

# THE EXPLORATION! IB HL IA

Adapted from Ellen Thompson, College Sturgeon Heights Collegiate, 2013

**Q: What is an “Exploration”?** **A: A written paper that explores the math behind a personal interest of your choice.**

## Objective:

- To apply and transfer skills to alternate situations, to other areas of knowledge, and to future developments
- To appreciate the moral, social, and ethical implications of Mathematics
- To appreciate the international dimensions & universality of Mathematics
- To appreciate the contribution of Mathematics to other disciplines

## Specifics:

- 8-12 pages, excluding graphs, diagrams, works cited, etc.
- All sources must be cited in the Works Cited.
- Not a regurgitation of facts or a historical essay.
- The target audience is your peers. Not expected to be a formal dissertation using ostentatious vocabulary.
- Use of some sort of mathematical technology or software is strongly encouraged.
- You are expected to use any mathematics at the level of this course.
- **100 Exam points** (At least 50 1<sup>st</sup> semester) + At least 10 Assignment points
- The IBO recommends a total of 20 hours for this assignment. Given that we plan to spend 20 hours of class time on the exploration, students should be able to complete the entire assignment with a minimal amount of work done at home.
- Recognizing that some students may be faced with a hurdle that prevents them from meeting a deadline, I expect any such student to communicate with me ASAP so that we can work together on a solution.

**Exam Point Distribution.** Items are due at the beginning of class on the date indicated.

### First Draft SHS Evaluation; 1<sup>st</sup> Semester

Preliminary outline WS	5 marks	Mon, Oct 2
Outline WS	10 marks	} Thu, Oct 12
with Typed Mathematics	25 marks	
Rough Draft Completion	<u>10 marks</u>	TBA (approx. Nov 3)
	<b>50 marks</b>	

### Final Draft (IB Evaluation); 1<sup>st</sup> Semester if possible

COMMUNICATION	4 marks	TBA (approx. Nov 14)
MATHEMATICAL	3 marks	
PRESENTATION		
PERSONAL ENGAGEMENT	4 marks	
REFLECTION	3 marks	
USE OF MATHEMATICS	<u>6 marks</u>	
	<b>20 marks</b>	

**IB mark x 2.5 = 50 marks (Will be curved for course grade).**

## Academic Honesty:

*The following are excerpts from IB Academic Honesty Policy. To read more, please see:*

[http://occ.ibo.org/ibis/documents/general/specific\\_interest/malpractice/g\\_0\\_malpr\\_sup\\_0707\\_1\\_e.pdf](http://occ.ibo.org/ibis/documents/general/specific_interest/malpractice/g_0_malpr_sup_0707_1_e.pdf)

- ❖ An authentic piece of work: Based on the candidate’s individual and original ideas with the ideas and work of others fully acknowledged
- ❖ Plagiarism: The representation of the ideas or work of another person as your own
- ❖ Collusion: Allowing one’s work to be copied or submitted for assessment by another
- ❖ Candidates must record the URL of all web sites from which they obtain information during their research, including the date when each web site was accessed. This includes the copying of maps, photographs, illustrations, data, graphs and so on.

Any students guilty of academic dishonesty may be given a 0 for their IA and thus not earn their diploma or certificate.

## Math Technology Resources

[www.geogebra.org](http://www.geogebra.org) Great software for working with graphs, diagrams, functions, spreadsheets, statistics, calculus and much, much more.

<http://www.khanacademy.org/> Fabulous resource for quick tutorial on many math topics. Use the search feature to find videos, applets, and notes to help you understand some of the math behind your topic.

[www.fooplot.com](http://www.fooplot.com) An online graph plotter with graphing capabilities similar to those of your graphical calculators.

[www.wolframalpha.com](http://www.wolframalpha.com) A really powerful search (For example, type “find antiderivative of  $f(x) = 3x$ ” into the search bar.) There is an app available for iPhones, etc.

Not sure how to do something? YouTube is a great source of tutorial videos. For example, here is a video on how to create a graph using Excel. <http://www.youtube.com/watch?v=oZAZj7Nkic>

Word has an equation editor built in – this will make your life easier when it comes to word processing mathematics. You may need to install this feature. There are YouTube videos and various websites that show you how to use the editor.

