Saxon® *Calculus* Scope and Sequence

Foundations
Real Numbers
Identify the subsets of the real numbers
Identify the order properties of the real numbers
Identify the properties of the real number field
Discuss 0, 1, π, and e
Graph absolute value inequalities
Use interval notation
Algebra
Solve equations and systems of equations
Simplify expressions
Factor
Use factorial notation
Use summation notation
Translate verbal descriptions into algebraic equations
Convert between logarithmic and exponential forms
Distinguish between zeros, roots, and x-intercepts
Characterize quadratic equations
Use the remainder theorem to evaluate polynomials
Use synthetic division
Use the rational roots theorem
Derive and use properties of logarithms
Recognize conics by their equations
Use the binomial theorem
Solve exponential growth problems without calculus
Understand irreducible quadratic factors and their graphical significance
Geometry
Use the midpoint and distance formulas
Write the equation of a line in various forms
Use the Pythagorean theorem
Use similar triangles
Translate or reflect graphs
Understand tangents and slope graphically
Logic
Identify the contrapositives, converses, and inverses of a conditional statement
Understand the logical equivalences of conditional statements to their contrapositives and of converses to inverses
Construct biconditional statements using *iff* (if and only if)
Trigonometry
Convert between radian measure and degrees
Define the trigonometric ratios
Evaluate trigonometric expressions
Simplify trigonometric expressions

Use the unit circle to evaluate trigonometric functions
Find the centerline, amplitude, phase angle, and period of sinusoids and use them in graphing
Derive or use trigonometric identities
Identify the meaning of *confunctions*
Identify the inverse trigonometric functions
Solve trigonometric equations
Graphing Calculator
Graph functions
Use zooming features
Use specific window settings
Use tracing features
Change modes
Find intersection points
Find zeros of polynomials
Find zeros of functions
Evaluate functions
Verify domains and ranges of functions
Generate tables of function values
Evaluate exponentials
Evaluate logarithms
Use the absolute value function
Approximate limits
Approximate slopes of curves
Graph conics
Use function variables
Find local extrema
Approximate definite integrals
Graph sequences
Graph parametric equations
Graph polar equations
Basics of Functions
Represent functions as rules to be applied to specified sets, as tables of values where members in one set are uniquely paired to members of another, and as graphs of such paired values
Evaluate functions
Use function notation
Use the vertical line test
Determine whether mappings are functions
Find the domains and ranges of functions
Add, subtract, multiply, divide, and compose functions
Find and evaluate inverse functions
Understand properties of even and odd functions
Functions, Graphs, and Limits
Analysis of Graphs
Graph functions and equations
Trigonometric functions

Inverse trigonometric functions
Exponential functions
Logarithmic functions
Absolute value functions
Piecewise functions
The greatest integer function
Rational functions
Conic sections
Reciprocal functions
Parametric equations
Polar curves
Vector functions
Using technology
Find points of intersection
Find zeros of functions
Identify the intervals on which a function is increasing (or decreasing)
Determine local and global extrema
Limits of Functions
Understand limits graphically
Understand limits using epsilon-delta proofs
Calculate limits using algebra
Approximate limits from graphs and data tables
Calculate one-sided limits
Calculate limits that are disguised derivatives
Evaluate $\lim_{x \to 0} (1 + x)^{1/x}$
Evaluate $\lim_{x \to 0} \frac{\sin x}{x}$
Approximate limits using technology
Find limits of sums, differences, products, and quotients
Use the squeeze theorem
Find limits of compositions
Use change of variables
Evaluate limits using logarithms
Asymptotic and Unbounded Behavior
Understand asymptotes graphically
Understand infinite and undefined limits
Find limits using asymptotes
Find asymptotes of rational polynomial functions
Graph functions with asymptotes
Find asymptotes using limits
Compare relative magnitudes of functions
Continuity as a Property of Functions
Understand continuity graphically
Understand continuity in terms of limits
Use the maximum-minimum value existence theorem (Extreme Value Theorem)
Use the critical number theorem
Understand point continuity

Understand interval continuity
Use the Intermediate Value Theorem
Parametric, Polar, and Vector Functions
Understand parametric equations
Convert between parametric and rectangular coordinates
Graph parametric equations
Use parametric equations to describe projectile motion
Understand polar coordinates
Convert between polar and rectangular coordinates
Graph rose curves, limaçons, and lemniscates
Understand vectors
Perform vector addition, subtraction, and scalar multiplication
Find unit and normal vectors
Graph vector functions
Derivatives
Concept of the Derivative
Understand the derivative geometrically
Define *derivative* as the limit of a difference quotient
Understand the derivative as an instantaneous rate of change
Prove the sum and difference rules for derivatives
Prove the product rule for derivatives
Prove the quotient rule for derivatives
Find differentials of functions
Describe the relationship between differentiability and continuity
Derivative at a Point
Calculate slope at a point
Find the line tangent to a curve at a point
Find the line normal to a curve at a point
Approximate slopes using technology
Approximate rate of change from graphs and tables
Find critical numbers
Find instantaneous rate of change
Use the derivative at a point for local linear approximation
Derivative as a Function
Use various notations for the derivative of a function
Relate the characteristics of the graphs of functions and their derivatives
Relate the increasing and decreasing behavior of functions to the signs of their derivatives
Translate verbal descriptions into equations involving derivatives
Derive the Mean Value Theorem
Understand consequences of the Mean Value Theorem
Second Derivatives
Find inflection points

