Diploma Programme subject outline—Group 5: mathematics			
School name	ELA GREEN SCHOOL	**School code**	060876
Name of the DP subject *(indicate language)*	Mathematics: analysis and approaches		
Level *(indicate with X)*	Higher ☐ Standard completed in two years X ☐ Standard completed in one year * ☐		
Name of the teacher who completed this outline	Raja Shekhar Reddy Malapati	**Date of IB training**	2 Oct -30 Oct 2019
Date when outline was completed	4 January 2022	**Name of workshop** *(indicate name of subject and workshop category)*	Mathematics: Analysis and approaches (Cat 2)

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

1. 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 thatstudents 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 shouldnot 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.

NUMBERS & ALGEBRA (19 hrs for SL)	**FUNCTIONS** (21 hrs for SL)	**GEOMETRY & TRIGONOMETRY** (25 hrs for SL)	**STATISTICS & PROBABILITY** (27 hours for SL)	**CALCULUS** (28 hrs for SL)
Common SL: Operations with numbers in the form a $x10^k$; Arithmetic sequences and series; Geometric sequence and series, including financial applications (excluding sum of infinite series); Exponent laws **A&A SL:** Simple deductive proofs; Exponent laws with rational exponents; Log laws; Exponential equations; Sum of infinite geometric series; Binomial theorem (excluding negative and fractional indices); Pascal's Triangle and ^nC_r	**Common SL:** Linear functions including parallel and perpendicular; domain; range; functional notation; Inverse functions (as a reflection in y = x); The graph of a function (sketching and using tech to find sums and differences); Key features of graphs; Points of intersection using tech **A&A SL:** Composite function; Identity functions; Quadratic functions including discriminant; Solutions quadratic equations and inequalities; Reciprocal functions; Rational functions in the form y = $\frac{ax+b}{cx+d}$; Exponential & logarithmic functions; Solving equations both graphically and analytically (including using tech); Transformations of graphs (translations, reflections, stretches)	**Common SL:** Distance between and midpoint of two points; volume and surface area of 3D solids; angles between intersecting lines or a line and a plane; trig ratios (sin, cos, tan); Sine law (excluding ambiguous case); Cosine ule; area of triangle: A = $\frac{1}{2}$absinC; applications of right and non-right angled trig (including angles of elevation and depression) **A&A SL:** Radian measure; length of arc; area of sector; unit circle (sin, cos, tan); Sine law – ambiguous case; Pythagorean ($\cos^2x + \sin^2x = 1$); double angle identities (sin and cos); Sinusoidal functions, including transformation and real-life problems; trig equations (including quadratic) in a finite interval both graphically and analytically	**Common SL:** Concepts of population, sample, random sample, discrete and continuous data Reliability of data sources and bias in sampling Outliers Sampling techniques and their effectiveness Frequency tables & histograms Cumulative frequency graphs to find median, quartiles, percentiles, range, and IQR Box and whisker plots Measures of central tendency (mean, median, mode) Measures of dispersion (IQR, SD, Var, quartiles) Effect of constant changes on the original data Linear correlation & Pearson's Coefficient Scatterplots & line of best fit Linear regression equations (y on x only) Concepts of trial, outcome, sample space... Probability formula Complimentary events Expected value Venn diagrams, tree diagrams,... $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ Mutually exclusive events Conditional probability, $P(A\|B) = P(A \cap B) / P(B)$ only Independent events Probability distributions & expected value of discrete random variables Binomial distribution, including mean and variance Normal distribution, including inverse normal (excluding Z-scores) **A&A SL:** Linear regression equations (x on y) Conditional probability, $P(A\|B) = P(A \cap B)$ $P(B)$ and $P(A\|B) = P(A) = P(A\|B')$ Z-scores & inverse normal where mean and SD are unknown	**Common SL:** Concept of limit Derivatives as gradients or rates of change Increasing and decreasing functions, including graphical interpretation of $f'(x) > 0, f'(x) = 0, f'(x) < 0$ Sum/difference & power rule for polynomial derivatives where all exponents are integers Tangents and normal Integration including finding C Definite integrals using tech Area between $y = f(x) > 0$ and the x-axis **A&A SL:** Derivatives of sinx, cosx, e^x,lnx Product, quotient, and chain rules Second derivatives Graphical behaviour of the graphs of $f(x), f'(x), f''(x)$ Local extrema and critical points Optimization Concavity and points of infection Kinematics Indefinite integrals of sinx, cosx, e^x,lnx, including composites of linear functions Integration by substitution Definite integrals Area between y = f(x) and the x-axis, with and without tech Area between curves

