Agenda for IB Math HL Networking Session

9 am to 1:30 pm, Mon 17 Dec

Robinson Secondary; Principal's Conference Room (Main Office)

1. Changes in new Course Guide (Bob)
2. Outline of the new Internal Assessment (Jim)
3. Creative Teaching Techniques
    a. 3 minute quiz
    b. Hw quizzes
    c. activities
4. Discuss Solutions to 2012-13 Portfolios
5. Textbooks; 3rd edition of H&H, other textbooks?
6. From Marshall; Discuss Success Strategies (Tommie)
    a. IB Exam Prep Strategies
7. 2014 Specimen Guide (Jim)
8. New Stuff on the OCC (Jim)
9. Calculators
10. Discuss the issue of juniors taking HL2
    a. What happens during their senior year
        i. Further Math HL?
11. Prerequisite Courses to HL1?
    a. What does your course sequence to HL look like?
12. Extended Essays in Math
13. Math in TOK; What are you discussing?

1. Tommie: Get copy of one-page formula sheet for use in class and on IB exam.
2. Ideas for engagement:
    a. Group quiz: 10 points with section B questions; end class with this activity; teacher-assigned with mixed ability and social levels; each submits their own paper; 3-4 per group
    b. 3-minute or quik quiz: short problems, easy to grade, good for spiral review, worth a few points
    c. Question-bank questions for whole class work; then show rubric to see how IB grades it
    d. Two-column worksheet: col 1 has a statement "When you see this…", col 2 asks to explain how to justify it "what do you think of doing?"
    e. Differentiate "up", i.e. give some more difficult optional problems for strongest learners to do
3. Marshall HS: Curve the quarter from FCPS to IB scale as the year goes on based on previous year subject report for IB exams (85% SL, 78% HL ~ A, ; curve to the quarter rather than curve tests to the average; 7 = A, 6 = B, 5 = C, 4 = D, 1 – 3 = F)
4. Test ideas
    a. Each unit test alternates between papers 1 and 2
    b. More part B questions
    c. Include part A questions from previous units
    d. Start with ~ 2 min/point, work to 1 min/point
    e. IB questionbank problems
5. Move option topic (calculus) after core in HL2
6. Exam prep:
    a. Give full 2-hour IB exams 2 or 3 times through lunch
    b. In-class review in groups, for points; no take-home review assignments (other than finish in-class review for homework)
    c. One 6-hour review session (incl dinner) at house
    d. Optional final exam grade/culminating activity
7. Web sites:
    a. Ibmaths.org
    b. http://www.ibmaths.co.uk/
    c. ibsurvival.org

IB HL Math: Differences between the 2008 and 2014 Calculus Core Topic Curriculum

2008 Core Topic 7	2014 Core Topic 6
Graphical behaviour of functions: tangents and normals, behaviour for large $\lvert x \rvert$; asymptotes. Oblique asymptotes.	Graphical behaviour of functions, including the relationship between the graphs of f, f' and f'' .
$f''(x) = 0$ is not a sufficient condition for a point of inflexion: for example, $y = x^4$ at (0,0) .	**Not required:** Points of inflexion, where $f''(x)$ is not defined, for example, $y = x^{(1/3)}$ at (0,0)
Use of definition of the limit derivative for differentiation of polynomials, and for justification of other derivatives.	Use of definition of the limit derivative for differentiation of polynomials only, with link to binomial theorem.
	Link with notation of higher derivatives to induction in 1.4.
Area under velocity–time graph represents distance.	Total distance travelled $= \int_{t_1}^{t_2} \lvert v \rvert \, dt$
Solution of first order differential equations by separation of variables.	Moved to **Option Topic 9**

IB HL Math: Differences between the 2008 and 2014 Calculus Option Topic Curriculum

2008 Option Topic 10	2014 Option Topic 9
Limit theorems as n approaches infinity. Limit of sum, difference, product, quotient; squeeze theorem. Formal definition: the sequence $\{u_n\}$ converges to the limit L, if for any $\varepsilon > 0$, there is a positive integer N such that $\lvert u_n - L \rvert < \varepsilon$, for all $n > N$.	Informal treatment of limit of sum, difference, product, quotient; squeeze theorem. Divergent is taken to mean not convergent.
Partial fractions and telescoping series (method of differences) for simple linear non-repeated denominators.	
	Rolle's Theorem and the Mean Value Theorem.
Taylor polynomials and series, including the error term. Applications to the approximation of functions; formulae for the error term, both in terms of the value of the $(n+1)$th derivative at an intermediate point, and in terms of an integral of the $(n+1)$th derivative.	Taylor polynomials; the Lagrange form of the error term. Applications to the approximation of functions; formula for the error term, in terms of the value of the $(n + 1)$th derivative at an intermediate point.

