Mathematics SL/HL

The Exploration

A Course Companion

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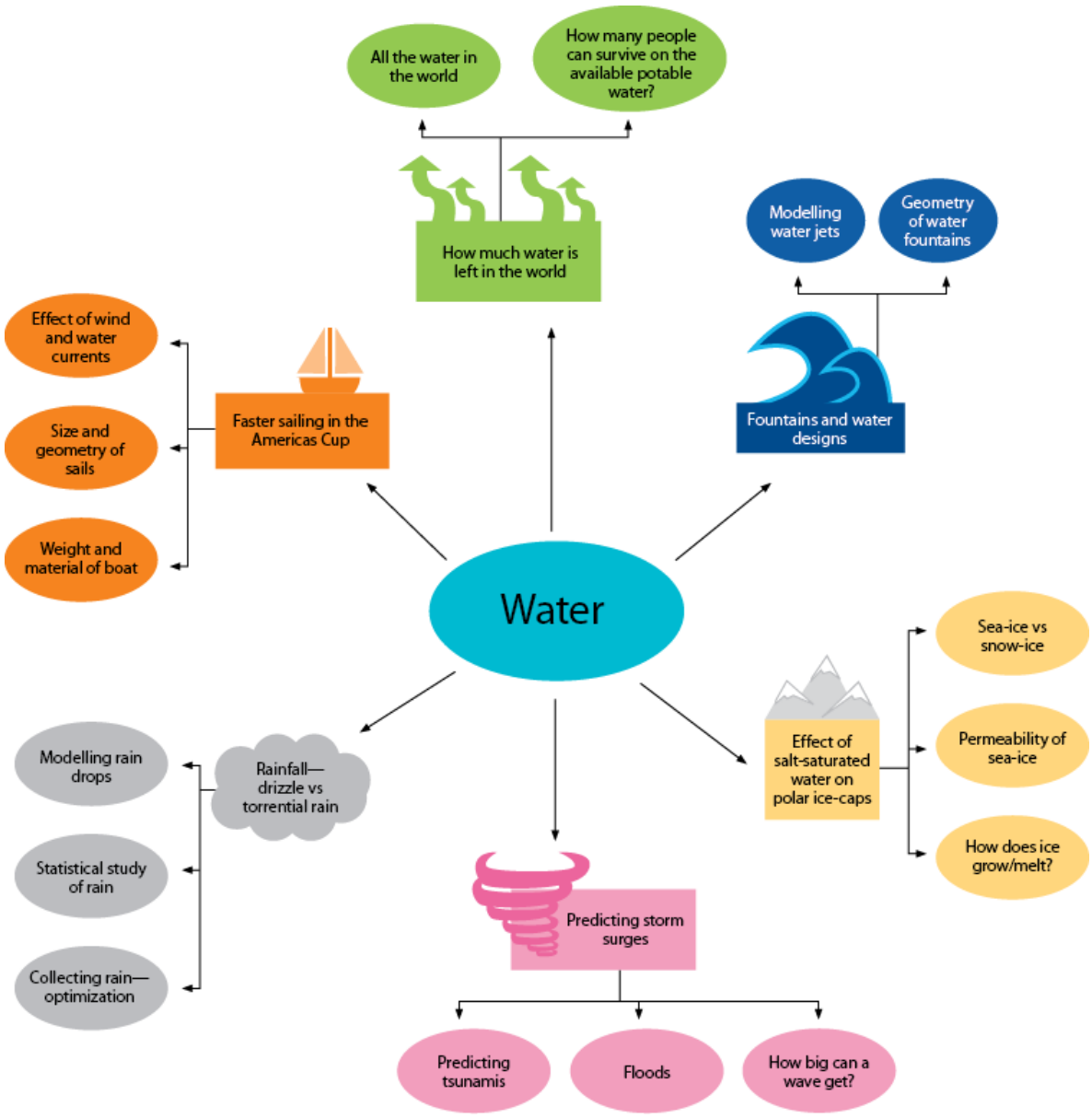
Timeline – Developing The Exploration