Understand the relationships between the graphs of functions, their first derivatives, and their second derivatives
Understand the relationship of the sign of the second derivative to concavity
Applications of the Derivative
Use differentiation to analyze linear motion
Interpret the derivative as a rate of change
Analyze curves in rectangular form
Model rates of change
Solve related-rates problems
Use derivatives in optimization problems
Use L'Hôpital's Rule
Use implicit differentiation to find the derivative of an inverse function
Use Newton's method
Use slope fields
Analyze curves in parametric, polar, and vector forms
Use Euler's method
Computation of Derivatives
Compute derivatives using the definition
Find derivatives of constant functions
Find derivatives of polynomial functions
Find derivatives of sums, products, differences, and quotients
Find derivatives of exponential functions
Find derivatives of logarithmic functions
Find derivatives of trigonometric functions
Find derivatives of inverse trigonometric functions
Find derivatives of absolute value functions
Compute and evaluate high-order derivatives
Differentiate implicitly
Use substitution
Use the chain rule
Use logarithmic differentiation
Find derivatives of functions defined by definite integrals
Find the derivatives of parametric, polar, and vector functions
Integrals
Reimann Sums
Learn the concept of a Reimann sum
Compute Reimann sums using left, right, and midpoint evaluation points
Compute Reimann sums using circumscribed and inscribed (upper and lower) rectangles
Interpretations and Properties of Definite Integrals
Define *definite integral* as the limit of a Reimann sum

Use geometry to evaluate definite integrals
Interpret the definite integral of the rate of change of a quantity on an interval as the change of the quantity on the interval
Use additive properties of definite integrals
Use linearity of definite integrals
Applications of Integrals
Find the areas of regions determined by rectangular curves
Solve mechanical work problems
Solve accumulation problems
Find the volumes of solids of revolution using disks
Find the forces of fluids on sides of tanks
Find the distances traveled by moving particles on lines
Find the volumes of solids of revolution using washers
Find the volumes of solids of revolution using shells
Use the Mean Value Theorem for Integrals
Find the average values of functions
Find the volumes of solids with known cross sections
Define the natural logarithm function using a definite integral
Find the lengths of rectangular curves
Find the lengths of parametric curves
Find the areas of regions determined by polar curves
Fundamental Theorem of Calculus
Use the Fundamental Theorem to evaluate definite integrals
Use the Fundamental Theorem to represent particular antiderivatives
Analyze functions defined by integrals
Prove the Fundamental Theorem
Techniques of Antidifferentiation
Use knowledge of derivatives to determine antiderivatives
Find antiderivatives of constants
Find antiderivatives of products of constants and functions
Find antiderivatives of power functions
Antidifferentiate sums
Antidifferentiate $\frac{1}{x}$
Antidifferentiate exponential functions
Antidifferentiate logarithmic functions
Antidifferentiate trigonometric functions
Use substitution of variables
Change limits of definite integrals
Antidifferentiate by parts
Use partial fractions
Use trigonometric substitution
Evaluate improper integrals
Perform piecewise integration
Applications of Antidifferentiation

Use antidifferentiation to analyze linear motion
Find specific antiderivatives using initial conditions
Solve separable differential equations
Model exponential growth by separable differential equations
Model logistic growth by separable differential equations
Numerical Approximation of Definite Integrals
Use Reimann sums to approximate definite integrals
Use the trapezoidal rule to approximate definite integrals
Use Taylor series to approximate definite integrals
Use technology to approximate definite integrals
Polynomial Approximations and Series
Concept of Series
Define sequence
Define *series* as the limit of a sequence of partial sums
Define *convergence* and *divergence* of series
Use technology to explore convergence and divergence of series
Understand arithmetic of series
Series of Constants
Represent repeating decimal numbers as series
Determine whether geometric series converge or diverge
Calculate the sums of convergent geometric series
Use geometric series to solve applied problems
Determine whether telescoping series converge or diverge
Calculate the sums of convergent telescoping series
Determine whether *p*-series converge or diverge
Understand the harmonic series
Use the integral test to determine whether series converge or diverge
Use the integral test to prove the convergence rules for *p*-series
Use the basic comparison test to determine whether series converge or diverge
Use the ratio test to determine whether series converge or diverge
Use the root test to determine whether series converge or diverge
Use the limit comparison test to determine whether series converge or diverge
Determine whether alternating series converge or diverge
Calculate error bound of alternating series approximation
Taylor Series
Find the Maclaurin series for e^x
Find the Maclaurin series for $\sin x$
Find the Maclaurin series for $\cos x$
Find the Maclaurin series for $\frac{1}{1+x}$
Compare graphs of functions and their Taylor polynomials

Approximate functions using Taylor polynomials
Express functions as general Taylor series centered at $x = a$
Find Lagrange error bound for Taylor polynomials
Determine radius and interval of convergence
Form new Taylor series by differentiating
Form new Taylor series by integrating
Define functions by power series
Form new Taylor series by substituting

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