Maclaurin series for arctan(x)	
Excluded: Use of products and quotients of Taylor series to obtain other series.	Use of products of Taylor series to obtain other series.
	Taylor series developed from differential equations.
	Repeated use of l'Hôpital's rule.
Geometric interpretation using slope fields	Geometric interpretation using slope fields, including identification of isoclines.
	Continuity and differentiability of a function at a point. Test for continuity: $\lim_{x \to a^-} f(x) = f(a) = \lim_{x \to a^+} f(x)$.
	Continuous functions and differentiable functions. Test for differentiability: f is continuous at a and $\lim_{h \to 0^-} \frac{f(a+h)-f(a)}{h}$ and $\lim_{h \to 0^+} \frac{f(a+h)-f(a)}{h}$ exist and are equal. Students should be aware that a function may be continuous but not differentiable at a point, eg $f(x)=\lvert x \rvert$ and simple piecewise functions.
	Fundamental theorem of calculus. $\frac{d}{dx}\left[\int_a^x f(y)\,dy\right] = f(x)$.

Syllabus outline

Syllabus component	Teaching hours
	HL
All topics are compulsory. Students must study all the sub-topics in each of the topics in the syllabus as listed in this guide. Students are also required to be familiar with the topics listed as prior learning.	
Topic 1 Algebra	30
Topic 2 Functions and equations	22
Topic 3 Circular functions and trigonometry	22
Topic 4 Vectors	24
Topic 5 Statistics and probability	36
Topic 6 Calculus	48
Option syllabus content Students must study all the sub-topics in one of the following options as listed in the syllabus details. **Topic 7** Statistics and probability **Topic 8** Sets, relations and groups **Topic 9** Calculus **Topic 10** Discrete mathematics	48
Mathematical exploration Internal assessment in mathematics HL is an individual exploration. This is a piece of written work that involves investigating an area of mathematics.	10
Total teaching hours	**240**

Assessment outline

First examinations 2014

Assessment component	Weighting
External assessment (5 hours)	**80%**
Paper 1 (2 hours) No calculator allowed. (120 marks) *Section A* Compulsory short-response questions based on the core syllabus. *Section B* Compulsory extended-response questions based on the core syllabus.	**30%**
Paper 2 (2 hours) Graphic display calculator required. (120 marks) Compulsory extended-response questions based on the core syllabus.	**30%**
Paper 3 (1 hour) Graphic display calculator required. (60 marks) Compulsory extended-response questions based mainly on the syllabus options.	**20%**
Internal assessment This component is internally assessed by the teacher and externally moderated by the IB at the end of the course. **Mathematical exploration** Internal assessment in mathematics HL is an individual exploration. This is a piece of written work that involves investigating an area of mathematics. (20 marks)	**20%**

The New Internal Assessment

From the TSM:

The internally assessed component in these courses is a mathematical exploration. This is a short report written by the student based on a topic chosen by him or her, and it should focus on the mathematics of that particular area. The emphasis is on mathematical communication (including formulae, diagrams, graphs and so on), with accompanying commentary, good mathematical writing and thoughtful reflection. A student should develop his or her own focus, with the teacher providing feedback via, for example, discussion and interview. This will allow all students to develop an area of interest for them, without a time constraint as in an examination, and will allow all to experience a feeling of success.

In addition to testing the objectives of the courses, the exploration is intended to provide students with opportunities to increase their understanding of mathematical concepts and processes, and to develop a wider appreciation of mathematics. These are noted in the aims of the courses, **in particular aims 6–9 (applications, technology, moral, social and ethical implications, and the international dimension)**. It is intended that, by doing the exploration, students benefit from the mathematical activities undertaken and find them both stimulating and rewarding. It will enable students to acquire the attributes of the IB learner profile.

