

Sessions 4 to 6 - Internal Assessment session 2014

The specific purposes of the exploration are to:

- develop students' personal insight into the nature of mathematics and to develop their ability to ask their own questions about mathematics
- provide opportunities for students to complete a piece of mathematical work over an extended period of time
- enable students to experience the satisfaction of applying mathematical processes independently
- provide students with the opportunity to experience for themselves the beauty, power and usefulness of mathematics
- encourage students, where appropriate, to discover, use and appreciate the power of technology as a mathematical tool
- enable students to develop the qualities of patience and persistence, and to reflect on the significance of their work
- provide opportunities for students to show, with confidence, how they have developed mathematically.

Group 5 aims

The aims of all mathematics courses in group 5 are to enable students to:

1. enjoy mathematics, and develop an appreciation of the elegance and power of mathematics
2. develop an understanding of the principles and nature of mathematics
3. communicate clearly and confidently in a variety of contexts
4. develop logical, critical and creative thinking, and patience and persistence in problem-solving
5. employ and refine their powers of abstraction and generalization
6. apply and transfer skills to alternative situations, to other areas of knowledge and to future developments
7. appreciate how developments in technology and mathematics have influenced each other
8. appreciate the moral, social and ethical implications arising from the work of mathematicians and the applications of mathematics
9. appreciate the international dimension in mathematics through an awareness of the universality of mathematics and its multicultural and historical perspectives
10. appreciate the contribution of mathematics to other disciplines, and as a particular "area of knowledge" in the TOK course.

Stimuli

Students sometimes find it difficult to know where to start with a task as open-ended as this. While it is hoped that students will appreciate the richness of opportunities for mathematical exploration, it may sometimes be useful to provide a stimulus as a means of helping them to get started on their explorations.

Possible stimuli that could be given to the students include:

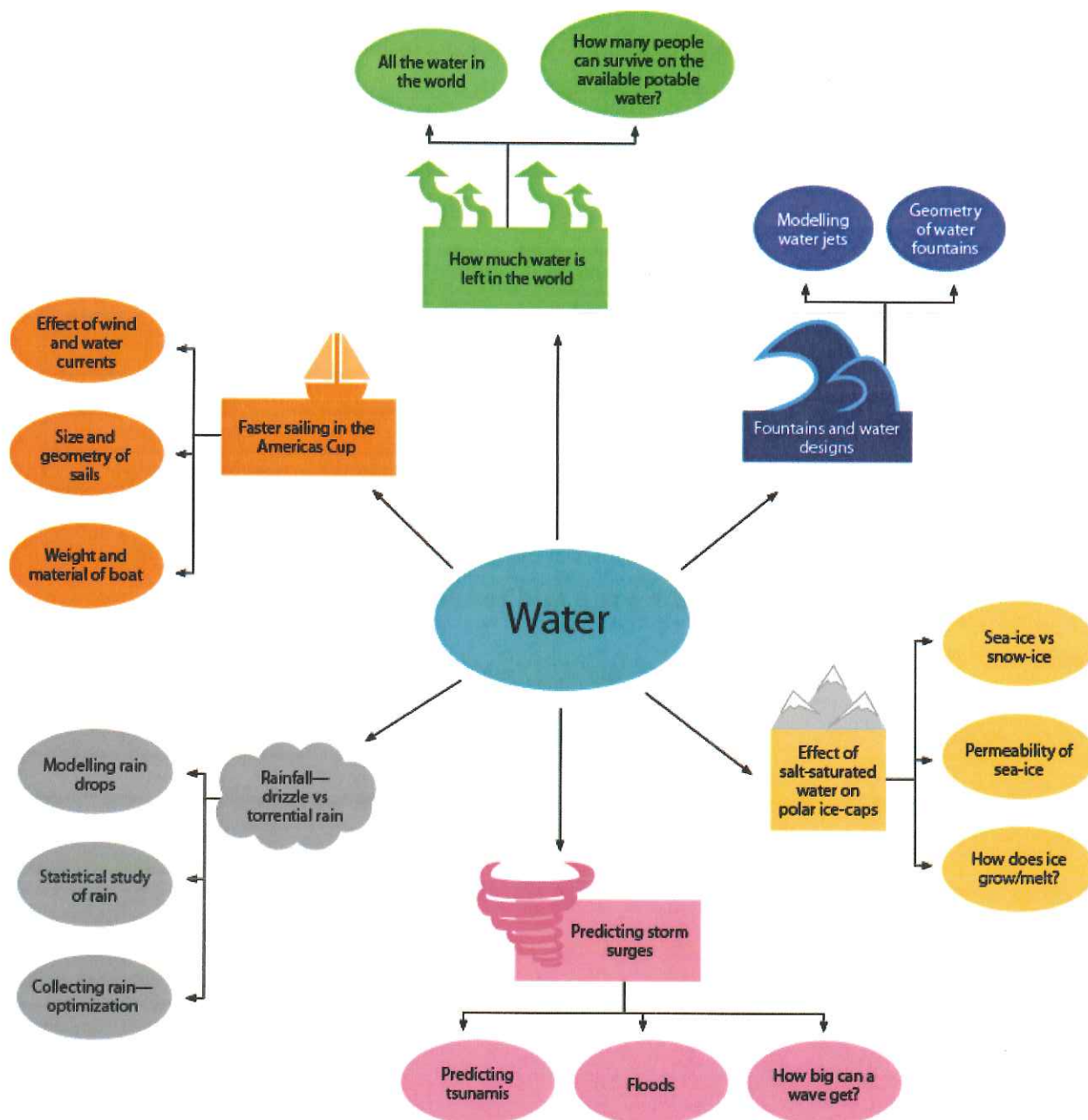
sport	archaeology	computers	algorithms
cell phones	music	sine	musical harmony
motion	e	electricity	water
space	orbits	food	volcanoes
diet	Euler	games	symmetry
architecture	codes	the internet	communication
tiling	population	agriculture	viruses
health	dance	play	pi (π)
geography	biology	business	economics
physics	chemistry	information technology in a global society	psychology

