**Curriculum**

**IB Math SL Y1**

**Course Overview**

This is a two-year course designed to prepare students with an average to above average background and ability in mathematics for the International Baccalaureate Diploma Program, a rigorous pre-university course of studies. A TI-83+ or TI-84+ is required for this course.

In the first year, students will study five of the seven topics that are to be covered during the two-year course as well as complete portfolio assignments that will be used as the internal assessment component of the students’ IB score at the end of the course. The five topics include Algebra, Functions and Equations, Circular Functions and Trigonometry, Matrices, and Vectors. The portfolio assignments will be of varying difficulty and will cover different areas of the curriculum. The purpose of the portfolio is to give students the opportunity to study a particular topic in greater detail. It will also provide the students with the opportunity to communicate effectively with sound mathematical writing.

**Department Standards**

Students will be able to comprehend mathematical concepts.

Students will apply mathematical procedures accurately, efficiently, and appropriately.

Students will be able to formulate, represent, and solve mathematical problems.

Students will develop logical mathematical thought and precise mathematical communication.

**Benchmarks**:

Students will be able to:

demonstrate mastery of basic algebraic concepts and their applications;

explore the notion of function as a unifying theme in mathematics and apply functional methods to a variety of mathematical situations;

explore circular functions and solve triangles using trigonometry;

explore both algebraic and geometric approaches to vectors; and

investigate the basic concepts of statistics.

**Performance Indicators**

First Quarter

Students will be able to:

receive help as needed concerning IB presumed knowledge;

find the vertex and axis of symmetry of a quadratic function in vertex form and general form;

analyze a quadratic equation, draw its graph, and find its maximum or minimum value;

write a quadratic equation or function using information about its roots and/or graph;

solve quadratic equations using various methods including factoring, the quadratic formula or completing the square;

use the discriminant to determine the nature of the roots of a quadratic equation;

expand powers of binomials;

identify domain, range and specific function values using the equation or graph of a function;

find the composite of two given functions;

evaluate a composite function;

work with the identity and reciprocal functions as equations and on graphs;

find the inverse of a function algebraically and through graph symmetry;

use a graphing calculator effectively;

identify horizontal and/or vertical asymptotes;

apply the laws of exponents;

solve exponential equations;

identify the important features of the graph of an exponential function; and

graph exponential functions.

Second Quarter

Students will be able to:

define logarithmic functions;

relate logarithmic and exponential functions;

apply the basic properties of logarithms;

use common logarithms in solving equations;

use exponential and logarithmic functions to solve growth and decay problems;

define and use the natural logarithm function;

graph and analyze the vertical shift, horizontal shift, reflection and stretch of the graphs of different types of functions (linear, quadratic, cubic, rational, exponential, logarithmic and trigonometric);

determine whether a sequence is arithmetic, geometric or neither;

supply the missing terms of a sequence;

find a formula for the nth term of an arithmetic or geometric sequence;

find specific terms of an arithmetic or geometric sequence;

distinguish between sequences and series and use sigma notation to represent series;

find the sum of finite arithmetic and geometric series;

apply sequence and series knowledge in applications of compound interest and population growth;

find the sum of an infinite geometric series; and

use the binomial theorem to expand a binomial; and

find a specified term in a binomial expansion.

Third Quarter

Students will be able to:

identify the parts of a circle;

convert from radians to degrees and degrees to radians;

find the length of an arc; find the area of a sector;

define cosθ and sinθ in terms of the unit circle;

find possible values of cosθ when given sinθ;

define tanθ as sinθ /cosθ;

find equations of lines having gradient tanθ;

use the identity (cosθ)^2+(sinθ)^2=1;

use the double angle formulas: sin2θ =2sinθ cosθ; cos2θ =(cosθ)^2-(sinθ)^2;

recognize and work with the circular functions sin(x), cos(x), and tan(x) by: identifying their domains and ranges; observing their periodic nature; and drawing their graphs;

find functions in the form f(x)=asin(b(x-c))+d given the graphs of those functions;

sketch graphs of functions of the form f(x)=asin(b(x-c))+d;

apply functions of the form f(x)=asin(b(x+c))+d to height of tide and Ferris wheel problems;

solve trigonometric equations given a finite interval using both analytical and graphical methods;

solve equations of the type asin(b(x-c))=k;

recognize trigonometric functions in quadratic form, solve them, and interpret their graphs;

use the Pythagorean theorem and trigonometric ratios to solve right triangles;

use the cosine rule to solve triangles and understand when it is applicable;

use the sine rule to solve triangles and understand when it is applicable;

remember there is an ambiguous case when using the sine rule and recognize that there may be two solutions when solving for θ; and

find the area of a triangle using A=(1/2)absinC, and apply it to problems in real-life situations.

