DP Unit Planner

Teacher(s)	TOK PLC	Subject group and course	IB CORE Theory of Knowledge		
Course part and topic	UNIT 4: KNOWLEDGE AND MATHEMATICS	SL or HL/Year 1 or 2	YEAR 2	Dates	November (3 Weeks)

Unit description and texts	DP assessment(s) for unit
This unit focuses on the required Area of Knowledge: Mathematics. It will reflect the following TOK Aims: 1. Exposing students to ambiguity and uncertainty. 2. Equip students to navigate and make sense of the world. 3. Engage students with multiple perspectives. 4. Encourage students to make connections between academic disciplines. 5. Prompt students to consider the importance of values, responsibilities and ethical concerns relating to this AOK. There are no specific texts for this unit. All videos, presentations and other materials are linked in the Resources section at the end of this planner.	Students will choose one of the following questions to explore as a group of three or four. Groups will prepare a brief slide presentation that will do the following: 1. Explain the question in your own words. 2. Develop three different perspectives/approaches to answering the question. The first perspective/approach should be stated as a claim, and the second and third should be stated as counterclaims that are built on the previous perspective(s)/approach(es). 3. Draw a final conclusion about the question chosen. Potential questions: *To what extent is progress harder to make in mathematics than in other areas of knowledge?* *Discuss this statement: Mathematics is the only AOK that is unbiased.* *To what extent is it possible to "experience" mathematics?* *Discuss this statement: Mathematics is the most "fundamental" of all the AOKs.* *To what extent does the use of statistics create different ethical responsibilities than other uses of math?*

ELA Resources

INQUIRY: establishing the purpose of the unit

Transfer goals
List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to "transfer" or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.
Students will be able to apply their learning from this unit to an evaluation of a KQ that helps prepare them for writing the external assessment in TOK, the TOK Essay. Students will use their knowledge from this unit to create an outline of a full TOK Essay that addresses a prompt of similar caliber and form to the ones that will be provided by IB.

ACTION: teaching and learning through inquiry

Content/skills/concepts—essential understandings	Learning process

	Highlight any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.

Students will know the following content:
 	
The different ways that math can be approached--as a discipline that exists in the real world and as a discipline that exists outside of the real world.
 	
The similarity between mathematics and language.
 	
The cultural connection of mathematics from an historical standpoint.
 	
The different approaches to the word "proof."
 	
The difference between scientific and mathematical reasoning.
 	
Students will develop the following skills:
 	
The ability to make connections between mathematics and other AOKs.
 	
The ability to think critically about math as a concept rather than simply a task.
 	
The ability to evaluate the value and the limits of using math to solve practical problems.
 	
Students will grasp the following concepts:
 	
Math is both a practical and a theoretical AOK.
 	
Math is utilized and valuable in all other AOKs.
 	
There is value, but also risk, in approaching global problems from a simply numerical position.
	Learning experiences and strategies/planning for self-supporting learning:
	
	Lecture
	Socratic seminar
	<mark>Small group/pair work</mark>
	<mark>PowerPoint lecture/notes</mark>
	Individual presentations
	<mark>Group presentations</mark>
	Student lecture/leading
	<mark>Interdisciplinary learning</mark>
	
	Details:
	● Scope
	    ○ Thinking about math as a language (paired activity)
	    ○ Is math discovered or invented? Evaluate responses to TikTok Video.
	    ○ The usefulness of math in the real world and its intersection with the other AOKs. (Brainstorming activity for ways that math is used in other AOKs)
	
	● Methods and Tools
	    ○ Discussion: The nature of proofs and then these three activities to illustrate the concept.
	        ■ Activity: how many ways to solve a simple quadratic equation?
	        ■ Activity: Sum of the Angles of a Triangle
	        ■ Activity: Monty Hall Problem
	    ○ Compare and contrast mathematical reasoning as shown in the previous activities vs. scientific reasoning.
	    ○ Compare and contrast the process for solving a mathematical problem and completing a work of art.
	
	● Perspectives

○ Discussion: did things like the calculation of the area of a square exist before we "discovered" it? Are there mathematical truths that currently exist even though we don't know about them yet?