	Topic/unit (as identifiedin the IB subject guide) *State the topics/unitsin the order you are planning to teach them.*	Contents	Allocated time One class is 45 minutes. In one week there are 4 classes.	Assessment instruments to be used	Resources *List the main resources to be used,including information technology if applicable.*
Year 1	Number and Algebra	Numbers – rounding – scientific form Sequences in general - Series Arithmetic sequences Geometric sequences Applications of G.S. – Percentage growth) The Binomial Theorem – $(a+b)^n$ Deductive proof	19 hours	**Using formative assessment in the classroom.** Just by simple definition the word formative is coined out of the word information. Formative assessment is one way of providing detailed actionable feedback to the students focusing on part of a unit that has been covered or even the entiretopic that they have through. This feedback is very important because it will give them the opportunity to reflect and take action based on their learning experience withinthat unit. Formative assessment can take multiple forms: quiz, video, a conversationteacher-student, an application to a new situation, can be written, oral, multimedia and in this way adapt to different types of intelligence.	Subject guide, syllabus, class expectations and procedures discussed,notation list, formula booklet. ● CASIO CG 20 (graphic display calculator – GDC). Oxford IB Diploma Programme: IB Mathematics: analysis and approaches,Higher Level IB Question Bank IBexchange https://www.christosnikolaidis.com/en/ Emulator Desmos Geogebra **Good Websites for Inspiring Mathematics!** ● Nrich Maths: https://nrich.maths.org/ ● Pacific Institute for the Mathematical Sciences: http://www.mathtube.org/

	Functions	Lines (or Linear functions) Quadratics (or Quadratic functions) Functions, domain, range, graph Composition of functions: fog The inverse function: f -1 Transformations of functions Asymptotes Exponents – the exponential function ax Logarithms – the logarithmic function logax Exponential Equations	21 hours	Informs learning by: **1.** feedback: differentiation of teachingapproaches for the rangeof student in a classroomwill occur more promptly and naturally. **2.** active learning: students must be intellectually engaged by asking questions, testing ideas, answering questions, connecting topic(s) of lesson to previously learned material, and consider extensions and difficulties. **3.** reflection: concepts & skills are retained more robustly when students think back on the activity/lesson and verify that it makes sense to them; mind maps are an effective reflection tool. ● Students are honest. Since the marks don't "count", they do not take the trouble to cheat or ask to be excused. You canget a real impression of where they are at.You can even get them to mark each other's work - they are often quite good at this. ● It's quicker to	● Vi Hart: http://vihart.com/, https://www.youtube.com/user/Vihart ● Plus Maths: https://plus.maths.org/content/ ● Numberphile: http://www.numberphile.com/ https://www.youtube.com/user/numberphile ● YouCubed: https://www.youcubed.org/tasks/ ● Math Science Music: https://mathsciencemusic.org/ ● ESPN Sport Science: http://www.espn.com/espn/sportscience/index ● Teach It Maths: https://www.teachitmaths.co.uk/investigations ● Dan Meyer's 3-Act Math: https://docs.google.com/spreadsheets/d/1jXSt_CoDzyDFeJimZxnhgwOVsWkTQEsfqouLWNNC6Z4/pub?output=html ● Math Factor Podcast: https://itunes.apple.com/gb/podcast/the-math- factor/id81854832 ● Yummy Maths: http://www.yummymath.com/ ● NASA – Explore Space Through Math https://www.nasa.gov/audience/foreducators/exploringmath/home/ ● Qedcat: https://www.qedcat.com/ ● Mathematical Intelligencer: http://www.springer.com/mathematics/journal/283 ● Math in the Movies:

