

STRING THEORY

S C H O O L O F D E S I G N

Math 145.DeA2: Pre-Calculus with Design Applications

Winter 2025

Total Hours: 45

Quarter Credits: 4.5

Faculty Name: Rob Snyder	Office Hours: Monday-Friday 10:00 - 10:30
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Course Description:

Math 145.DeA2

This course provides a comprehensive study of pre-calculus mathematics, preparing students for the calculus sequence while connecting concepts to applications in design and the creative arts. Topics include polynomial, rational, exponential, logarithmic, and trigonometric functions and their graphs; systems of equations and inequalities; analytic geometry; sequences and series; and vectors. Emphasis is placed on mathematical modeling, transformations, scaling, and proportional reasoning as tools for problem-solving in both calculus preparation and design practice. Successful completion positions students for transfer credit at most 4-year institutions.

IDeATE Program Educational Objectives Alignment: This course is designed to help students achieve the following IDeATE Program Educational Objectives:

- Apply Knowledge to Design Challenges
- Think Critically and Creatively
- Apply Technique to Create Quality

Completion of this course will yield the following student learning outcomes:

- Dive Deep in Design
- Construct Core Knowledge
- Plan Strategically

Course Learning Goals

By the end of the course, students will be able to:

- Interpret, analyze, and create mathematical models relevant to design, media arts, engineering, and business.

- Understand and apply functions (linear, polynomial, rational, exponential, logarithmic, trigonometric) in real-world creative and technological contexts.
- Use graphical, numerical, and algebraic representations to communicate ideas clearly.
- Apply growth models to entrepreneurship and business forecasting.
- Use trigonometry for spatial reasoning, digital imaging, audio synthesis, and physical computing.
- Leverage digital tools (Desmos, GeoGebra, spreadsheet modeling, and basic coding) to visualize and prototype solutions.
- Collaborate on interdisciplinary design challenges requiring quantitative reasoning.

IDeATE Competencies and Mastery Credits:

Competencies	Course Specific Mastery Targets
Inquiry	Patterns: Organizing information (including numerical and visual) to identify patterns and/or relationships to answer a question or solve a problem
Design	Modeling: Representing concepts (abstract situations/information, processes, and systems) with models, visual representations or symbols.
Critical Thinking	Logic and Reasoning: Using logic and reasoning to justify a response or explain a phenomenon
Core Knowledge	Core: STEM and Design
Collaboration	Dialogue: Communicating ideas and contributing to discussion through listening, questioning, connecting, and probing.
Communication	Precision: Expressing ideas and information with exactness, specificity, correct use of terminology, and refinement
Engagement	Perseverance/Work Ethic: Committing to doing what you are tasked to do with integrity, quality, thoroughness, and attention to when others need it despite potential difficulties, failure, or opposition.
Technical Proficiency	Core: Math

Course Materials:

Required Texts and Materials:

Precalculus: Graphical, Numerical, Algebraic (8th Edition)

ISBN-13: 9780131369061

ISBN-10: 0131369067

Publisher: Pearson

Publication Date: 2010-03-06T00:00:01Z

Author: Franklin D. Demana, Bert K. Waits, Gregory D. Foley, Daniel Kennedy

Edition: 8

1. <https://iblog.dearbornschools.org/mrkcalc/wp-content/uploads/sites/1385/2017/09/Precalculus-by-Demana-Waits-TEXTBOOK-1.pdf>

Suggested Resources:

1. Lippman, David. 2012. Math In Society. Create Space Publishing
<http://www.opentextbookstore.com/mathinsociety/>

Mastery Grading System:

3.8 - 4.0 Exceeds Mastery	3.0 - 3.7 Mastery	2.0 - 2.9 Developing	1.0 - 1.9 Insufficient Evidence
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Whole number mastery grades (1 - 4) are recorded for each mastery credit (evidenced by products, performances, or assessments) with points used to compute a synthesized mastery course grade for each student at the end of each quarter. Students must earn a mastery course grade of 3.0 to evidence mastery of course learning goals. Students with a 2.0 or higher receive credit for a course and evidence readiness for any future learning for which this course serves as a prerequisite in the IDeATE program.

