series, mathematical induction, and limits. The year will conclude with an introduction to Differential Calculus. This course is also designed to serve the needs of both college and career bound students.

Honors Math Analysis is designed to prepare a student to enter and be successful in AP Calculus BC. This course meets the same requirements as Math Analysis and Trigonometry but takes it to a deeper level by focusing on conceptual understanding in order to make connections, which is essential to be successful in advanced mathematics. In addition, during the second semester we transition to the enrichment topics beginning with vectors that are beyond the regular Math Analysis and Trigonometry courses.

Alignment: This course is aligned with California Mathematics Standards.

Instructional Materials

Required Textbook(s)

1. Blitzer, Robert, "Pre-Calculus", Pearson Prentice Hall 3d Edition, 2007, ISBN: 013195993X

Supplemental Materials

1. Instructor's Edition, ISBN: 0131880454
 2. Instructor's Solutions Manual, ISBN: 0131880373
 3. Larson, Hostetler, Edwards, "Calculus of a Single Variable", Houghton Mifflin, 8th Edition, 2006, ISBN: 0618503048

Web Sites

1. <http://mathispower4u.yolasite.com/>
 2. <http://patrickjmt.com/>

Software

1. Test Generator, ISBN: 0131880403

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Exit Criteria

<u>Activities</u>	<u>Percentage</u>
Homework/ Class work.....	30%
Tests/ Quizzes	50%
Final Examination.....	<u>20%</u>
Total:	100%

Development Team

This Course of Study was written in 2011 by Denise M. Tschida and Francisco Villegas.

Pacing Guide for Honors Math Analysis

First Semester

Week: 1-2: Functions and Their Graphs

Expectations, Motivation, Effort, Syllabus, Intervention

Lesson 1.2 – Basics of Function and Their Graphs

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Mathematical Analysis 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Lesson 1.3 – More on Functions and Their Graphs

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry 9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

Lesson 1.4 – Linear Functions and Slope

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Trigonometry 7.0 Students know that the tangent of the angle that a line makes with the x -axis is equal to the slope of the line.

Lesson 1.5 – More on Slope

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 1.6 – Transformations of Functions

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Mathematical Analysis 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Trigonometry 4.0 Students graph functions of the form $f(t) = A \sin (Bt + C)$ or $f(t) = A \cos (Bt + C)$ and interpret A , B , and C in terms of amplitude, frequency, period, and phase shift.

Lesson 1.7 – Combinations of Function; Composite Functions

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

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Lesson 1.8 – Inverse Functions

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Lesson 1.9 – Distance and Midpoint Formulas: Circles

Mathematical Analysis 5.1 Students can take a quadratic equation in two variables; put it in standard form by completing the square and using rotations and translations, if necessary; determine what type of conic section the equation represents; and determine its geometric components (foci, asymptotes, and so forth).

Lesson 1.10 – Modeling with Functions

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Trigonometry 19.0 Students are adept at using trigonometry in a variety of applications and word problems.

Review and Assessment

Weeks 3-4: Polynomial and Rational Functions

Lesson 2.1 – Complex Numbers

Mathematical Analysis 2.0 Students are adept at the arithmetic of complex numbers. They can use the trigonometric form of complex numbers and understand that a function of a complex variable can be viewed as a function of two real variables. They know the proof of DeMoivre's theorem.

Lesson 2.2 – Quadratic Functions

Mathematical Analysis 2.0 Students are adept at the arithmetic of complex numbers. They can use the trigonometric form of complex numbers and understand that a function of a complex variable can be viewed as a function of two real variables. They know the proof of DeMoivre's theorem.

Trigonometry 4.0 Students graph functions of the form $f(t) = A \sin (Bt + C)$ or $f(t) = A \cos (Bt + C)$ and interpret A , B , and C in terms of amplitude, frequency, period, and phase shift.

