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**PINEWOOD – THE AMERICAN INTERNATIONAL SCHOOL OF THESSALONIKI, GREECE**

**NAME OF COURSE: MATHEMATICS IB 2 / CALCULUS**

**GRADE LEVEL: 12**

**SCHOOL YEAR: 2011 – 2012**

### **COURSE DESCRIPTION**

Designed as the continuation Mathematics IB 1, this course completes the material in the IB Standard Level Mathematics syllabus as well as the AP Calculus syllabus. It continues with all work not completed in the IB 1 course, reviews all previous work and provides an in depth study differential calculus and its applications, followed by a study of integral calculus and its applications. The course emphasizes a multirepresentational approach to calculus, with concepts, results, and problems being expressed geometrically, numerically, analytically and verbally.

Throughout the course great emphasis is placed on quantitative reasoning and problem solving techniques.

The graphic display calculator is an integral part of the program. It is used regularly by the students and teachers to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

Throughout the year, the students will also have the opportunity to practice for their final exams by taking previous IB exams.

Prerequisite: Mathematics IB1, teacher recommendation

### **LEARNING OBJECTIVES**

- know the mathematical concepts and principles
- read and interpret a given problem in appropriate mathematical terms
- organize and present information/data in tabular, graphical and/or diagrammatic forms
- know and use appropriate notation and terminology
- formulate a mathematical argument and communicate it clearly
- select and use appropriate mathematical techniques
- understand the significance and reasonableness of results
- recognize patterns and structures in a variety of situations and draw inductive generalizations
- demonstrate an understanding of, and competence in, the practical applications of mathematics
- use appropriate technological devices as mathematical tools.

## SCOPE AND SEQUENCE \*

### QUARTER I

#### Topic 5: Vectors (ctd)

- Vector equation of a line
- Angle between two lines
- Coinciding and parallel lines
- Points of intersection

#### Topic 6: Statistics and Probability

- Concepts of population, sample, random sample and frequency distribution
- Presentation of data: frequency tables and diagrams, box and whisker plots
- Grouped data: mid-interval values, interval width; upper and lower boundaries,
- Frequency histograms
- Mean, median, mode; quartiles, percentiles
- Range; IQR; variance; standard deviation
- Cumulative frequency tables and graphs; use to find median, quartiles, percentiles

### QUARTER II

#### Topic 6: Statistics and Probability (ctd)

- Sample space of an experiment
- Probability of an event
- Probability using permutations and combinations
- Mutually exclusive events
- Independent events
- Conditional probability
- Venn, Lattice and Tree Diagrams, Tables of Outcomes
- Concept of discrete random variables and their distributions
- Expected value
- Binomial Distribution; mean of binomial distribution
- Normal Distribution, properties of normal distribution, standardization of normal variables
- Applications

#### Topic 7: Calculus

##### Differentiation

- Informal concept of limits and convergence
- Rates of change
- Definition of derivative using first principles

## QUARTER III

### Differentiation (ctd)

- Gradient of a curve at a point
- Differentiation of polynomials
- Differentiation of trigonometric functions
- Differentiation of exponential and logarithmic functions
- Chain rule for composite functions
- Product and quotient rules
- Second derivative
- Stationary points
- Simple max/min problems
- Application – economics, kinematics

### **Integration**

- Reverse of differentiation
- Indefinite integrals and applications
- Integration with a boundary condition
- Definite integrals
- Area under a curve
- Applications – kinematics
- Volumes of revolution
- Area between two curves

### **Graphical Behavior of functions**

- Tangents and normals
- Behavior for large  $|x|$

## QUARTER IV

- Horizontal and vertical asymptotes
- Significance of second derivative
- Points of inflexion with zero and non-zero gradients
- **Review for exams**

The rest of the year is spent on reviewing all the work covered in year 1, taking short and long tests based on past papers and generally helping the students prepare for their exams. My aim is to take their weaknesses and try to convert them into strengths. Exam strategies will be discussed and tips for using the GDC will be given.

Throughout the year all portfolio work is completed. Appropriate time is given in class for discussion on criteria and on completing mock portfolios. About 3 weeks of class time is incorporated in the program for this type of work.

Time is also spent in the computer lab for work on graphing software.

***Students in the I.B. program, whose predicted grade is 3 or less, have to take the semester exams set by the school in order for them to get our High School diploma.***

*\*Note that the order in scope and sequence is subject to change during the school year.*

## **HOMEWORK POLICY**

Frequent homework assignments, based on the day's lecture and assigned out of the main textbook or given in the format of a worksheet. All homework is to be collected and graded. Homework submitted late will lose 10% of the overall score for each day late, and will only be accepted up to two days after the due date.

