

Dr. Del's Tiers 1 – 6 Syllabus

Tier 1 – 28 SCIENTIFIC CALCULATOR & PRE-ALGEBRA LESSONS

Using a Scientific Calculator: Introduction plus 16 lessons

- CI: Introduction (5 Min.)
- C1: Basic Operations (6 Min.)
- C2: Real Numbers (6 Min.)
- C3: Negative Numbers (6 Min.)
- C4: Multiplication, Division and Percentage (7 Min.)
- C5: Percentage (3 Min.)
- C6: Using Memory (7 Min.)
- C7: Squares (3 Min.)
- C8: Square Roots (5 Min.)
- C9: Reciprocals (6 Min.)
- C10: Fractions (6 Min.)
- C11: Proper & Improper Fractions (6 Min.)
- C12: Converting Fractions to Decimals (6 Min.)
- C13: Trigonometry Operations (6 Min.)
- C14: Using Sine (6 Min.)
- C15: Using Cosine (6 Min.)
- C16: Using Tangent (6 Min.)

Pre-Algebra: Introduction plus 10 lessons:

- PI: Introduction (3 Min.)
- P1: Real Numbers, Integers & Rationals (5 Min.)
- P2: The Number Line & Negative Numbers (8 Min.)
- P3: Rules of Addition (10 Min.)
- P4: Rules of Multiplication (11 Min.)
- P5: Distributive Law (7 Min.)
- P6: Fractions (6 Min.)
- P7: Squares (5 Min.)
- P8: Square Roots (7 Min.)
- P9: Reciprocals (5 Min.)
- P10: Exponents (15 Min.)

Tier2 – 39 ALGEBRA, GEOMETRY & TRIGONOMETRY LESSONS

Algebra: Introduction plus 10 lessons

- AI: Introduction (7 Min.)
- A1: Four Ways to Solve an Algebra Equation (5 Min.)
- A2: The Rule of Algebra (8 Min.)
- A3: $X + A = B$ (9 Min.)
- A4: $AX = B$ (6 Min.)
- A5: $AX + B = CX + D$ (11 Min.)
- A6: $A/X = B/C$ (8 Min.)
- A7: $X \text{ squared} = A$ (5 Min.)
- A8: Square Root of $X = A$ (5 Min.)

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- A9: $\sin X = A$ (11 Min.)
- A10: $\cos X = A$ (8 Min.)

Geometry: 19 lessons

- G1: What is Geometry? (9 Min.)
- G2: Straight Lines and Angles (8 Min.)
- G3: Parallel Lines (19 Min.)
- G4: Triangle Basics and the Sum of Angles (11 Min.)
- G5: Right Triangles and the Pythagorean Theorem (12 Min.)
- G6: Similar Triangles (12 Min.)
- G7: Quadrilaterals, Polygons and Perimeters (14 Min.)
- G8: Area of Triangles and Rectangles (18 Min.)
- G9: Formulas for Polygons (11 Min.)
- G10: Circles and Circumferences (13 Min.)
- G11: Circles and Areas (13 Min.)
- G12: Circles and Special Properties (10 Min.)
- G13: Surface Areas of Blocks and Cylinders (9 Min.)
- G14: Surface Areas of Cones (7 Min.)
- G15: Volumes of Blocks and Cylinders (7 Min.)
- G16: Volumes of Cones (7 Min.)
- G17: Surface Areas of Spheres and Balls (7 Min.)
- G18: Archimedes Tombstone, Sphere Area and Volume (12 Min.)
- G19: When Geometry is not enough for Triangles (7 Min.)

Trigonometry: Introduction plus 8 lessons

- T1: Introduction (6Min.)
- T1: Trigonometry Functions (16 Min.)
- T2: Sines (20 Min.)
- T3: Cosines (18 Min.)
- T4: Tangents (9 Min.)
- T5: Warning about \sin^{-1} (9 Min.)
- T6: Law of Sines (12 Min.)
- T7: Law of Cosines and the generalized Pythagorean Theorem (14 Min.)
- T8: Trigonometry beyond Practical Math (5 Min.)

Tier 3 – 39 SAT/ACT AND STANDARDIZED TEST PREP LESSONS

Tier 3 Part 1

T3 Part 1	Introduction	
T3 P1 L1	The Real Number System	(Simmons pp. 34 - 36)
T3 P1 L2A	Notation and Rules	(Simmons pp. 36 - 39)
T3 P1 L2B	Notation and Rules	(Simmons pp. 36 – 39)
T3 P1 L3	Integral Exponents	(Simmons pp. 39 – 40)
T3 P1 L4	Root, Radical, Fractional Exponents	(Simmons pp. 40 – 43)
T3 P1 L5	Polynomials	(Simmons pp. 43- 45)