Course Schedule (subject to change, with notice):

Week #	Topics/Experiences	Content	Products/Performances/ Assessments
Week 1	<p>Foundations of Mathematical Thinking for Creative Technology</p> <p>Topics</p> <ul style="list-style-type: none"> ● Mathematical modeling in design, arts, and tech ● Function notation and language ● Domain, range, and transformations 	<p>Function notation ($f(x)$)</p> <p>Domain & range determination</p> <p>Basic parent functions (linear, quadratic, absolute value, exponential)</p> <p>Transformations: shifts, reflections, stretches</p> <p>Intro to modeling cycles and easing curves</p>	<p>Case study: How designers use functions for animation easing curves</p> <p>Desmos exploration: Transforming basic functions</p> <p>Mini-project: Create a visual model of a real-world relationship (lighting fade, audio envelope, pricing graph)</p>
Week 2	<p>Linear & Piecewise Models for Creative & Entrepreneurial Systems</p> <p>Topics</p> <ul style="list-style-type: none"> ● Linear functions ● Systems of equations ● Piecewise and conditional design logic 	<p>Slope, rate of change, intercepts</p> <p>Point-slope & slope-intercept forms</p> <p>Solving systems (graphical & algebraic)</p> <p>Piecewise-defined functions</p> <p>Linear modeling & interpretation</p>	<p>Startup pricing models and break-even analysis</p> <p>Designing piecewise rules for interactive media (if/then logic)</p> <p>Lab: Use spreadsheets to model cost, revenue, and profit lines</p>
Week 3	<p>Quadratic & Polynomial Behavior in Motion, Media & Design</p> <p>Topics</p> <ul style="list-style-type: none"> ● Quadratic functions ● Parabolas, optimization, and curvature ● Polynomial behavior and graphing 	<p>Standard, vertex, and factored forms</p> <p>Completing the square</p> <p>Quadratic formula & discriminant analysis</p> <p>Graphing quadratics & identifying key features</p> <p>Intro to higher-degree polynomial behavior (end behavior, turning points)</p>	<p>Motion arcs in animation & game design</p> <p>Optimizing design parameters (e.g., minimizing material cost)</p> <p>Project: Model a quadratic trajectory for an animation or physics-based simulation</p>

Week #	Topics/Experiences	Content	Products/Performances/ Assessments
Week 4	<p>Rational Functions & Feedback Systems</p> <p>Topics</p> <ul style="list-style-type: none"> ● Rational functions and asymptotes ● Rates, proportions, scaling ● Modeling real-world constraints 	<p>Rational expressions and simplification</p> <p>Vertical, horizontal, and slant asymptotes</p> <p>Domain restrictions</p> <p>Behavior near asymptotes & holes</p> <p>Modeling rates & ratios</p>	<p>Case study: Audio feedback and resonance models</p> <p>Visual design: Mapping functions with asymptotic behavior</p> <p>Lab: Build and interpret rational models in Desmos or Python notebooks</p>
Week 5	<p>Exponential Growth & Decay for Technology and Entrepreneurship</p> <p>Topics</p> <ul style="list-style-type: none"> ● Exponential functions ● Compound interest ● Growth and decay systems 	<p>Exponential growth & decay functions</p> <p>Compound interest & continuous compounding (e^x)</p> <p>Solving basic exponential equations</p> <p>Growth/decay word problems & interpretation</p>	<p>Entrepreneurship case: Viral marketing & user-growth modeling</p> <p>Technology case: Battery life, signal decay, & audio fade-outs</p> <p>Spreadsheet lab: Simulating compound interest and iterative growth</p>
Week 6	<p>Logarithmic Functions in Data, Sound, and Perception</p> <p>Topics</p> <ul style="list-style-type: none"> ● Logarithms as inverses ● Logarithmic scales in technology ● Solving exponential/log equations 	<p>Logarithm definition & properties</p> <p>Change of base formula</p> <p>Solving log and exponential equations</p> <p>Logarithmic scales (pH, decibels, data compression)</p>	<p>Audio: Decibel levels & logarithmic loudness perception</p> <p>Data: Log scales in big-data visualization</p> <p>Lab: Interpreting log plots for art, science, and tech applications</p>