Lesson 2.3 – Polynomial Functions and Their Graphs

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry 9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

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Lesson 2.4 – Dividing Polynomials: Remainder and Factor Theorems

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Lesson 2.5 – Zeros of Polynomial Functions

Mathematical Analysis 4.0 Students know the statement of, and can apply, the fundamental theorem of algebra.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry 9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

Review and Assessment

Weeks 5-6: Polynomial and Rational Functions

Lesson 2.6 – Rational Functions and Their Graphs

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry 9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

Lesson 2.7 – Polynomial Inequalities

Mathematical Analysis 6.0 Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Review and Assessment

Weeks 7-9: Exponential and Logarithmic Functions

Lesson 3.1 – Exponential Functions

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

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Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Trigonometry 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

Lesson 3.2 – Logarithmic Functions

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Trigonometry 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry 9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

Lesson 3.3 – Properties of Logarithms

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Review and Assessment

Lesson 3.4 – Exponential and Logarithmic Equations

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 3.5 – Exponential Growth and Decay: Modeling Data

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

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Trigonometry 19.0 Students are adept at using trigonometry in a variety of applications and word problems.

Review and Assessment

Weeks 10-12: Unit Circle

Lesson 4.1 – Angles and Radian Measure

Trigonometry 1.0 Students understand the notion of angle and how to measure it, in both degrees and radians. They can convert between degrees and radians.

Lesson 4.2 – Trigonometric Functions: The Unit Circle

Trigonometry 2.0 Students know the definition of sine and cosine as y - and x -coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions.

Lesson 4.3 – Right Triangle Trigonometry

Trigonometry 2.0 Students know the definition of sine and cosine as y - and x -coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions.

Trigonometry 3.0 Students know the identity $\cos^2(x) + \sin^2(x) = 1$

Trigonometry 12.0 Students use trigonometry to determine unknown sides or angles in right triangles.

Lesson 4.4 – Trigonometric Functions of Any Angle

Trigonometry 2.0 Students know the definition of sine and cosine as y - and x -coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

Trigonometry 6.0 Students know the definitions of the secant and cosecant functions and can graph them.

Review and Assessment

Weeks 13-15: Trigonometric Functions

Lesson 4.5 – Graphs of Sine and Cosine Functions

Trigonometry 2.0 Students know the definition of sine and cosine as y - and x -coordinates of points on the unit circle and are familiar with the graphs of the sine and cosine functions.

Trigonometry 4.0 Students graph functions of the form $f(t) = A \sin(Bt + C)$ or $f(t) = A \cos(Bt + C)$ and interpret A , B , and C in terms of amplitude, frequency, period, and phase shift.

Lesson 4.6 – Graphs of Other Trigonometric Functions

Trigonometry 4.0 Students graph functions of the form $f(t) = A \sin(Bt + C)$ or $f(t) = A \cos(Bt + C)$ and interpret A , B , and C in terms of amplitude, frequency, period, and phase shift.

Trigonometry 5.0 Students know the definitions of the tangent and cotangent functions and can graph them.

6.0 Students know the definitions of the secant and cosecant functions and can graph them.

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Lesson 4.7 – Inverse Trigonometric Functions

Trigonometry 8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

Trigonometry 9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

Lesson 4.8 – Application of Trigonometric Functions

Trigonometry 4.0 Students graph functions of the form $f(t) = A \sin (Bt + C)$ or $f(t) = A \cos (Bt + C)$ and interpret A , B , and C in terms of amplitude, frequency, period, and phase shift.

Trigonometry 12.0 Students use trigonometry to determine unknown sides or angles in right triangles.

Trigonometry 19.0 Students are adept at using trigonometry in a variety of applications and word problems.

Review and Assessment

Weeks 16-17: Analytic Trigonometry

Lesson 5.1 – Verifying Trigonometric Identities

Trigonometry 3.0 Students know the identity $\cos^2(x) + \sin^2(x) = 1$

Lesson 5.2 – Sum and Difference Formulas

Trigonometry 10.0 Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities.

Lesson 5.3 – Double-Angle, Power-Reducing, and Half-Angle Formulas

Trigonometry 11.0 Students demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities.

Review and Assessment

Week 18: Semester Final Examinations

Review and Semester Final Examinations

Second Semester

Weeks 1-2: Analytic Trigonometry

Lesson 5.4 – Product-to-Sum and Sum-to-Product Formulas

Trigonometry 10.0 Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities.