	Geometry & Trigonometry	3D Geometry Triangles – Sine and Cosine rules Applications in 3D Geometry – Navigation The trigonometric circle – Arcs and Sectors sinθ, cosθ, tanθ on the unit circle Trigonometric identities and equations Trigonometric functions	25 hours	organise at most schools, as summative assessments must be carefully scheduled in advance so as not to collide with assessments from other subjects. But a quick formative assessment doesn't need any warning or specialtiming. ● I can focus the assessment on the particular skill or concept which Iam interested in. Idon't need to cover every concept or skill or achieve a balanceof the categories (knowledge, communication, etc) which is necessary in a summative assignment. **Formative assessment** I conduct Formative assessment almost in every class. While introducing the new concept, I check the prior learning.	https://www.qedcat.com/moviemath/ ● Wolfram Alpha: https://www.wolframalpha.com/ ● Pamoja Maths http://ibmathpamoja.edublogs.org/category/internal-assessnebt/exploration-ideas/ ● Great Maths Teaching Ideas: http://www.greatmathsteachingideas.com/ ● Itune Math podcasts: https://itunes.apple.com/gb/podcast/the-math-factor/id81854832 "Jing" is a free download that students can use to make quick (5 minute max) , effective videos that can be shared with teachers and students. It can be used tocomplete homework, enrich a problem, or ask questions. The best part is that it captures the students writing as they work on their laptops. https://www.techsmith.com/jing-tool.html We use Desmos a lot. It has a feature called Desmos Activity Builder that allows the teacher to create and develop specific units of instruction andenrichment. https://www.desmos.com/ Online Graphing Calculators: https://www.desmos.com/calculator Parlay is a neat way to record observations and conversations in theclassroom. https://parlayideas.com/ Recognizing there are many graphing software's available, FXGraph is very visually pleasing and has excellent

Year 1 Year 2	**Calculus**	**Calculus (part of differentiation)** The limit lim f (x) – The derivative f ′(x): A rough idea! Derivatives of known functions – Rules Tangent line – Normal line at some point xo The chain rule **Calculus (part of differentiation - integration)** Monotony – max, min Concavity – points of inflection Optimisation The indefinite integral Integration by substitution The definite integral - Areas between curves Kinematics (displacement, velocity, acceleration)	28 hours	I start every class by checking the understanding of the concepts taught in the previous class. Solving a problem, a discussion or investigation from the Oxford text book.	annotation capabilities. http://www.efofex.com/fxgraph.php This is a superb software for statistical analysis. https://fathom.concord.org/ Google Classroom - allows the easy distribution of materials and assignments and provides a forum forclass discussion. Google forms - I have used this to build short formative assessments into everyday lessons. This has provided a very efficient way of providing feedback on student examples. It has a nice ' Most missed questions' feature allowingyou to quickly identify and deal with misunderstandings and misconceptions. GIZMOS - this provides students with an interactive applet that allows them to explore and develop mathematical concept and theorems for themselves. Ithas built in investigations and lesson plans that can be edited. It is a great way of providing students with a visual representation of mathematical models and problems. Geogebra - free graphing software andmuch more. Can be downloaded or added as a Google add-in. Allows students to graph and explore various concepts visually. It has a very intuitivedesign that allows teachers to quickly build investigations by the use of sliders. Can also be used for Statistics

	Statistics and Probability	Basic concepts of Statistics Measures of central tendency – Measures of spread Frequency tables – Grouped Data Regression Elementary Set Theory Probability Conditional probability – Independent events Tree diagrams Distributions – Discrete random variables Binomial distribution – B(n,p) Normal distribution – N(μ,σ) Alternative scenario swap between YEAR 1 YEAR 2 Topic 4 (Statistics) Topic 5 (part of Calculus)	27 hours		

	The toolkit and the mathematical exploration (Year 1 & 2 Combined)	Investigative, problem-solving and modelling skills development leading to an individual exploration. The explorationis a piece of written work that involves investigating an area of mathematics.	30 hours		

2. 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.