Process	Date begun	Date ended	Progress check
Think about a stimuli • Choose a topic	Nov. 25th	Dec 4th	
Draft exploration	Dec 4th		
• Introduction ○ *Outline the aim and purpose in a clear and succinct manner.* ○ *Justify the exploration choice* ○ *Briefly discuss the area of mathematics that will be used.* ○ *Evidence of some research.*		Dec 12th	
• Body/Mathematical Exploration ○ *Describe the method, followed by an investigation* ○ *Record your results (tables, lists etc)* ○ *Analyze the results (graphs, diagrams, calculations etc) and form conjectures.*		Jan 14th	
• Conclusion and Bibliography ○ *Summarise your findings in response to your aim. Restate any rules, conjectures or models that you found.* ○ *Comment on any limitations to your approach, or to your findings.* ○ *Comment on possible extensions and real life connections. Relate it to your personal knowledge and to your previous knowledge.* ○ *Including a reflection on what you have learned and what you have taken away from this experience will reflect personal engagement.*		Jan 21st	
Submit self-assessment and first draft to turnitin.com	Jan 21st	Jan 24th	
Teacher to review & comment on draft • Meet with teacher	Jan 24th	Jan 27th	
Final writing • Revise draft • Submit to turnitin.com (where required)		Feb 21st	
Final version due date:			

Planning – Mind Mapping

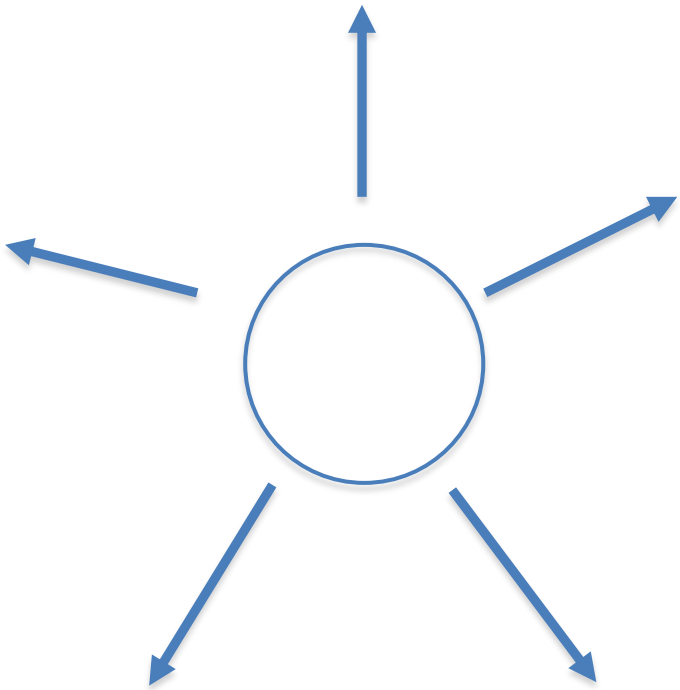
Mind Map – an example



Stimuli

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

Choose a stimulus and create your own mind map here.



The Assessment Criteria

The exploration is internally assessed by the teacher and externally moderated by the IB using assessment criteria that relate to the objectives for mathematics SL.

Each exploration is assessed against the following five criteria. The final mark for each exploration is the sum of the scores for each criterion. The maximum possible final mark is 20.

Students will not receive a grade for mathematics SL if they have not submitted an exploration.

Criterion A	Communication
Criterion B	Mathematical presentation
Criterion C	Personal engagement
Criterion D	Reflection
Criterion E	Use of mathematics

Your teacher expects these skills and strategies from you:

Choosing a topic

- Identifying an appropriate topic
- Developing a topic
- Devising a focus that is well defined and appropriate
- Ensuring that the topic lends itself to a concise exploration

Communication

- Expressing ideas clearly
- Identifying a clear aim for the exploration
- Focusing on the aim and avoiding irrelevance
- Structuring ideas in a logical manner
- Including graphs, tables and diagrams at appropriate places
- Editing the exploration so that it is easy to follow
- Citing references where appropriate

Mathematical presentation

- Using appropriate mathematical language and representation
- Defining key terms, where required
- Selecting appropriate mathematical tools (including information and communication technology)
- Expressing results to an appropriate degree of accuracy

Personal engagement

- Working independently
- Asking questions, making conjectures and investigating mathematical ideas
- Reading about mathematics and researching areas of interest
- Looking for and creating mathematical models for real-world situations
- Considering historical and global perspectives
- Exploring unfamiliar mathematics

Reflection

- Discussing the implications of results
- Considering the significance of the exploration
- Looking at possible limitations and/or extensions
- Making links to different fields and/or areas of mathematics

Use of mathematics

- Demonstrating knowledge and understanding
- Applying mathematics in different contexts
- Applying problem-solving techniques
- Recognizing and explaining patterns, where appropriate
- Generalizing and justifying conclusions

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.

