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| **Diploma Programme subject outline—Group 5: mathematics** |
| **School name** |  Lessing-Gymnasium Köln/Cologne, Germany | **School code** | 003089 |
| **Name of the DP subject***(indicate language)* | Mathematics SL (English) |
| **Level***(indicate with X)* |  |
| Higher |  | Standard completed in two years | X | Standard completed in one year \* |  |  |
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| **Name of the teacher who completed this outline** | Ms Andrea MeineckeMs Ina Hoffmans | **Date of IB training** | Feb. 17 to Feb. 19, 2012March 15 to March 18, 2017 |
| **Date when outline was completed** | 05 November 2017 | **Name of workshop***(indicate name of subject and workshop category)* | Mathematics SL Category 3Maths SL Category 1 |

\* All Diploma Programme courses are designed as two-year learning experiences. However, up to two standard level subjects, excluding languages ab initio and pilot subjects, can be completed in one year, according to conditions established in the *Handbook of procedures for the Diploma Programme*.

##### Course outline

* + Use the following table to organize the topics to be taught in the course. If you need to include topics that cover other requirements you have to teach (for example, national syllabus), make sure that you do so in an integrated way, but also differentiate them using italics. Add as many rows as you need.
	+ This document should not be a day-by-day accounting of each unit. It is an outline showing how you will distribute the topics and the time to ensure that students are prepared to comply with the requirements of the subject.
	+ This outline should show how you will develop the teaching of the subject. It should reflect the individual nature of the course in your classroom and should not just be a “copy and paste” from the subject guide.
	+ If you will teach both higher and standard level, make sure that this is clearly identified in your outline.

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|  | **Topic/unit**(as identified in the IB subject guide)*State the topics/units in the order you are planning to teach them.* | **Contents** | **Allocated time** | **Assessment instruments to be used** | **Resources***List the main resources to be used, including information technology if applicable.* |
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| One class is | 45 | minutes. |
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| In one week there are | 4-5 | classes. |
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| Year 1 | Topic 2 Functions and equations | 2.4 the quadratic function2.7 solving equations | 10 classes | Formative assessment:Oral participation, group work, problem solving, tests on old exam questionsSummative assessment:4 written assignments |  |
| Topic 5 Statistics and probability | 5.1 presentation of data5.2 statistical measures5.3 cumulative frequency5.4 linear correlation | 15 classes |
| Topic 2 Functions and equations | 2.1 concept of function2.2 graphs of functions2.3 transformations of graphs | 5 classes |
| Topic 6 Calculus | 6.1 limit and convergence6.2 derivatives of rational functions6.3 max / min points, points of inflection6.4 indefinite integration6.5 boundary conditions6.6 kinematic problems | 40 classes |
| Topic 4 Vectors | 4.1 algebraic and geometric approaches to vectors4.2 scalar product, angles4.3 vector equation of a line4.4 relation of two lines | 30 classes |
| Year 2 | Topic 1 Algebra | * 1. sequences and series

1.3 binomial theorem | 15 classes |  |  |
| Topic 5 Statistics and probability | 5.5 probability of an event5.6 combined events5.7 probability distributions5.8 binomial distribution5.9 normal distribution | 30 classes |
| Topic 1 Algebra | 1.2 exponents and logarithms | 5 classes |
| Topic 2 Functions and equations | 2.6 Exponential functions and their graphs | 5 classes |
| Topic 6 Calculus | 6.2 – 6.6 for exponential and logarithmic functions | 15 classes |
| Topic 3 Circular functions and trigonometry | 3.1 the circle3.2 definition of cos and sin3.3 trigonometric ratios3.4 circular functions3.5 solving trig. Equations3.6 solution of triangles | 20 classes |
| Topic 2 Functions and equations | 2.5 the reciprocal function | 5 classes |
| Topic 6: Calculus | 6.2 – 6.6 for trgonometric and reciprocal functions | 5 classes |

##### IB internal assessment requirement to be completed during the course

Briefly explain how and when you will work on it. Include the date when you will first introduce the internal assessment requirement to your students, the different stages and when the internal assessment requirement will be due.

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| Year 1: At the beginning of the course the students are introduced to the concept of the mathematical exploration and are asked to watch out for areas of mathematics or concepts they would like to explore.Year 2: After the Autumn break students are introduced to the details and assessment criteria of the exploration, they use the criteria to assess an example from the support material. Examples of promissing and inappropriate topics as well as methods of topic finding are discussed. The students are asked to find the topic and briefly describe the approach they want to take until after the Christmas break. In January / February of Year 2 students are given a period of 3 weeks to work on their first draft. Oral feedback to the first draft is given by the teacher. After that the students are given another 10 days before the final draft is due. |

##### Links to TOK

You are expected to explore links between the topics of your subject and TOK. As an example of how you would do this, choose one topic from your course outline that would allow your students to make links with TOK. Describe how you would plan the lesson.