Fourth Quarter

Students will be able to:

represent vectors as displacements in the plane and in three dimensions;

find the distance between points in three dimensions;

recognize the components of a vector and be able to represent them in columns;

find the sum and difference of two vectors using both algebraic and geometric approaches;

recognize the difference of v and w is v-w=v+(-w);

identify and represent the zero vector and the vector -v both algebraically and geometrically;

represent multiplication by a scalar geometrically;

find the magnitude of a vector;

change from unit vector form to base/component vector form and vice versa;

use correct notation to represent position vectors (AB=OB-OA=b-a);

find the scalar product of two vectors;

recognize that the scalar product is also known as the "dot product" or "inner product";

identify parallel vectors;

show two vectors are parallel;

know that for non-zero parallel vectors v•w=±|v||w|;

prove that two vectors are perpendicular;

know that for non-zero perpendicular vectors v•w=0;

find the angle between two vectors;

define appropriately the concepts of population, sample, random sample, and discrete and continuous data;

present and interpret data in frequency distribution tables;

present and interpret data in frequency histograms with equal class intervals using a GDC;

present and interpret data in box-and-whisker plots using a GDC;

identify outliers;

use mid-interval values for calculations in grouped data;

identify interval width and upper and lower interval boundaries;

identify modal class;

find mean (using formula and technology), median and mode;

identify quartiles and percentiles;

calculate range and interquartile range;

calculate standard deviation and variance using technology;

determine the effect of constant changes to original data;

analyse linear correlation;

find Pearson’s correlation coefficient *r* using technology;

describe correlation of data (positive, zero, negative; strong, weak, or no correlation);

use scatter diagrams;

find line of best fit;

use technology to find the equation of a line of regression; and

use the equation for prediction purposes.

**Assessments**

First Quarter

Diagnostic Test

Homework

Paper One Style Assessments

Paper Two Style Assessments

Second Quarter

Homework

Paper One Style Assessments

Paper Two Style Assessments

Semester Exam

Third Quarter

Homework

Paper One Style Assessments

Paper Two Style Assessments

Fourth Quarter

Homework

Paper One Style Assessments

Paper Two Style Assessments

Semester Exam

**Core Topics**

First Quarter

Quadratic Equations and Functions

Other Functions

Exponents

Second Quarter

Logarithms

Graphing and Transforming Functions

Sequences and Series

The Binomial Expansion

Third Quarter

The Unit Circle and Radian Measure

Non-Right Angled Triangle Trigonometry

Advanced Trigonometry

Fourth Quarter

Vectors in Two and Three Dimensions

Lines and Planes in Space

Descriptive Statistics

Linear Modelling

**Specific Content**

Quarter 1

The quadratic function f(x) = ax^2 + bx + c: its graph, y-intercept (0, c)

Axis of symmetry x = -b/(2a)

The form f(x) = a(x - h)^2 + k: vertex (h, k)

The form f(x) = a(x - p)(x - q): x intercepts (p, 0) and (q, 0)

The solution of ax^2 + bx + c = 0, a ≠0

The quadratic formula

The discriminant Δ = b^2 - 4ac and its uses

Concept of a function f(x): domain, range; image (value)

Composite functions f(g(x))

Identity function

Inverse function

The reciprocal function f(x) = 1/x; its graph; its self inverse nature

The graph of a function; its equation y = f(x)

Function graphing skills: use of a graphing calculator to graph a variety of functions; investigation of key features of graphs

The graph of the inverse function as the reflection in y = x of the graph of y = f(x)

Solutions of equations graphically

Laws of exponents

Graphs of exponential functions and their inverse functions

Solution of a^x = b

The exponential function f(x)=e^x.

Quarter 2Laws of logarithms

Change of base

The natural logarithmic function f(x)=ln x; x > 0

Solution of a^x = b using logarithms

Transformations of graphs: translations; stretches; reflections

Arithmetic sequences and series

Sum of a finite arithmetic series

Geometric sequences and series

Sum of finite and infinite geometric series

Sigma notation

The binomial theorem: expansion of (a + b)^n, n∈{Natural Number}.

Quarter 3

The unit circle

Radian measure of angles

Length of an arc

Area of a sector

Definition of cosθ and sinθ in terms of the unit circle

Definition of tanθ as sinθ/cosθ

The identity (cosθ)^2+(sinθ)^2=1

Double angle formula: sin2θ =2sinθ cosθ; cos2θ =(cosθ)^2-(sinθ)^2

The circular functions sin(x), cos(x), and tan(x): their domains and ranges; their periodic nature; and their graphs.

Composite functions of the form f(x)=asin(b(x-c))+d

Solution of trigonometric equations in a finite interval

Equations of the type asin(b(x-c))=k

Equations leading to quadratic equations in, for example, sin(x)

Graphical interpretation of the above

Solutions of triangles

The cosine rule

The sine rule

Area of a triangle as (1/2)absinC.

Quarter 4

Vectors as displacements in the plane and in three dimensions

Components of a vector; column representation

Algebraic and geometric approaches to the following topics: the sum and difference of two vectors; the zero vector; the vector, -v; multiplication by a scalar, kv; magnitude of a vector, |v|; unit vectors; base vectors i, j, and k; position vectors OA=a

The scalar product of two vectors, v•w = |v||w| cosθ; v•w= v1w1 + v2w2 + v3w3

Perpendicular vectors; parallel vectors

The angle between two vectors

Concepts of population, sample, random sample and frequency distribution of discrete and continuous data.

Use of both continuous and discrete data.

Presentation of data: frequency tables and diagrams, box and whisker plots.

Grouped data: mid-interval values, interval width, upper and lower interval boundaries, frequency histograms.

Mean, median, mode; quartiles, percentiles.

Range; interquartile range; variance; standard deviation.

Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles

Variance and standard deviation

Correlation

Pearson’s correlation coefficient

Line of best fit

The least squares regression line

Interpolation and extrapolation.

**Resources**

TI-84 Plus Graphing Calculator

IB Formula Booklet

SL Guide

SMART Board

Textbook: *Mathematics for the international student: Mathematics SL (3rd edition)* by Haese & Harris Publications