Summary Only:

First-Year Core Calculus

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Core Calculus Subcommittee:

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Core Curriculum – Sciences Calculus
First-Year

A first year (two-semester) Sciences Calculus course must include all the topics from the **Core Topics** list. It is expected that coverage of this material would constitute three-quarters of the course(s) with the remaining one-quarter chosen from the **Additional Topics** list. For breadth, at least four Additional Topics should be included.

Reference Text: Edwards & Penney, *Calculus, Early Transcendentals, Fifth Edition*, Prentice Hall,1998.

Core Topics (75%)

1. Limits, continuity, intermediate value theorem
2. Differentiation
   - First and second derivatives with geometric and physical interpretations
   - Mean value theorem
   - Derivatives of exp and log functions, exponential growth and decay
   - Derivatives of trigonometric functions and their inverses
   - Differentiation rules (including chain rule, implicit differentiation)
   - Linear approximations and Newton's Method
   - Optimization - local and absolute extrema with applications
3. Taylor polynomials and special Taylor series (sin, cos, exp, 1/(1-x))
4. Curve sketching
5. Integration
   - Definition of the definite integral
   - Areas of plane regions
   - Average value of a function
   - Fundamental Theorem of Calculus
   - Integration techniques: substitution (including trig substitution), parts, tables, partial fractions
   - Applications of integration
6. Numerical Integration (including The Trapezoidal Rule)
7. Improper integrals: evaluation and convergence estimates
8. Differential equations (first-order linear) with applications

Additional Topics (25%)

1. Sequences and series
2. Arc length, volumes, centroids, surface areas
3. Additional differential equations topics
4. Complex numbers
5. Continuous probability density functions
6. Polar coordinates and parametric equations (with calculus applications)
7. Additional numerical methods (eg. Simpson's Rule)
8. Related rates
9. L'Hôpital's Rule

Core Curriculum – Social Sciences/Business Calculus First-Year

A first year (two-semester) Social Sciences/Business Calculus course must include all the topics from the **Core Topics** list. It is expected that coverage of this material would constitute approximately two-thirds of the course(s) with the remaining one-third chosen from the **Additional Topics** list. For breadth, at least four Additional Topics should be included.

Reference Text: Haeussler and Paul, *Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences*, *Ninth Edition*, Prentice Hall, 1998.

Core Topics (67%)

1. Limits, continuity, intermediate value theorem
2. Differentiation
   - First and second derivatives with geometrical and physical interpretations
   - Applications to economics, business and social sciences
   - Derivatives of exp and log functions, exponential growth and decay with applications
   - Derivatives of trigonometric functions
   - Differentiation rules (including chain rule, implicit differentiation)
   - Linear approximations and Newton's Method
   - Optimization - local and absolute extrema with applications
3. Curve sketching
4. Integration
   - Definition of the definite integral
   - Areas
   - Average value of a function
   - Fundamental Theorem of Calculus
   - Integration techniques: substitution, parts, tables
   - Applications of integration
5. Numerical integration (including The Trapezoidal Rule)
6. Differential equations (first-order linear) with applications

Additional Topics (33%)

1. Introduction to probability and statistics
2. Partial derivatives and Lagrange multipliers
3. Matrix analysis and Gaussian Elimination
4. Sequences and series
5. Arc length, volumes, centroids, surface areas
6. Taylor polynomials and special Taylor series (sin, cos, exp, 1/(1-x))
7. Improper integrals: evaluation and convergence estimates
8. Continuous probability density functions
9. Related rates
10. Derivatives of inverse trigonometric functions
11. Further techniques of integration
12. Additional numerical integration methods

Transfer Proposal for First-Year Calculus

The BCcupm affirms the autonomy of BC's post-secondary institutions in their freedom to design calculus courses to meet the needs of their unique constituencies. However, the diversity of calculus courses in first year offerings in these institutions has created difficulties for transferring students and their institutions. For example, while current first-year "business" calculus courses at SFU, UBC and UVic share many common topics, the additional material covered by these institutions is irreconcilable within a single two-term calculus sequence.

This proposal addresses the significant challenges encountered by students transferring first-year calculus courses and by their sending institutions. To lessen the impact of these challenges, we propose that all post-secondary institutions in BC recognize a common curriculum for first-year calculus courses. Such recognition will have the following benefits for students and their institutions:

a) Provide transferring students with a solid background for subsequent math courses requiring first-year calculus.
b) Allow primarily sending institutions to design calculus courses that will meet the needs of their students post-transfer.
c) Guide primarily receiving institutions in assessing the adequacy of courses proposed for transfer.

Recommendations:

1. That the BCcupm accept the Report of the First-Year Calculus Sub-committee and endorse the Core Sciences Calculus and Core Social Sciences/Business Calculus curricula as described in this report.

2. That receiving institutions grant full transfer credit to first-year calculus courses from other BC post-secondary institutions whose courses are consistent with the curricula as described in this report.

3. That, when designing or modifying first-year calculus courses, all BC post-secondary mathematics departments strive to include within their courses the calculus topics as described in this report.

4. That any post-secondary institution sensing that the Core Calculus curricula as described in this report require a full or partial review raise its concerns at the next regularly scheduled meeting of the BCcupm.

5. That, in the absence of an earlier full review, the Core Calculus curricula be subject to a mandatory, full review after five years.