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T3 P1 L6	Factoring Polynomials	(Simmons pp. 45 – 46)
T3 P1 L7	Linear Equations & Rule of Algebra	(Simmons pp. 46 – 49)
Plus: Review of Algebra and Rules from the Tier 2 Practical Math Foundation.		
T3 P1 L8	Quadratic Equation	(Simmons pp. 46 – 49)
T3 P1 L9	Inequalities and Absolute Values	(Simmons pp. 49 – 50)
T3 P1 L10	Coordinates in a Plane	(Simmons pp. 53 – 54)
T3 P1 L11	Functions and Graphs	(Simmons pp. 51 – 53)
T3 P1 L12	Straight Lines & Linear Functions	(Simmons pp. 55 – 56)
T3 P1 L13	Parallel and Perpendicular Lines	(Simmons pp. 55 – 56)
T3 P1 L14	Intersecting Straight Lines	(Custom Training)

You will learn a process you should master by practice.

Part 1 of Tier 3 should prepare you for a standard test you will need to pass to graduate from high school.

Part 2 of Tier 3 will teach you additional mathematics you will need to excel on the SAT and ACT and other exams.

Tier 3 Part 2

T3 P2 L1	Prime Numbers	(Custom Notes)
T3 P2 L2	Number Facts and Ideas	(Custom Notes)
T3 P2 L3	Percents and Percentage	(Custom Notes)
T3 P2 L4	Chain Discounts	(Custom Notes)
T3 P2 L5	Markups and Discounts	(Custom Notes)
T3 P2 L6	Means, Medians, Averages	(Custom Notes)
T3 P2 L7	Ratios and Proportions	(Custom Notes)
T3 P2 L8	Logic	(Custom Notes)
T3 P2 L9	Arithmetic Progressions	(Simmons pp. 77)
T3 P2 L10	Geometric Progressions	(Simmons pp. 74 – 76)
T3 P2 L11	Geometric Series	(Simmons pp. 74 – 76)
T3 P2 L12	Permutations and Combinations	(Simmons pp. 78 – 81)
T3 P2 L13	Combinations (continued)	(Simmons pp. 78 – 81)
T3 P2 L14	Probability	(Custom Notes)

Tier 3 Part 3

T3 P3 L1	Pep Talk
T3 P3 L2	Test Preparation
T3 P3 L3	Test Techniques
T3 P3 L4	Sample Problems A
T3 P3 L5	Sample Problems B
T3 P3 L6	Sample Problems C
T3 P3 L7	Sample Problems D
T3 P3 L8	More Fun
T3 P3 L9	Fun & Games

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Tier 4 – 66 PRE-CALCULUS LESSONS

Precalculus Mathematics in a Nutshell, and Notes will be used. Geometry, Algebra, Trigonometry, and Complex Numbers, with Wolfram-Alpha will be covered.

T4I Introduction to Tier 4, and Overview

Geometry

- G1 Introduction to Geometry Overview pp 2-3
- G2 Triangles: Angles, Parallel Lines, Area pp 4-5
- G3 Triangles: Similar Congruent p 6
- G4 Pythagorean Theorem pp 6-7
- G5 Circles: Pi, Area, Sector pp 7-8
- G6 Circles: Inscribed angles pp 8-9
- G7 Circles: Tangents & Constructions, Notes
- G8 Angles: Bisect, Trisect, Compass, Impossibilities Notes
- G9 Cylinder: Area, Volume pp 9-10
- G10 Cone: Overview pp 10-11
- G11 Cone: Problems – Help pp 21-22
- G12 Cone: Optional Proof for Math majors Simmons
- G13 Sphere: Volume and Area, Problems pp 22 - 23
- G14 Sphere: Optional Proof with Cavalieri's Principle pp 13-14

Interlude #1

Algebra

- A1 Introduction to Algebra, Rules of Algebra Review p 33
- A2 Basics: Numbers pp 34-35
- A3 Review – Overview Tier 3 pp 36-50
- A4 Review – Overview Tier 3 pp 51-56
- *A5 Introduction to Wolfram-Alpha Notes
- A6 Circles: pp 57-58
- A7 Parabolas: 58-60
- A8 Ellipses: Notes
- A9 Hyperbolas: Notes
- A10 Conic Sections
- A11 Functions and Graphs pp 60-62
- A12 Polynomial Division pp 65-67
- A13 Logarithms Calculator pp 63-65
- A14 Logarithms Exponents Notes
- A15 Examples Log Scale

Interlude #2

Trigonometry

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- T1 Introduction to Trigonometry pp 92-93
- T2 Review of some Analytical Geometry pp 93-96
- T3 Radian Measure pp 96-98
- T4 Trig Functions Circle Definition pp 98-100
- T5 Trig Identities Intro pp 100-101
- T6 Evaluating Trig Functions pp 101-103
- T7 Trig functions graphs pp 103-105
- T8 Frequency and Phase Notes
- T9 Identities pp 105-6 sec 4 pp 114-5
- T10 Identities and graphs Notes
- T11 Proofs of Identities Appendix B pp 111-112
- T12 Inverse Trig Functions pp 107-109
- T13 Law of Sines and Cosines p 109

Complex Numbers

Complex Numbers will be treated with a modern geometric approach. Real Numbers correspond to points on a straight line. Complex Numbers correspond to points in the plane. Complex Numbers have many wonderful geometric properties that relate geometry and algebra. Trigonometry is more fully understood when one understands complex numbers. Euler's identity is the key to this. Complex numbers are very powerful and indispensable in modern STEM subjects.