Any other stimuli that we can add to the suggested list above?

See person HK (new)
for a long list of stimuli

A possible mind map for the stimulus “water”

During introductory discussions about the exploration, the use of brainstorming sessions can be useful to generate ideas. In particular, the use of a mind map has been shown to be useful in helping students to generate thoughts on this. The mind map below illustrates how, starting with the stimulus “water”, some possible foci for a mathematical exploration could be generated.



concise... something is there that is not needed!

Questions on the exploration assessment criteria

Criterion A – Communication

- How can an exploration be coherent but not complete? *yes!*
- How can an exploration be organized but not concise? *yes!*
- Can an exploration be complete but not coherent?

What is complete?!

... some bit is missing... thing extra 20% needed.

Concise Short but sweet!

If things are there but not needed then it is not concise. Put stuff in the appendix. You don't need 8 pgs of data!

Criterion B – Mathematical presentation

- What are possible mathematical presentations?
- Does the student have to use a certain variety of presentations to achieve B3? *needs to be precise!*
- Is the use of ICT tools appreciated in criterion B?

ICT

should have many presentations. But appropriate.

Criterion C – Personal engagement

- What could be considered significant personal engagement?
- What could be considered outstanding personal engagement?

Tech to display results vs exploring w/ technology. probably scores better.

asking questions all along
Time, effort, enjoyment

Criterion D – Reflection

What is the difference between meaningful reflection and critical reflection? Give examples

It should be here relevant to the task goal effort:

above + beyond.

higher level thinking - good writing. sound/complete analysis.

Criterion E – Use of mathematics

- How can you ensure that the level of mathematics is commensurate with the level of the course? *check the syllabus... or equivalent advanced math.*
- How can the mathematics be sophisticated but not rigorous? *loose treatment of sophisticated math. steps missing etc.*
- How are levels E5 and E6 different?

Start at the top + work down.

1
2
3
4

Internal Assessment criteria - HL

Criterion A: Communication

This criterion assesses the organization and coherence of the exploration. A well-organized exploration includes an introduction, has a rationale (which includes explaining why this topic was chosen), describes the aim of the exploration and has a conclusion. A coherent exploration is logically developed and easy to follow.

Graphs, tables and diagrams should accompany the work in the appropriate place and not be attached as appendices to the document.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	The exploration has some coherence.
2	The exploration has some coherence and shows some organization.
3	The exploration is coherent and well organized.
4	The exploration is coherent, well organized, concise and complete.

Checklist for criterion A

All over the exploration, I expressed my ideas clearly. (My grandmother can understand it without the need for clarifications)	
I Identified a clear aim for my exploration	
I focused on the aim and avoiding irrelevance (My teacher won't get bored when reading it)	
I structured my ideas in a logical manner so that the reader does not need to go back and forth in order to understand it	
I included graphs, tables and diagrams at appropriate places. They are there where needed and not in appendices	
I edited my exploration so that it is easy to follow	
I cited references where appropriate	

Criterion B: Mathematical presentation

This criterion assesses to what extent the student is able to:

- use appropriate mathematical language (notation, symbols, terminology)
- define key terms, where required
- use multiple forms of mathematical representation, such as formulae, diagrams, tables, charts, graphs and models, where appropriate.