Week #	Topics/Experiences	Content	Products/Performances/ Assessments
Week 7	<p>Introductory Trigonometry for Creative Computing</p> <p>Topics</p> <ul style="list-style-type: none"> • Angles, radian measure • Sine, cosine, tangent • Unit circle concepts 	<p>Angle measure: degrees & radians</p> <p>Unit circle fundamentals</p> <p>Defining sine, cosine, tangent using right triangles & unit circle</p> <p>Basic trig values (0°, 30°, 45°, 60°, 90°)</p> <p>Intro to sinusoidal modeling</p>	<p>Motion design: Cyclical motion & oscillation modeling</p> <p>Audio synthesis: Sine waves and harmonics</p> <p>Project: Create an animation or sonic pattern using trig waves</p>
Week 8	<p>Trigonometric Models for Spatial Design & Physical Systems</p> <p>Topics</p> <ul style="list-style-type: none"> • Trigonometric identities (basic) • Graphs of trig functions • Inverse trig functions for modeling 	<p>Graphing sine, cosine, tangent (amplitude, period, phase shift)</p> <p>Inverse trig functions</p> <p>Sinusoidal modeling & interpretation</p> <p>Basic identities (Pythagorean & reciprocal)</p>	<p>AR/VR spatial mapping using trig</p> <p>Modeling periodic behavior</p> <p>Lab: Build a trig-based motion path or lighting cycle</p>
Week 9	<p>Modeling, Optimization & Problem-Solving Across IDEATE Fields</p> <p>Topics</p> <ul style="list-style-type: none"> • Synthesis of function families • Modeling with technology tools • Multistep creative math problem solving 	<p>Polynomial + exponential hybrid models</p> <p>Trig + linear motion models</p> <p>Piecewise + exponential business models</p> <p>Multi-function interpretation</p> <p>Review of all function families</p>	<p>Students choose a domain (design, tech, entrepreneurship, arts)</p> <p>Build a functional model (growth, motion, optimization, spatial)</p> <p>Project studio sessions with instructor guidance</p>
Week 10	TBD - Capstone Design Challenge		

Submission Dates:

SUBMISSION DATE biweekly on Thursday or Friday	PRODUCT/PERFORMANCE/ASSESSMENT DUE Concept quizzes
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Thurs/Fri, December 5, 2025	Essential Question
Thurs/Fri, December 11/12, 2025	Product Packaging Proposal
Wed/Thurs, December 17/18, 2025	Quiz 1 on Algebra Concepts
Thurs/Fri, January 8/9, 2026	Product Packaging Research
Thurs/Fri, January 15/16, 2026	Quiz 2 on Dimensional Analysis
Thurs/Fri, January 22/23, 2026	Package Model First Draft
Thurs/Fri, January 29/30, 2026	Quiz 3 on Geometric Concepts
Wed/Thurs, February 11/12 2026	Package Model Second Draft
Thurs/Fri, February 19/20, 2026	Quiz 4 on Probability Concepts
Thurs/Fri, February 26/27, 2026	Package Model Final Submission
Thurs/Fri, March 2/3 2026	Narrative Self-Reflection

IDeATE PROGRAM POLICIES:

Academic Integrity: IDeATE students and professors uphold academic integrity as one of our highest priorities, and the String Theory School of Design investigates any allegation of violations of academic integrity. Violations include, but are not limited to: plagiarism, cheating, fabrication, and other forms of academic misconduct. Students who believe they have been wrongly accused or sanctioned have a right to an appeals process.

Attendance Requirements:

Students are expected to attend all classes, and must notify professors if they are not able to attend class for any reason. It is the student's responsibility to inquire about experiences, content, and work missed due to that absence. For further information on the attendance policy, please consult the IDeATE Program catalog.

Course Change Policy: IDeATE program faculty reserve the right to make changes to the course during the quarter to best actualize course learning goals. Changes will be announced to individual classes and conveyed in writing in advance of the change.

Accessibility and Disability Accommodations: Students with disabilities requesting accommodations and services need to complete an Accessibility Form, along with documentation from a licensed medical professional with a diagnosis of disability (defined as an impairment and/or condition that substantially limits a major life activity for 6+ months). Temporary adjustments are available for individuals with short-term impairments, i.e., those due to accident or injury. Please see the String Theory School of Design IDeATE Program course catalog for more details.

Course Drops and Withdrawals: Enrolled students may drop a course through the end of Week 1, and may withdraw from a course through Week 7. Please be aware of the potential financial and academic implications of course drops and withdrawals. Please see the String Theory School of Design course catalog for more details. Once registered, it is your obligation to attend, drop, or withdraw. Dropping will remove the course from your transcript. Withdrawing will result in a "W" on a student's transcript.

Commitment to Inclusive Practices: The String Theory School of Design welcomes individuals from diverse backgrounds and perspectives, and promotes an inclusive and respectful environment that enriches the school community and the educational and employment experience of its members. To report an incident, sexual misconduct, discrimination or harassment based on race, color, national origin, religion, sex, sexual orientation, disability, gender identity or expression, age, veteran status, or any other protected category or identity, please follow current guidance in the String Theory School of Design IDeATE Program course catalog.