I shall introduce exploration (IA) in grade 11 in the month of August. I shall make them understand the assessment criterion and also mark a few samples. Create mind maps as a group and then start working individually. In the second semester of grade 11, students shall choose a topic of their interest and get it approved and work on the data collection and the math part. They shall be given time in school to discuss further. By new year they shall complete the mathematics part and submit the draft by 1 Feb for which I shall give a written feedback and they would have to submit the find IA copy as per the deadlines given.

The deadline for submission of the Draft IA in Mathematics is 1st Feb
The following timeline with mini deadlines should help students achieve a timely and meaningful draft.

Due date	*What's due*	*Notes*
DP 1 **Semester 1 &2** **Aug-March** **DP 1** **Semester 2** **April-May** **DP 2** **Semester 1** **August**	**Topic and brief outlineof your Exploration** **2 x A4 only**	Introduction, Sample marking, Mind Maps, Going throuh Assessed samples. 1. Stimulus +In the form of a photo or link to a video 2. Brainstorming of ideas +In the form of a mind map (drawn or digital version) or sketch note 3. Review of literature on your topic +Minimum 3 research papers on your topic +Source for primary/ secondary data - validity checked +source supporting your line of inquiry +Write a summary of 100-150 words on each source
July	**Exploration Introductionno more than one A4 page**	**Introduction**: Introduce research question to audience (which is your peers); embed the stimulus and mind map into thisintroduction; make reference to research - note the citations in the exemplars; introduce how you will use Mathematics **Aim**: Aim is what is being explored **Rationale**: Rationale is why have you chosen this topic **Page specification** : Spacing 1 1/2 lines; Paragraphs - 1 space; all variables in italics Font - New Times Roman Size 12; language English UK, d a spell check for Introduction; ADD page number bottom right hand

		corner
Aug	**Methodology**	We will use the same document we had for Exploration checkpoint 2 (Introduction) Methodology or it may be called collection of data procedures or action plan. This will depend on your topic. This section may be 1/2 page, 1 page or several pages BUT it must explain completely how you will go about your exploration.
Sep	**Detailed plan and more research into the mathematics**	This copy will receive a mark out of 20 - Summative taskUpload your exploration with the following parts: - Suggested Length: 4-5 pages -Include your introduction, contents page and the detailed plan for your Exploration. 1. Title page (see attached) 2. Table of contents (see attached) 3. Introduction / Aim / Rationale (one page) 4. Methodology - Demonstrate a clearer picture of the detailed mathematics. What examples/ scenario can you devise to ***demonstrate your understanding of the mathematics***? Get deeper into some of the calculations. 5. A new page with heading Collection of data (or similar depending on topic) 6. References (use MLA 8 format) - last page - Start your Bibliography page. List books, journal articles, websites that have contributed meaningfully.
Oct	***Interim deadline***	Data collection started
Nov	***Interim deadline***	Data presented in tables and graphical form
1st Jan	***Complete mathematics***	The main body of your Exploration, with all the relevant mathematical calculations. Remember to (i) Define any variables (ii) Explain any unfamiliar symbols, notation or terminology (use MathType or similar – e.g. use of ^ and / is penalized heavily)
1st Feb	***Complete draft***	This is the only draft of your Exploration that your teacher is allowed to comment on, so make sure it is as complete as possible.

Topic	Contribution to the development of the attribute(s) of the IB learner profile
Exploration	Inquirer :It includes a research that develops their natural curiosity, Knowledgeable: students will explore “concepts, ideas, and issues that have global and local significance”Thinkers: they are going to use all their skills Communicators: They will have to write a report to the teacher and their peers.Principled: students have to be honest and show integrity in the work Open – minded: this depends on their exploration subject Risk –takers: they do not know beforehand the steps necessary to achieve their goal Reflective: They would be thinking about what they have learned in the classroom and how to use it in real life situation, making the link betweentheoretical mathematics and real-life mathematics.