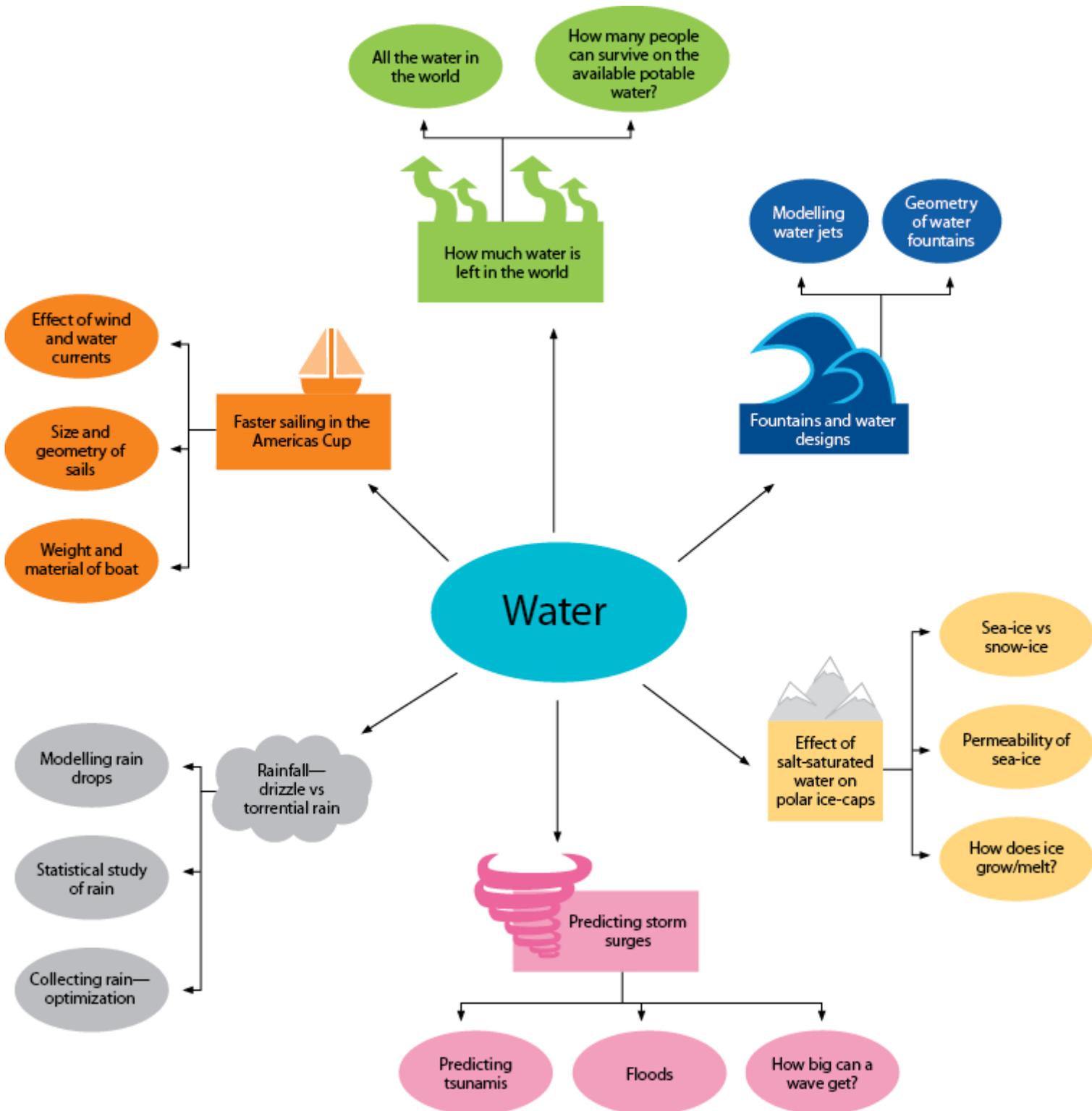
<http://calculator.runiter.com/graphing-calculator/> Graphing Calculator 3D: A free program that can graph in three dimensions. Can be downloaded or used online

