

HM3 : Calculus

Course Curriculum

FALL SESSION (SEP - DEC) - 12 Classes	
Units	Topics
Unit 1A	<i>Chapter 1: Introduction to Calculus</i> <ul style="list-style-type: none"> ● Velocity and Distance ● Calculus Without Limits ● The Velocity at an Instant ● Circular Motion
Unit 1B	<i>Chapter 1: Introduction to Calculus (continued)</i> <ul style="list-style-type: none"> ● A Review of Trigonometry ● A Thousand Points of Light ● Computing in Calculus
Unit 1C	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 1D	<i>Chapter 2: Derivatives</i> <ul style="list-style-type: none"> ● The Derivative of a Function ● Powers and Polynomials ● The Slope and the Tangent Line ● Derivative of the Sine and Cosine
Unit 1E	<i>Chapter 2: Derivatives (continued)</i> <ul style="list-style-type: none"> ● The Product and Quotient and Power Rules ● Limits ● Continuous Functions
Unit 1F	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 2A	<i>Chapter 3: Applications of the Derivative</i> <ul style="list-style-type: none"> ● Linear Approximation ● Maximum and Minimum Problems ● Second Derivatives: Minimum vs. Maximum ● Graphs
Unit 2B	<i>Chapter 3: Applications of the Derivative (continued)</i> <ul style="list-style-type: none"> ● Ellipses, Parabolas, and Hyperbolas ● Iterations $x_{n+1} = F(x_n)$

	<ul style="list-style-type: none"> • Newton's Method and Chaos • The Mean Value Theorem and L'Hôpital's Rule
Unit 2C	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 2D	Chapter 4: The Chain Rule <ul style="list-style-type: none"> • Derivatives by the Chain Rule • Implicit Differentiation and Related Rates • Inverse Functions and Their Derivatives • Inverses of Trigonometric Functions
Unit 2E	Chapter 5: Integrals <ul style="list-style-type: none"> • The Idea of the Integral • Antiderivatives • Summation vs. Integration • Indefinite Integrals and Substitutions
Unit 2F	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
WINTER SESSIONS (JAN - MAR) - 12 Classes	
Unit 3A	Chapter 5: Integrals (continued) <ul style="list-style-type: none"> • The Definite Integral • Properties of the Integral and the Average Value • The Fundamental Theorem and Its Consequences • Numerical Integration
Unit 3B	Chapter 6: Exponentials and Logarithms <ul style="list-style-type: none"> • An Overview • The Exponential e^x • Growth and Decay in Science and Economics • Logarithms
Unit 3C	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 3D	Chapter 6: Exponentials and Logarithms (continued) <ul style="list-style-type: none"> • Separable Equations Including the Logistic Equation • Powers Instead of Exponentials • Hyperbolic Functions
Unit 3E	Chapter 7: Techniques of Integration <ul style="list-style-type: none"> • Integration by Parts • Trigonometric Integrals • Trigonometric Substitutions

	<ul style="list-style-type: none"> • Partial Fractions • Improper Integrals
Unit 3F	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 4A	<i>Chapter 8: Applications of the Integral</i> <ul style="list-style-type: none"> • Areas and Volumes by Slices • Length of a Plane Curve • Area of a Surface of Revolution
Unit 4B	<i>Chapter 8: Applications of the Integral (continued)</i> <ul style="list-style-type: none"> • Probability and Calculus • Masses and Moments • Force, Work, and Energy
Unit 4C	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 4D	<i>Chapter 9: Polar Coordinates and Complex Numbers</i> <ul style="list-style-type: none"> • Polar Coordinates • Polar Equations and Graphs • Slope, Length, and Area for Polar Curves • Complex Numbers
Unit 4E	<i>Chapter 10: Infinite Series</i> <ul style="list-style-type: none"> • The Geometric Series • Convergence Tests: Positive Series • Convergence Tests: All Series • The Taylor Series for e^x, $\sin x$, and $\cos x$ • Power Series
Unit 4F	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
SPRING SESSION (APR - JUN) - 12 Classes	
Unit 5A	<i>Chapter 11: Vectors and Matrices</i> <ul style="list-style-type: none"> • Vectors and Dot Products • Planes and Projections • Cross Products and Determinants • Matrices and Linear Equations • Linear Algebra in Three Dimensions
Unit 5B	<i>Chapter 12: Motion along a Curve</i> <ul style="list-style-type: none"> • The Position Vector • Plane Motion: Projectiles and Cycloids

	<ul style="list-style-type: none"> • Tangent Vector and Normal Vector • Polar Coordinates and Planetary Motion
Unit 5C	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 5D	Chapter 13: Partial Derivatives <ul style="list-style-type: none"> • Surfaces and Level Curves • Partial Derivatives • Tangent Planes and Linear Approximations • Directional Derivatives and Gradients
Unit 5E	Chapter 13: Partial Derivatives (continued) <ul style="list-style-type: none"> • The Chain Rule • Maxima, Minima, and Saddle Points • Constraints and Lagrange Multipliers
Unit 5F	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 6A	Chapter 14: Multiple Integrals <ul style="list-style-type: none"> • Double Integrals • Changing to Better Coordinates • Triple Integrals • Cylindrical and Spherical Coordinates
Unit 6B	Chapter 15: Vector Calculus <ul style="list-style-type: none"> • Vector Fields • Line Integrals • Green's Theorem
Unit 6C	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>
Unit 6D	Chapter 15: Vector Calculus (continued) <ul style="list-style-type: none"> • Surface Integrals • The Divergence Theorem • Stokes' Theorem and the Curl of F
Unit 6E	Chapter 16: Mathematics after Calculus <ul style="list-style-type: none"> • Linear Algebra • Differential Equations • Discrete Mathematics
Unit 6F	<i>Homework Review, 1 on 1 with Teacher, Bi-Weekly Test</i>