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| **Topic**  | **Link with TOK (including description of lesson plan)** |
| * 1. Geometric sequences
 | Difference between mathematical facts and intuitionStudents are asked to guess the hight of a tower made from building blocks af a hight of 1 m, 0.5 m, 0.25 m …The different assumptions are discussed and heights of different towers calculated. From there the formula for the sum to infinity is developed and restrictions are discussed. At the end of the lesson students discuss other examples where mathematical facts and intuition are contradictory like Achilles and the tortoise are discussed. |

##### Approaches to learning

##### Every IB course should contribute to the development of students’ approaches to learning skills. As an example of how you would do this, choose one topic from your outline that would allow your students to specifically develop one or more of these skill categories (thinking, communication, social, self-management or research).

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| **Topic** | **Contribution to the development of students’ approaches to learning skills (including one or more skill category)** |
| 2.6. Exponential functions and their graphs | Technology to enhance visualization of the graphs of exponential functionsStudents are asked to investigate the graphs of exponential functions $f\left(x\right)=c∙a^{k∙x}$ in groups by varying the value of a, c and k. Each group focuses on one variable. With the help of the GDC students find out about all the properties of exponential funcions, including domain, range, intercepts on the axes, asymptotes, shape and behavior of each graph as x tends to infiinty. Students start with definite numbers, make a conjecture, test it and then deduce properties about exponential functions. At the end of the lesson, students present their results to the classmates. In this lesson students are active learners who experiment, question and discover the most important properties of the graphs of exponential functions. |

##### International mindedness

Every IB course should contribute to the development of international-mindedness in students. As an example of how you would do this, choose one topic from your outline that would allow your students to analyse it from different cultural perspectives. Briefly explain the reason for your choice and what resources you will use to achieve this goal.

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| **Topic** | **Contribution to the development of international mindedness (including resources you will use)** |
| 5.6. Probability | The Monty Hall dilemmaIn 1990 Marylin vos Savant answered a probability question about the game show “Let’s make a Deal” hosted by Monty Hall in her column “Ask Marilyn”. Her response caused an avalanche of correspondence, mostly from people who would not accept her solution. By showing the students some of the rude responses she received from prestigious mathematicians from all over the US, insulting her and also women’s reasoning, students learn about an international mathematical debate. The game show was aired in 22 countries all over the world, including Germany. After reading the letters, the students are asked to play the game themselves and find out whether Marylin or several Ph.D.s were correct. Resources: readers’ letters: http://marilynvossavant.com/game-show-problem/ |

##### Development of the IB learner profile

Through the course it is also expected that students will develop the attributes of the IB learner profile. As an example of how you would do this, choose one topic from your course outline and explain how the contents and related skills would pursue the development of any attribute(s) of the IB learner profile that you will identify.

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| **Topic** | **Contribution to the development of the attribute(s) of the IB learner profile** |
| 2.7. Solving quadratic equations | CommunicatorsIn a group jigsaw students are responsible for their own and their group members’ learning. At first the group allocates the subtopics factorization, completing the square, and quadratic formula among themselves. Each member acts fair and considers the individual strengths. Then the subtopics are worked on in expert groups. The students always have in mind that during the next phase of the jigsaw the original group will rely on their work. Thus it is important to communicate and collaborate with the others. In the last phase of the jigsaw, students solve quadratic equations and explain their method to each other. If they can’t, the group won’t succeed.  |

#### **Resources**

Describe the resources that you and your student will have to support the subject. Indicate whether they are sufficient in terms of quality, quantity and variety. Briefly describe what plans are in place if changes are needed.

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| Book : Mathematics Standard Level – Course Companion : very good structure, included TOK pages and information about international mathematicians, examstyle questions including solutions are also very usefulRevision Guide: IB Mathematics 3rd edition – OSC IB Revision Guiedes: concise revision of the most important contents and methods for the final exam preparationOld exam questions: IB Diploma Programme Question Bank: used for revision and to help students tackle exam questionsGeogebra : helps visualizing geometric problems, or graphs of functionsGraphic Display Calulator CASIO fx-CG 20: Graphs, tables, statistics – very sufficient in terms of variety Videos : khanacademy.org – maths easily explained Projecor : useful to visualize students work or problems to be solved |