- C1 Real Numbers Synopsis
- C2 Complex Number Definition
- C3 Complex Numbers Geometry
- C4 Complex Number Geometry Proof
- C5 Interlude for Inspiration y^x
- C6 Interlude Preparation
- C7 Wonderful Equation
- C8 Motivation for Wonderful Equation
- C9 Roots of Unity
- C10 Clocks and Frequency
- C11 Exponents and Logarithms

Algebra Special Topics

- AST1 Mathematical Induction pp 83-84
- AST2 Progressions and Permutations and Combinations Review Tier3 pp 74-80
- AST3 Binomial Theorem pp 81-82
- AST4 Linear Equations Determinants pp 68-70
- AST5 Linear Equations 3D pp 71-73
- AST6 Cone and Sphere, Calculus Preview pp 84-87

Geometry Special Topics for Math Majors/Teachers

- GST1 Review of Geometry
- GST2 Ceva's Theorem pp 27-29
- GST3 Heron's & Brahmagupta's Formulae p 18 Prob 20, pp 30-31

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GST4 Geometry and Algebra, Analytical Geometry
GST5 Euclid Geometry vs Non-Euclidean Geometries
GST6 Calculus Preview

Tier 5 – 32 DIFFERENTIAL & INTEGRAL CALCULUS LESSONS

Part 1. Differential Calculus (14 Lessons)

- T5 C1 Introduction to Calculus
 - Approach to Learning Calculus
 - Calculus Overview
- T5 C2A Functions
 - Graph Terms for Functions
 - Function Graph Terms Sheet for Calculus
 - Function Graphs #1 Worksheet
 - Examples of Graphs
- T5 C2B Functions
 - More Examples
- T5 C3 Derivative
 - Differential Calculus
 - Infinitesimals
 - Derivative definitions
 - Examples
- T5 C4 Derivative Examples
 - From definition
 - From Wolfram Alpha
- T5 C5 Applications to Graphing
 - Increasing/Decreasing
 - Max/Min
 - Points of Inflection
 - Concavity
- T5 C6 Derivative Rules
 - Linear combination Rule
 - Leibniz Rule
 - Quotient Rule
- T5 C7 Chain Rule
 - Derivative Examples from Rules
 - Wolfram Alpha examples
- T5 C8 Implicit Differentiation
- T5 C9 Relative Rates of Change
- T5 C10A Inverse Functions Basics
- T5 C10B Inverse Functions
- T5 C11 Series Expansions
- T5 C12 Final Thoughts on Derivatives

Part 2. Integral Calculus (18 Lessons)

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T5 C13 Integral Calculus Overview
T5 C14 Definition of Integral and the FTC
T5 C15 Techniques of Integration Overview
T5 C16 Applications of Integration Areas
T5 C17 Applications of Integration Arc Length
T5 C18 Applications of Integration Volumes Disc
T5 C19 Applications of Integration Volumes Shell
T5 C20 Applications of Integration Surface Areas
T5 C21 Parametric Functions Graphs
T5 C22 Parametric Functions Arc Length
T5 C23 Parametric Functions Tangent Line
T5 C24 Parametric Functions Area
T5 C25 Wolfram Alpha Commands
T5 C26 Improper Integrals Vertical Asymptotes
T5 C27 Improper Integrals Horizontal Asymptotes
T5 C28 Improper Integrals H A continued
T5 C29 Surface areas of solids revisited
T5 C30 Wolfram Alpha Modern STEM Tool

Tier 6 – 14 DIFFERENTIAL EQUATIONS LESSONS

DE1 Introduction to Differential Equations
DE2 First Order Differential Equations
DE3 First Order Linear Differential Equations
DE4 First Order Linear Differential Equations II
DE5 Polynomial Approximations of Functions
DE6 Math Models (MMs) Chimera or Reality?
DE7 First Order Differential Equations, Separation of Variables
DE8 First Order Differential Equations Redux
DE9 Second Order Linear Differential Equations
DE10 Second Order Linear Differential Equations Constant Coefficients
DE11 First Order Non-Linear ODEs
DE12 Differential Equations Tricks
DE13 Orthogonal Curves
DE14 Polar Coordinates and ODE's