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.

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.

Criterion D: Reflection

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.

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.

SL

Criterion E: Use of mathematics

This criterion assesses to what extent 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.

The mathematics can be regarded as correct even if there are occasional minor errors as long as they do not detract from the flow of the mathematics or lead to an unreasonable outcome.

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

HL

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.

The mathematics can be regarded as correct even if there are occasional minor errors as long as they do not detract from the flow of the mathematics or lead to an unreasonable outcome.

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.

Self-Assessment

When completing your self assessment, use the language of the rubrics and the teacher expectations to comment on why you have given yourself this particular grade. Set goals for yourself for each criterion.

Title:
A - Communication (/4)
B - Mathematical presentation (/3)

C - Personal engagement (/4)

D - Reflection (/3)

E - Use of mathematics (/6)

Checklist

Item	Yes	Partially	No
Is the work entirely yours?			
Have you chosen a topic that you are interested in and developed your own ideas? Is it evident in your exploration?			
Have you explained the reason why you have chosen your topic in your exploration?			
Is the aim of your exploration included in your introduction?			
Do you have an introduction and conclusion? Is your exploration organized?			
Have you defined key terms/variables?			
Have you used appropriate mathematical language (notation, symbols and terminology) consistently throughout your exploration? ** Calculator/computer notation should **not** be used. **			
Have you used more than one form of mathematical representation? Are all graphs, tables and diagrams sufficiently described and labeled?			
Are formulae, graphs, tables and diagrams in the main body of the text? No full-page graphs and no separate appendices.			
Have you used technology to enhance your exploration?			
Have you explained what you are doing at all times? Explanatory comments should be seen throughout your exploration?			
Have you used mathematics that is commensurate with the Standard Level course (or beyond)?			
Is the mathematics in your exploration correct?			
Have you reflected on your finding at appropriate places in your exploration, particularly in your conclusion?			
Have you considered limitations and extensions in your reflection?			
Have you considered the assessment criteria when writing your exploration? Have you self assessed your exploration?			
Is your exploration approximately 6 to 12 pages long?			
Have you referenced your work in a bibliography?			
Have you had someone else read your exploration to ensure that the communication is good? Does it have flow and coherence? Is it easily understandable? Does it read well?			
Have you completed your self-assessment?			
Have you submitted a first draft to your teacher and used the feedback to improve your report?			
If your teacher requires you to submit your report to turnitin.com, have you done so?			

Authenticity

Plagiarism
This includes copying quotes, information and ideas, directly or paraphrased, from books and websites.

Collusion
This includes working closely with another student such that the work between the two students is similar.

Ensuring academic honesty
To prevent plagiarism, you need to cite your sources correctly and include any sources in your bibliography. If you have questions on how to properly cite your sources, seek advice from your teacher or from the school librarian.

To prevent collusion, you should discuss ideas with other students, but you should never giver another student your work, either in print or electronically.

Turnitin.com

Class ID:

Join password:

Recommended Technology

Some examples of technology include:

- any kind of calculators, the internet, data logging devices
- word processing packages, spreadsheets, graphics packages
- statistics packages or computer algebra packages.

GeoGebra

Great software for working with graphs, diagrams, functions, spreadsheets, statistics, calculus and much, much more.

www.geogebra.org

python™

A modern, easy-to-learn, programming language that is great for writing simulations. There are loads of tutorials available: just google “python tuts”.

www.python.org

Texas Instruments

Not sure how to use your TI-83/84. The Baltimore County Community College website has a set of excellent video tutorials that are mainly statistics-oriented, but that are also useful for a general familiarisation.

http://faculty.ccbcmd.edu/elmo/math141s/TIVideo/TIWebpage.htm

FOOPLOT

An online graph plotter with graphing capabilities similar to those of your graphical calculators.

www.fooplot.com

WolframAlpha

A really powerful search / CAS engine. (For example, type “find antiderivative of f(x) = 3x” into the search bar.)

www.wolframalpha.com

Notes

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