Students are expected to use mathematical language when communicating mathematical ideas, reasoning and findings.

Students are encouraged to choose and use appropriate ICT tools such as graphic display calculators, screenshots, graphing, spreadsheets, databases, drawing and word-processing software, as appropriate, to enhance mathematical communication.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	There is some appropriate mathematical presentation.
2	The mathematical presentation is mostly appropriate.
3	The mathematical presentation is appropriate throughout.

Exploring w/ tech vs screen dump

Checklist for criterion B

I used the appropriate method for representation (A table when needed, a graph when I am supposed to,...etc)	
I used appropriate mathematical language (used appropriate terminology)	
I reviewed the work and made sure that all key terms are defined	
I used the appropriate mathematical tool (spread sheet, graphing software, GDC, CAS software...etc)	
My results are expressed appropriately. When the result was exact, I used use ($=$) and when it was approximated I used (\approx)	

I like the checklists!

Technology is in check here!

Never penalize in both areas!!!

Criterion C: Personal engagement

This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These include thinking independently and/or creatively, addressing personal interest and presenting mathematical ideas in their own way.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	There is evidence of limited or superficial personal engagement.
2	There is evidence of some personal engagement.
3	There is evidence of significant personal engagement.
4	There is abundant evidence of outstanding personal engagement.

Checklist for criterion C

I explained why I took the initiative for working on MY exploration	
MY exploration is related to MY interests and this is explained in MY exploration	
I enjoyed working on MY exploration	
I worked on MY exploration <u>independently</u>	
I read about the mathematics used in MY exploration	
I expressed then the mathematical ideas in MY own way	
I considered historical and global perspectives related to MY exploration	

How many hours did they give?

Man! Really trying to avoid plagiarism.

Comments here are essential (always essential) but especially here.

- See TSM for "evidences" of personal engagement
- refer to specific ps #s in the project & refer to these specific checklists.

Criterion D: Reflection

(evaluation/analyse)

This criterion assesses how the student reviews, analyses and evaluates the exploration. Although reflection may be seen in the conclusion to the exploration, it may also be found throughout the exploration.

I like this!

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	There is evidence of limited or superficial reflection.
2	There is evidence of meaningful reflection.
3	There is substantial evidence of critical reflection.

Checklist for criterion D

what do these results imply?!

I discussed the implications of my results	
I reflected on the method(s) I used and made links to different fields and/or areas of mathematics	
I stated possible limitations	
I considered the significance of my exploration	
I discussed possible extensions	
My reflection in the conclusion and within the work went beyond correct interpretations and reached critical interpretations	

Mark

Criterion E: Use of mathematics

This criterion assesses to what extent and how well students use mathematics in the exploration.

Students are expected to produce work that is commensurate with the level of the course. The mathematics explored should either be part of the syllabus, or at a similar level or beyond. It should not be completely based on mathematics listed in the prior learning. If the level of mathematics is not commensurate with the level of the course, a maximum of two marks can be awarded for this criterion.

Sophistication in mathematics may include understanding and use of challenging mathematical concepts, looking at a problem from different perspectives and seeing underlying structures to link different areas of mathematics.

Rigour involves clarity of logic and language when making mathematical arguments and calculations.

Precise mathematics is error-free and uses an appropriate level of accuracy at all times.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	Some relevant mathematics is used. Limited understanding is demonstrated.
2	Some relevant mathematics is used. The mathematics explored is partially correct. Some knowledge and understanding are demonstrated.
3	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct. Good knowledge and understanding are demonstrated.
4	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct and reflects the sophistication expected. Good knowledge and understanding are demonstrated.
5	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct and reflects the sophistication and rigour expected. Thorough knowledge and understanding are demonstrated.
6	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is precise and reflects the sophistication and rigour expected. Thorough knowledge and understanding are demonstrated.

Checklist for criterion E

The mathematics I used is either within the HL syllabus or on a similar level	
I applied mathematics in different contexts	
I reviewed and re-reviewed my calculations and they are all correct – No errors (Precise)	
The degree of accuracy I used for each of my results is appropriate and justified (e.g. my height is just 163 cm and not 163.2156089 cm) (Precise)	
I applied different problem-solving techniques	
I generalized and justified my conclusions	