## **ASSESSMENT**

### **ASSESSMENT OUTLINE (PINEWOOD CREDIT)**

The students are evaluated on the following:

- Homework assignments, quizzes and tests.
- Class participation including board work, attentiveness of the student during the lecture, interest and effectiveness of the student in answering and asking questions about the lecture, and general classroom behavior of the student.
- Three to four tests per quarter, testing the student's overall knowledge and comprehension of a specific chapter or a number of sections. Where possible, the questions will be based on past IB questions.
- The Math Department will not be giving any re-take tests, therefore thorough preparation is expected.

## **GRADING POLICY**

TESTS, QUIZZES AND PROJECTS: 60% of the Quarter grade

HOMEWORK: 30% of the Quarter grade

CLASS PARTICIPATION: 10% of the Quarter grade

- 4% PARTICIPATION
- 3% EFFORT
- 3% BEHAVIOR / ATTITUDE

Semester I grade: 40% Quarter I grade + 40% Quarter II grade + 20% Exam I

Semester II grade: 40% Quarter III grade + 40% Quarter IV grade + 20% Exam II

FINAL GRADE: 50% SEMESTER I GRADE + 50% SEMESTER II GRADE

## INTERNATIONAL BACCALAUREATE ASSESSMENT

**A. INTERNAL ASSESSMENT – The Portfolio – 20% of final mark**

**B. EXTERNAL ASSESSMENT – Examination Papers – 80% of final mark**

### A. THE PORTFOLIO

In Mathematics SL every candidate has to produce a portfolio containing two pieces of work completed during the course. Each piece of work in the portfolio is internally assessed by the teacher against criteria which collectively address all the group 5 objectives. A sample of two portfolios from each school is then externally moderated to ensure uniformity of standards.

Each piece of work in a portfolio is assigned by the teacher. The assignments must be based on different areas of the syllabus and represent the two types of tasks: mathematical investigation and mathematical modelling.

### B. EXAMINATION PAPERS

#### PAPER ONE

- ◆ 1 hour 30 minutes
- ◆ Consists of section A, short questions answered on the paper and section B, extended-response questions answered on answer sheets
- ◆ Knowledge of all topics is required, however, not all topics are necessarily assessed in every examination session.
- ◆ Paper 1 questions will mainly involve analytical approaches to solutions rather than requiring the use of a GDC.
- ◆ It is not intended to have complicated calculations with the potential for careless errors. However, questions will include some arithmetical manipulations when they are essential to the development of the question.
- ◆ Calculators will **not** be allowed on paper 1.
- ◆ 90 marks, 40% of final mark

#### PAPER TWO

- ◆ 1 hour 30 minutes
- ◆ Paper 1 and paper 2 will both
- ◆ Consists of section A, short questions answered on the paper , and section B, extended-response questions answered on answer sheets.
- ◆ Knowledge of all topics is required, however, not all topics are necessarily assessed in every examination session.
- ◆ Graphic display calculators (GDCs) will be **required** on paper 2
- ◆ Students must have access to a GDC at all times, however not all questions will necessarily require the use of the GDC.
- ◆ There will be questions where a GDC is not needed and others where its use is optional. There will be some questions that cannot be answered without a GDC that meets the minimum requirements.
- ◆ 90 marks, 40% of final mark

**Rubrics for each paper and section are included below.**

Section A questions should be answered in the spaces provided, and Section B questions on the answer sheets provided by the IBO. Graph paper should be used if required. The answer spaces have been included with the first 2 questions of Section A on each paper.

**Paper 1**

*Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.*

**Section A**

*Answer all the questions in the spaces provided. Working may be continued below the lines, if necessary.*

**Section B**

*Answer all the questions on the answer sheets provided. Please start each question on a new page.*

**Paper 2**

*Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer.*

*Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.*

**Section A**

*Answer all the questions in the spaces provided. Working may be continued below the lines, if necessary.*

**Section B**

*Answer all the questions on the answer sheets provided. Please start each question on a new page.*

**RESOURCES**

- Mathematics SL (3<sup>rd</sup> edition) – IBID press
- Mathematics SL – Oxford Press
- Advanced Mathematics: Pre-Calculus with Discrete Mathematics and Data Analysis – Houghton, Mifflin
- Pure Mathematics – Cambridge University Press
- Pure Mathematics – Oxford Press
- Statistics – Cambridge University Press
- Pure Mathematics – The Jacaranda Press
- Pure Mathematics for Advanced Level, 2<sup>nd</sup> Edition – Heinemann Educational Books
- Calculus with Analytic Geometry - Holt, Rinehart and Winston
- TI-83/4 work booklets

## **ACADEMIC HONESTY**

Academic honesty is fundamental to the integrity and operation of our school. Acts of academic dishonesty, including plagiarism (the act of presenting others' words and ideas as one's own without crediting the source), stealing in quizzes and tests, copying work from other students or allowing their own work to be copied, or using notes during a test, are considered serious offences. The consequences of academic dishonesty will be a zero grade on the specific test/assignment, and additional disciplinary action. The said student will be ineligible or removed from the National Honor Society.