Lesson 5.5 – Trigonometric Equations

Trigonometry 19.0 Students are adept at using trigonometry in a variety of applications and word problems.

Review and Assessment

Pacing Guide for Honors Math Analysis

Weeks 3-5: Additional Topics in Trigonometry

Lesson 6.1 – The Law of Sines

Trigonometry 13.0 Students know the law of sines and the law of cosines and apply those laws to solve problems.

Trigonometry 14.0 Students determine the area of a triangle, given one angle and the two adjacent sides.

Trigonometry 19.0 Students are adept at using trigonometry in a variety of applications and word problems.

Lesson 6.2 – The Law of Cosines

Trigonometry 13.0 Students know the law of sines and the law of cosines and apply those laws to solve problems.

Trigonometry 19.0 Students are adept at using trigonometry in a variety of applications and word problems.

Lesson 6.3 – Polar Coordinates

Mathematical Analysis 1.0 Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically.

Trigonometry 15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

Trigonometry 16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

Lesson 6.4 – Graphs of Polar Equations

Mathematical Analysis 1.0 Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically.

Review and Assessment

Weeks 6-7: Miscellaneous Topics

Lesson 6.6 – Vectors

Mathematical Analysis 1.0 Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically.

Lesson 7.3 – Partial Fractions

Mathematical Analysis 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Lesson 7.5 - Systems of Inequalities

Mathematical Analysis 3.0 Students can give proofs of various formulas by using the technique of mathematical induction.

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Review and Assessment

Pacing Guide for Honors Math Analysis

Weeks 8-10: Miscellaneous Topics

Lesson 9.5 – Parametric Equations

Mathematical Analysis 7.0 Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Lesson 10.3 – Geometric Sequences and Series

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 10.4 – Mathematical Induction

Mathematical Analysis 3.0 Students can give proofs of various formulas by using the technique of mathematical induction.

Review and Assessment

Week 11-12: Introduction to Calculus

Lesson 11.1 – Finding Limits Using Tables and Graphs

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 11.2 – Finding Limits Using Properties of Limits

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 1.3 – Finding Limits: Properties of Limits

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 11.3 – Limits and Continuity

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Review and Assessment

Week 13-15: More on Limits

Lesson 1.4 – Limits and Continuity

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 1.5 – Infinite Limits

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 3.5 – Limits at Infinity

Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Lesson 11.4 – Introduction to Derivatives

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Mathematical Analysis 8.0 Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Review and Assessment

Week 16-18: Introduction to Derivatives

Lesson 2.2 – Constant and Power Rule

Calculus 5.0 Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.

Lesson 2.3 – Product and Quotient Rule and Higher Power Rule

Calculus 5.0 Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.

Prep for 7.0 Students compute derivatives of higher orders.

Lesson 2.4 – Chain Rule

Calculus 5.0 Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.

Lesson 2.5 – Implicit Differentiation

Calculus 6.0 Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.

Review and Assessment

Weeks 19: Final Examinations

Review and Semester Final Examinations

Instructional Guides for Honors Math Analysis

Support for English Language Learners:

Extra time or modified versions of assignments will be given. The District will provide a language assistant. Additional strategies will be developed through the Response to Intervention plans –such as:

- SDAIE strategies
- Flexible grouping
- Peer pairing
- Realia
- Texts/materials in first language.
- Structured engagement
- Academic vocabulary development

Support for Special Education Students:

Extra time or modified versions of assignments will be given. The District will provide an instructional assistant. Additional strategies will be developed through the Individual Education Plan process – such as:

- Realia
- Flexible grouping
- Modified assignments
- Tutoring (peer & teacher)
- Texts/materials in first language
- Peer pairing
- Modified texts
- Audio & visual aids
- Individualized academic instruction
- Testing accommodations

Stretching the Lesson for GATE Students:

Differentiated curriculum will be provided to challenge the student and provide the student with opportunities to develop their identified talent. Teachers will use a variety of the following:

- Independent study supplemented with mentoring/tutoring
- Acceleration
- Modified assignments
- Enriched materials and learning experiences
- Compacting
- Depth & Complexity icons
- Flexible grouping
- Modified texts
- Inquiry-based Learning