## POSSIBLE IA STIMULI

Math	Photovoltaic	Fishing	Immigration	how this affects
Violin	Wasps	Swimming	Issues	their sound
High school	Traveling	Running	The stock market	Fractals as art
Biking	Cards	Biking	Tangrams	String art
Infinity	Space	Skiing	The Abacus	Drumming
Basketball	Smiles	Golf	Anthropology	Advertising
Planes	Working out	Costuming	Matrices	DNA
Trains	Starbucks	Puzzles	Imaginary	Population
Cars	Hockey	Exploring	numbers	growth
Skydiving	Global warming	Baseball	Binary number	Energy
Money	Population	Fishing	systems	conservation
Football	Motorcycles	Cooking	Carnival games	Wireless
Hamster	Model trains	Volleyball	Quipus	technology
Explosion	Clocks	The beach	Navajo blankets	Shrinking forests
Frisbee	Car reliability	Investing	Sudokus	Aerodynamics
Soccer	Star Trek	Quilting	Fermat's last	Recycling
Investments	(original)	Baking	theorem	Computer
Music	Tennis	Cake decorating	Bar codes	programming
Robotics	Biking	Remodelling	The enigma	Construction
Space	Ice Cream	Gardening	Machine	Topography
Sports	Running	Finances	The Rosetta	Topology
Physics	Skydiving	Earthquakes	stone	Body Mass Index
Computer	BMWS	Income	Cryptography in	Skateboarding
Videogames	Baseball	Cards	war	Earth day
Traveling	Guitar	Shotput	Cryptography in	Agriculture
Cats	Debt	Lighting & Stage	computer	Roller coasters
Cooking	Card Games	Sabermetrics	Email and data	Computer game
Business	Rock Climbing	Bridges	transferring	design
Engineering	Bowling	Soccer	Credit/debit	Immunology
Investment	Travel	Golden ratio	cards	Oceanography
Programing	Suntanning	Music	Poetry	Chaos theory
Jetskiing	Coffee	Basketball	Acoustics	Queuing theory
Basketball	Book Publishing	Crowd sourcing	Kaleidoscopes	Projectiles
Swimming	Sewing	Social	Da Vinci	Paper airplanes
Soccer	Road trips	networking	Platonic solids	Rockets
Rocketry	Dog racing	Drug/alcohol	Roman	GPS
Games	Ecology	testing	architecture	Bicycles
Technology	Shopping	Girls vs Boys	Labyrinths	Baseball
Investments	Birding	Political polling	Mixing colours	Cars
Baseball	Space travel	Cooking	One point	Religion
Hiking	Camping	Finance	perspective	Sailing
Cars	Mortgages	Video Games	drawing	Meteorology
Flying planes	\$1 000 000	Sports Stats	Octaves, tuning,	Game theory
Baking	Reading	CSI	and pitch	Maps
Music	Airplanes	College costs	The shapes of	
	Piano	Art	instruments and	

## 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.



**IB MATH HL IA PRELIMINARY OUTLINE WORKSHEET**

Name \_\_\_\_\_ Period \_\_\_\_\_ Marks \_\_\_\_\_/5

Type or print your responses in the table.

Topic	Math Topics:
My Research question is:	
My Aim is: (What is the point of your exploration?)	
My Rationale is: (Why did you choose this topic? What do you hope your reader will learn?)	

What are the math connections to your area of interest? Be specific.

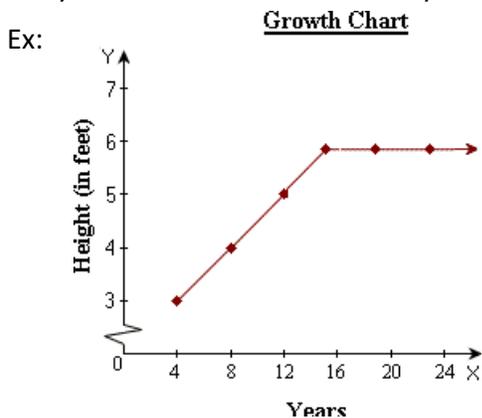
Provide at least three bibliographies that you have investigated in order to answer your research question?

What are the terms you will need to define for people not familiar with this topic?

What are some possible visual representations (graphs, tables, diagrams,...) that you might want to have?

## Hints and Tips to writing a good Math Exploration

- Start with an introduction that includes your research question.
- Then state your aim and rationale.  
Aim: What is the point of your exploration?  
Rationale: Why did you choose this topic? What do you hope your reader will learn?
- Create an outline to help you organize your ideas and streamline your research.
- While doing your research, keep a record of each website you visited and include the date.
- If you need to round any decimal, consider the degree of accuracy. For your topic, how many decimal places are relevant? For example, while a difference of one tenth may not matter if you are talking about speed of a locomotive, it could matter if you are talking about the amount of milligrams of morphine administered to a patient.
- Use  $\approx$  for any rounded values.
- Include page numbers for easier reference later on.
- Only use mathematics that YOU understand. Khan Academy or YouTube could help. If you still can't figure it out, it's probably too hard for this level of math. It is not your teacher's responsibility to teach you the math.
- Ask and answer personal questions ("I wonder if...", "What if...")?. Make conjectures (an opinion or theory without sufficient evidence or proof).
- Use proper math vocabulary (plug in  $\rightarrow$  substitute) and notation ( $x^2 \rightarrow x^2$ ). Use Equation Editor or similar for mathematical expressions and equations.
- Consider the historical and global perspectives of your topic.  
Historical perspective: things that have happened with your topic in the past  
Global perspective: the links between your own life and others throughout the world
- Discuss the implications of your results. (What do they mean? Why are they important? How do they affect your life?...)
- Discuss your results in the context of your topic, not just in general terms.



*The graph levels off at  $x > 15$   
The graph levels off after the age of 15 because that is the average age when girls tend to reach their maximum height.*

- Discuss possible limitations and/or extensions of your topic.  
Limitation: a restriction, a defect or failing  
Extension: an occurrence in another area
- Make connections between your topic and different disciplines and/or areas of mathematics?
- Add "your voice" to your paper.