Multivariable Calculus
Course Compendium

Multivariable Calculus Credits: 5 Prerequisite: AP Calculus BC Grade: 12

This course is designed to continue study in the field of calculus. It is intended for students who have completed courses equivalent of Calculus 1 & 2 and are now ready to extend the ideas they have learned and apply them to functions of more than one variable. The course will begin with a review of the concepts taught in Calculus 2 and then introduce the traditional material covered in a college-level "Calculus 3" program: lines and planes in 3-space, vectors, functions of several variables, partial derivatives, multiple integrals, line integrals and vector analysis. These topics will be especially valuable to students who plan on continuing their studies in mathematics, engineering, physics or computer science.

UNITS OF STUDY*

Unit 1- *A brief review of differential Calculus*
Unit 2- A *brief review of integral Calculus*
Unit 3- *Vectors and Three Dimensional Space*
Unit 4- *Vector Functions*
Unit 5- *Functions of Several Variables and Partial derivatives*
Unit 6- *Multiple Integrals*
Unit 7- *Matrices and Systems of Equations*

INTERDISCIPLINARY CONNECTIONS

NJSLS Companion Standards Grades 9-12
(Reading & Writing in Science & Technical Subjects)

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

21st Century Life and Careers

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

**See individual units for Pacing Guide, NJSLS Standards, Transfer Skills, Enduring Understandings, Essential Questions, Learning Objectives, Key Vocabulary, Skills, Resources, & Assessments*

CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.
9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.
9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.12.A.CS1 Understand and use technology systems.

8.1.12.A.CS2 Select and use applications effectively and productively.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment

E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.

MODIFICATIONS / ACCOMMODATIONS

GENERAL CONSIDERATIONS FOR DIVERSE LEARNERS		
English Language Learners	**Students Receiving Special Education Services**	**Advanced Learners**
- Personal glossary - Text-to-speech - Extended time - Simplified / verbal instructions - Frequent breaks WIDA Can Do Descriptors for Grade 9-12 WIDA Essential Actions Handbook FABRIC Paradigm Wall Township ESL Grading Protocol	- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback	- Use of high level academic vocabulary/texts - Problem-based learning - Pre-assess to condense curriculum - Interest-based research - Authentic problem-solving - Homogeneous grouping opportunities Knowledge and Skill Standards in Gifted Education for All Teachers Pre-K-Grade 12 Gifted

**See individual units for Pacing Guide, NJSLS Standards, Transfer Skills, Enduring Understandings, Essential Questions, Learning Objectives, Key Vocabulary, Skills, Resources, & Assessments*

Use WIDA Can Do Descriptors in coordination with Student Language Portraits (SLPs).	Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner. Considerations for Special Education Students 6-12 National Center on Universal Design for Learning - About UDL UDL Checklist UDL Key Terms	Programming Standards Gifted Programming Glossary of Terms **Students with 504 Plan** Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.

At Risk Learners / Differentiation Strategies

Alternative Assessments Games and Tournaments Group Investigations Multiple Texts Personal Agendas Homogeneous Grouping Online Math Practice	Independent Research & Projects Multiple Intelligence Options Varied Supplemental Activities Tiered Activities/Assignments Choice of Activities Mini-Workshops to Reteach or Extend Use of Collaboration of Various Activities	Jigsaw Flexible Grouping Goal-Setting with Students Homework Options Open-Ended Activities Work Alone/Together

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