Topic	Contribution to the development of the ATL’s
Exploration	**Thinking:**

	• Creative Thinking - stimulus, development of ideas • Critical Thinking - Peer assessment, critique of previous research on chosen topic • Transfer - Able to link areas of mathematics with chosen topic and develop ideas even more Activity to encourage students to develop and use the research skills and critical thinking skills required for the Exploration. In small groups, create a History of Mathematics timeline. Discovering mathematics through inquiry leads to a deeper understanding and greater enjoyment. Group presentations to list possible activities that build on students' research and collaboration skills. E.g. Calculus — Newton v Leibniz;Pythagoras' Theorem in Greece (570-495 BC), Mesopotamian or Egyptian Theorem (2000-1600 BC), China - Gougu Theorem (220-202 BC) and India — Baudhayana Theorem (800-500 BC).

Mathematics in Action:

1. Discuss how mathematics can be applied to various jobs in other subjects. (Transdisciplinary)
2. Mathematics in modelling the effects of a drug.
3. Mathematics in weather predictions.
4. History of mathematicians - Construct timeline. (Awareness project)

3. 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.

Topic	Link with TOK (including description of lesson plan)
Number and Algebra: Sequences,Series and proof.	I initiate discussions by asking the following questions • Is zero the same as "nothing"? • Is mathematics a formal language? • How accurate is a visual representation of a mathematical concept? • Do the names that we give things impact how we understand them? For instance, what is the impact of the fact that some largenumbers are named, such as the googol and the googolplex, while others are represented in this form? • Is all knowledge concerned with identification and use of patterns? Consider Fibonacci numbers and connections with the golden ratio. • How do mathematicians reconcile the fact that some conclusions seem to conflict with our intuitions?Consider for instance that a finite area can be bounded by an infinite perimeter. • How have technological advances affected the nature and practice of mathematics? Consider the use of financial packages forinstance. • Is mathematics invented or discovered? For instance, consider the number e or logarithms–did they already exist before man definedthem? • Is mathematical reasoning different from scientific reasoning, or reasoning in other Areas of Knowledge? • Is it possible to know about things of which we can have no experience, such as infinity? • How have notable individuals shaped the development of mathematics as an area of knowledge? Consider Pascal and "his" triangle. • What counts as understanding in mathematics? Is it more than just getting the right answer? • What is the role of the mathematical community in determining the validity of a mathematical proof? Do proofs provide us with completely certain knowledge? What is the difference between the inductive method in science and proof byinduction in mathematics?

4. 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).

Topic	Contribution to the development of students' approaches to learning skills (including one or more skill category)
Number and Algebra: Sequences, Series and proof.	I shall ask my students higher-order questions to encourage higher-order thinking. Also, I shall plan time for students to think about their answers to questions, rather than engaging in rapid questions and answers that do not give students time to thinkdeeply about their responses. I shall create an atmosphere in the classroom where the "group's collective as well as individual thinking is valued, visible, and actively promoted as part of the regular, day-to-day experience of all students. **Thinking** In this unit, we will • ask students to formulate a reasoned argument to support their opinion or conclusion • give students time to think through their answers before asking them for a response • ask open questions, • set students a task which required higher-order thinking skills (such as analysis or evaluation) • help students to make their thinking more visible (for example, by using a strategy such as a thinking routine) • ask questions that required the use of knowledge from a different subject from the one you are teaching • include a reflection activity • make a link to TOK **Communication** In this unit, we will • ask students to explain their understanding of a text or idea to each other • ask students to formulate arguments clearly and coherently • encourage all students to contribute to discussions

5. Internationalmindedness

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.

