COURSE PROFICIENCY OUTLINE

ADVANCED PLACEMENT CALCULUS - 1320

5 Credits

Purpose

Calculus is a subject in which much can be learned by doing problems. In the subject course of instruction, special attention has been given to selecting an ample supply of problems that relate to the various mathematical concepts being taught. These problems are assigned to the students on a daily basis to give them as wide a variety of experiences as possible.

The assigned problems at the completion of a teaching experience contain not only problems that require straightforward application of the material, but also problems that involve subtle use of new ideas in conjunction with concepts already developed.

This course of instruction follows the recommendations of the Committee on Mathematics of Advanced Placement Program. The course covers material of analytic geometry and essentially all of the material on functions of one variable.

Also, there is a more leisurely introduction to such topics as inequalities, absolute values, intervals, functions and limits. Some time is devoted on infinite series and differential equations. This selection of topics meets the requirements set forth in the syllabus of the College Entrance Examination Board for both the AB and BC examination.

I. Student Outcomes 4.1, 4.2, 4.3, and 4.5

The major goal of the Advanced Placement Calculus course is successful student results on the AP Calculus examination administered by the College Entrance Exam Board.

The Advanced Placement Calculus Examinations are three hours long and seek to determine how well a student has mastered the concepts and techniques of the subject matter of the corresponding course. Each examination consists of (1) a multiple-choice section testing proficiency in a wide variety of topics, and (2) a problem section requiring the student to demonstrate the ability to carry out proofs and solve problems involving a more extended chain of reasoning. In the determination of the grade for each examination, the two sections are given equal weight. Since the examinations are designed for full coverage of the subject matter, it is not expected that all students will be able to answer all the questions.

II. Content 4.1, 4.2 ,4.3 and 4.5

A. Elementary Functions (algebraic, trigonometric, exponential, and logarithmic)

1. Properties of functions
   a. Definition, domain, range
   b. Sum, product, quotient, and composition
   c. Absolute value
   d. Inverse
   e. Odd and even
   f. Periodicity
   g. Graphs: symmetry and asymptotes
   h. Zeroes of a function

2. Properties of particular functions
   a. Fundamental identities and addition formulas for trigonometric functions
   b. Amplitude and periodicity of A sin (bx+c)
   c. a^x ($a > 0$, $a=1$) and $\log_a x$
      ($a > 0$, $a=$, and $x > 0$) and their inverse relationship

3. Limits
   a. Statement and applications of properties, e.g., limit of a constant, sum, product and quotient
   b. The number e such that
      $$\lim_{n} \left(1 + \frac{1}{n}\right)^{n} = e$$
   c. $$\lim_{x \to 0} \frac{\sin x}{x} = 1$$
   d. Nonexistent limits
   e. Continuity
   f. Statements and applications but not proofs of continuity theorems.

B. Differential Calculus

1. The derivative
   a. Definitions of the derivative
   b. Derivatives of elementary functions
   c. Derivatives of sum, product, quotient
   d. Derivative of a composite function (chain rule)
   e. Derivative of an implicitly defined function
   f. Derivative of the inverse of a function (including Arcsin x and Arctan x)
   g. Logarithmic differentiation
   h. Derivatives of higher order
   i. Statement (without proof) of The Mean Value Theorem; applications and graphical illustrations
   j. Relation between differentiability and continuity
   k. Use of l'Hopital's rule (quotient indeterminite forms)

2. Applications of the derivative
   a. Slope of a curve; tangent and normal lines to a curve (including linear approximations)
   b. Curve sketching increasing and decreasing functions; relative and absolute maximum and minimum points; concavity, points of inflection
   c. Extreme value problems
   d. Velocity and acceleration of a particle moving along a line
   e. Average and instantaneous rates of change
   f. Related rates of change

C. Integral Calculus

1. Antiderivatives

2. Applications of antiderivatives
   a. Distance and velocity from acceleration with initial conditions
   b. Solutions of y = ky and applications to growth and decay

3. Techniques of integration
   a. Basic integration formulas
   b. Integration by substitution (use of identities, change of variable)
   c. Simple integration by parts

4. The definite integral
   a. Concept of the definite integral as an area
   b. Approximations to the definite integral using rectangles
   c. Definition of the definite integral as the limit of a sum
   d. Properties of the definite integral
   e. Fundamental theorems of calculus

5. Applications of the integral
    a. Average (mean) value of a function on an interval
    b. Area between curves
    c. Volume of a solid revolution (disc, washer, and shell methods) about the X- and Y- axes or lines parallel to the axes

III. **Materials**

A. Student's Knowledge - This course is intended for students who have a thorough knowledge of college preparatory mathematics, including algebra, axiomatic geometry, trigonometry, and analytic geometry (rectangular and polar coordinates, equations and graphs, lines and conics). It is not assumed that they have acquired a sound understanding of the theory of elementary functions.

B. Text: Sworkowski, Calculus, Prindle, Webber and Schmidt Publishing Company

C. Other

1. Past Advanced Placement Tests
2. Notebook and graphing calculator

IV. Evaluation

A. The student will be expected to complete classwork, homework, keep a notebook and take tests and quizzes. These will be checked and reviewed by the teacher.

B. The student will be expected to demonstrate an acceptable level of proficiency in the objectives and content of this course.

C. The student will be expected to demonstrate at all times appropriate classroom behavior such as self-control, respect for others, respect for property and a mature attitude.

D. The student will be expected to adhere to the school rules and regulations for behavior and the district policy for attendance.

E. Students will be required to successfully pass the High School Proficiency Test as mandated in the graduation law (N.J.S.A. 6:8-4.2).

F. Students who fail the HSPT examination will be placed in a Basic Skills Math class as required by N.J.S.A. 6:8-4.2. There will be no exceptions to this requirement.

G. The final grade represents the teacher's professional judgment of the student's performance and all of the aforementioned activities and/or requirements are included in the evaluative process.

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