

This course is an introduction to calculus for students intending to concentrate in Mathematics, Statistics or Physics.

**Textbook:** *Calculus, Early Transcendentals*, 5th Edition  
by James Stewart (Brooks/Cole)

**Prerequisite:** OAC Calculus.

**Instructor:** G.G. Smith

<b>Evaluation:</b>	Homework	20%
	4 Term Tests (5% each)	20%
	December Examination	30%
	Final Examination	30%

**Outline:**

- IRRATIONAL NUMBERS: definition, examples.
- INEQUALITIES: absolute values, triangle inequality.
- LIMITS: definition, properties, limits involving infinity.
- CONTINUITY: definition, elementary functions, intermediate value theorem, extreme value theorem.
- DERIVATIVES: definition, interpretations, rate of change, tangent lines, relationship with continuity.
- DIFFERENTIATION: linearity, product rule, elementary functions.
- CHAIN RULE: related rates, implicit functions.
- INVERSE FUNCTIONS: injective, derivatives,  $\ln(x)$ ,  $\arctan(x)$ ,  $\arcsin(x)$ .
- MEAN VALUE THEOREM: kernel of derivative, increasing function theorem.
- OPTIMIZATION: local and global extrema, critical points, open and closed intervals.
- L'HÔPITALS RULE: using derivatives to evaluate limits.
- CONVEXITY: inflection points, second derivatives.
- CURVE SKETCHING: asymptotes, families of curves.
- DEFINITE INTEGRAL: estimating definite integrals, definition, interpretations, properties, relationship with continuity.
- FUNDAMENTAL THEOREM OF CALCULUS: total change in rate, constructing functions using definite integrals.
- TECHNIQUES OF INTEGRATION: substitution, integration by parts, partial fractions (distinct linear factors, irreducible quadratics).
- IMPROPER INTEGRALS: locally integrable, improperly integrable, absolutely integrable, comparison theorem.
- APPLICATIONS OF INTEGRALS: area between two functions, volume (disk and shell method), probability (density functions, cumulative distribution, median, mean).
- APPROXIMATE INTEGRATION: Simpson's rule.

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- PARAMETRIC CURVES: velocity, acceleration, tangent lines, arc length.
- CARDINALITY OF SETS: bijections, countable sets, size of rationals, size of the reals, intervals of real numbers.
- SEQUENCES: properties of convergent sequences, squeeze theorem, monotone convergence theorem, Cauchy sequences.
- INFINITE SERIES: partial sums, geometric series, harmonic series, telescopic series,  $p$ -series, absolute convergence.
- TEST FOR CONVERGENCE OF SERIES: divergence test, integral test, comparison test, limit comparison test, ratio test, alternating series test.
- TAYLOR POLYNOMIALS: definition, approximating functions.
- POWER SERIES: radius of convergence, standard series (geometric, exponential,  $\sin(x)$ ,  $\cos(x)$ ,  $\arctan(x)$ ,  $\ln(1 + x)$ ), term-by-term integration and differentiation, binomial series.
- FUNCTIONS OF SEVERAL VARIABLES: functions of two variables, graphs, cross-sections, contours, limits, continuity, partial derivatives, local linearity.