Topic	Contribution to the development of international mindedness (including resources you will use)
Algebra: The Binomial Theorem	Overview of the Topic: This topic will be covered in the first unit on the first year. The topic consists of arithmetic and geometric sequences. How understanding the concept, utilizing sequencing, and how to calculate using sequences is important and used in the real world. In the topic we will also discuss Pascal's Triangle and how it is used inmathematics as well as other areas such as art. Throughout the course we will discuss the history of mathematics from around the world. We will relate how the past is influencing the future mathematics achievements. We will start out learning about the history of Pascal's Triangle. How did he get credited for the mathematical breakthrough? Did it appear in the world before Pascal? If so, why was it named after Pascal? Where else in the world was Blaise Pascal's work done around the time of his discovery? This discussion will set up future conversations when we learn about Pythagoras, Newton, and so on. Learning Objectives: At the end of this topic, students will be able to: 1. Recognize geometric and arithmetic sequences 2. Solve problems involving sequencing 3. Be able to accurately describe different areas of a sequence 4. Use technology to calculate sequences 5. Calculate binomials using Pascal's Triangle 6. Have a deeper understanding of the history of math, Pascal, and uses of mathematics in other fields of expertise Link to International-Mindedness: Students will learn how mathematics is used in a variety of professions and how math was used around the world. Through individual and group research projects and presentations (ATL: Research, communication, thinking, self-management and social skills), students will learn about mathematics in building, art, military strategy, city planning, and many other areas. Students will get real world application to many of the mathematics they are learning and examples of how it is usedall over the world. Students will also learn how certain people received credit for work and whether they deserve to have their name used or if it was used in other parts of the world before the discovery was credited through debates. Assessment Objectives: At the end of the topic, students are able to demonstrate the following. 1. Knowledge and understanding: recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of familiar and unfamiliarcontexts by describing how mathematics is used in different professions and areas 2. Communication and interpretation: transform common realistic contexts into mathematics; comment on the context through short essays and presenting findingsand participation in discussions. Justification for Choice of Topic: I chose this topic because it opens students up to understanding how mathematics was used in our past and how it can shape our future. Students will practice researching topics and writing short papers which will help them with their internal assessment in the future. It also allows me to collaborate with the history and English departments for interdisciplinary curriculum. Students will also be able to reflect how the math they are learning today has been relevant for many years allover the world. Resources: Library research database

6. 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.

Topic	Contribution to the development of the attribute(s) of the IB learner profile
Statistics: Concepts and Presentationof Data	Overview of the Topic: This topic covers the organization and presentation of data. Students will be able to gather information and display their finding in a number of different mediums. Students will then describe their findings to a class and tell what they have learned about their topic of interest in this section. Students will use technology such as computers, Word, Excel, graphing calculators, and others, to gather their data and display it in an easy to read and understand format. Learning Objectives: At the end of the topic, students will be able to 1. Distinguish different types of data and tell when to use them 2. Interpret data and find key points within data such as central tendency, quartiles, percentiles, and so on 3. Present data in a professional and easy to understand format 4. Use different graphs and charts to display the same set of data 5. Use equations to predict the possibility of different future events given a set of data 6. Apply data in many different real world situations Links to the IB Learner Profile: During our study about statistics we will explore and discuss the use of statistics to push an agenda (how statistics is used to manipulate information in your favour). Students will examine different examples of how statistics is skewed in mediums such as magazines, news articles, politics, and advertisements andwrite analysis reports. We can also show examples of how statistics can show two different sides of the same information. This is a good time to discuss using mathematics appropriately and to not mislead others into thinking a certain way. This will develop their ATL –Research, communication, thinking, social and self-management skills while showing them how to be principled, balanced, and knowledgeable (IB learner profile attributes) about their topics as well as others' topics. Assessment Objectives: At the end of the topic, students are able to demonstrate the following. 1. Problem solving: recall, select and use their knowledge of mathematical skills, thereby identifying why there are certain trends in data and what couldcause a large or small variance within the data 2. Communication and interpretation: Transform common realistic contexts into mathematics, using technology to evaluate data and displaying results in anorganized manner 3. Technology: use technology, accurately, appropriately and efficiently both to explore new ideas and to solve problem by gathering data from volunteers intheir community and computing data to indicate trends, intervals, mean, variance and standard deviation 4. Reasoning: construct mathematical arguments through use of precise statements, that is, summarizing and drawing conclusions from a data set

7. 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 a

We have sufficient resources.
Oxford text book
IB question bank
IB exchange
Emulator
Desmos
Geogebra

https://www.christosnikolaidis.com/en/

Mathematics in nature
Patterns

https://www.youtube.com/watch?v=Ig9RUaJe00c

Paterns in Nature
Mother Nature's handiwork

https://www.youtube.com/watch?v=u_CaCie8R4U

Towers of Hanoi

http://towersofhanoi.info/Play.aspx

If changes are to be done I shall discuss with my colleague and DPC and do the needful as per the requirement.