○ Paired/group activity: the ways cultures have used math in history. Students will research how an ancient culture used mathematics and present it to the class.

- Ethics
  ○ Focus on the extent to which global problems like hunger, housing, child mortality, etc. can be understood and solved through mathematics.
    ■ Students will use the website Worldmapper.org to explore a specific global issue, referencing the source of the data that informs the map.
    ■ Students will consider what the data/map can tell us, what it leaves out, and the extent to which it can be used to find solutions.
    ■ Which additional AOKs might need to be integrated with math to find solutions?

Other/s:

Formative assessment:

o **Discussion Post: Comment on this statement--"math only provides knowledge about the real world when it is paired with another AOK?"**

o **Compare/Contrast Graphic Organizer: Mathematical Reasoning vs. Scientific Reasoning; Solving Math Problem vs. Creating Piece of Art.**

o **Paired/Group Presentation: Mathematics in ancient cultures.**

	o **Evaluation of Global Problem through the lens of math.**
	Summative assessment: **Students will choose one of the following questions to explore as a group of three or four. Groups will prepare a brief slide presentation that will do the following:** 1. **Explain the question in your own words.** 2. **Develop three different perspectives/approaches to answering the question. The first perspective/approach should be stated as a claim, and the second and third should be stated as counterclaims that are built on the previous perspective(s)/approach(es).** 3. **Draw a final conclusion about the question chosen.** **Potential questions:** *To what extent is progress harder to make in mathematics than in other areas of knowledge?* *Discuss this statement: Mathematics is the only AOK that is unbiased.* *To what extent is it possible to "experience" mathematics?* *Discuss this statement: Mathematics is the most "fundamental" of all the AOKs.* *To what extent does the use of statistics create different ethical responsibilities than other uses of math?*

	Differentiation:
	Affirm identity—build self-esteem Value prior knowledge <mark>Scaffold learning</mark> Extend learning Details: Students will be approaching mathematics from a completely new perspective that is more theoretical than they are used to. As a result, their expansion of their thought process will build gradually, allowing for multiple opportunities to collaborate and receive consistent feedback.

Approaches to learning (ATL)
Highlight any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.

Thinking
<mark>Social</mark>
<mark>Communication</mark>
Self-management
<mark>Research</mark>

Details: Students will have multiple opportunities to collaborate during this unit. They will also be presenting in class, as well as sharing ideas verbally through discussion. Additionally, students will have two opportunities to conduct their own research to illustrate learning that occurs within this unit.

Language and learning	TOK connections	CAS connections

Highlight any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.	Highlight any explicit TOK connections made during the unit.	Highlight any explicit CAS connections. Provide a brief note in the "details" section explaining how students engaged in CAS for this unit, if applicable.
Activating background knowledge Scaffolding for new learning <mark>Acquisition of new learning through practice</mark> Demonstrating proficiency Details: Students will be challenged to think of mathematics as a language, allowing new perspectives on what language actually is.	Personal and shared knowledge Ways of knowing Areas of knowledge The knowledge framework Details: **N/A**	Creativity Activity <mark>Service</mark> Details: Through the activity of examining a global problem through the lens of math, students will be provided information about how to advocate for these problems in a more direct way if they find that they have a passion for the issue.

Resources
List and link (if applicable) any resources used in this unit.

- https://docs.google.com/document/d/1n4UvNr-hC_Ag0G3vgUyoGS9xVdliL1CMrPb4W5lar5c/edit?usp=sharing
- TED Talk: https://youtu.be/X_xR5Kes4Rs
- TikTok Video: https://www.msn.com/en-gb/video/viral/math-isn-t-real-16-year-old-a-student-goes-viral-breaking-down-history-back-to-pythagoras-while-putting-on-makeup/vi-BB18riwM
- https://www.smithsonianmag.com/science-nature/what-math-180975882/
- https://www.storyofmathematics.com/16th.html

- Activity - Sum of Angles in a Triangle
- Activity - Monty Hall Problem
- www.worldmapper.org

REFLECTION: considering the planning, process and impact of the inquiry

What worked well	What didn't work well	Notes/changes/suggestions:
List the portions of the unit (content, assessment, planning) that were successful	*List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	*List any notes, suggestions, or considerations for the future teaching of this unit*