Frequently asked questions

What is the difference between a mathematical exploration and an extended essay in mathematics?

The criteria are completely different. It is intended that the exploration is to be a much less extensive piece of work than a mathematics extended essay. The intention is for students to “explore” an idea rather than have to do the formal research demanded in an extended essay.

How long should it be?

It is difficult to be prescriptive about mathematical writing. However, the *Mathematics SL guide* and the *Mathematics HL guide* state that 6–12 pages should be appropriate. A common failing of mathematical writing is excessive repetition, and this should be avoided, as such explorations will be penalized for lack of conciseness. However, it is recognized that some explorations will require the use of several diagrams, which may extend them beyond the page limit.

How long should it take?

It is difficult to give a single answer. However, the guideline of 10 hours class time with approximately the same amount of time outside class should suffice for students to develop their ideas and complete the exploration.

Does the exploration need a title?

It is good practice to have a title for all pieces of work. If the exploration is based on a stimulus, it is recommended that the title not just be the stimulus. Rather, the title should give a better indication of where the stimulus has taken the student. For example, rather than have the title “water”, the title could be “Water—predicting storm surges”.

Can students in the same school/class use the same title for the exploration?

Yes, but the explorations must be different, based on the avenues followed by each student. As noted above, the title should give an idea of what the exploration is about. Group work is not allowed.

Assessment criteria

Each exploration should be assessed against the following five criteria.

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

The descriptions of the achievement levels for each of these five assessment criteria follow and it is important to note that each achievement level represents the **minimum** requirement for that level to be awarded. The final mark for each exploration is obtained by adding together the achievement levels awarded for each criterion A–E. It should be noted that the descriptors for criterion E are different for mathematics SL and mathematics HL.

The maximum possible mark is 20.

Planning

1. Ensure that students have time to explore the mathematics.
2. Give a realistic deadline for submission of a draft of the written exploration.
3. Give a realistic deadline for feedback to the students.
4. Give a realistic deadline for final submission.
5. Be aware of students' mathematical experience in relation to the exploration at the time of doing the exploration and record this.

Long-term planning

The aim of long-term planning is to put the exploration into perspective in relation to the whole course. It should take into account:

- the sequencing of teaching units over the duration of the course
- those topics that are more applicable to the exploration
- appropriate places where the skills and strategies of the exploration can be introduced
- opportunities for students to record and develop ideas relevant to the exploration, for example, journals or blogs
- the resources available
- the role, if any, that the exploration will play in terms of school assessment
- timetabling exploration deadlines into the school calendar.

Short-term planning

The aim of short-term planning is to provide a framework for the exploration so that students gain the maximum benefit from the experience.

It is expected that teachers will give help and guidance to the students while they are doing the exploration. Ten hours of class time should be allocated to management of the exploration work. Some of this time can be taken up with individual or group activities, where students learn some of the skills associated with exploration work. It is expected that students will spend additional time working on their explorations outside class time. Teachers should briefly discuss the exploration early during the course, so that students are aware of what is required and that this is an essential part of the course.

A possible time frame for the exploration

It is envisaged that 10 hours of class time and approximately 10 hours outside class be spent on the exploration.

Choosing a focus/topic: 2 weeks

Class time: 2–3 hours

This will involve introductory lesson(s) leading to each student having a focused aim to their exploration. The purpose and scope of the exploration should be explained. In doing this, teachers could demonstrate in various ways how a stimulus will be used. The list below shows the wide range of stimuli that are suitable as starting points to generate an idea as a focus for the exploration.

It could also be useful to look at an example of one or more stimuli and discuss with students how this could lead to a focus for a mathematical exploration. An example of a "mind map" starting from the stimulus "water" is included below to exemplify how this process could develop.

Examples of explorations from the TSM and other sources could be looked at to demonstrate to students what is expected of them.

IB Math HL I
Unit 3; Differentiation Rules (Chap 3)
Mr. Evans, Rm B-108
Periods 4 & 6

"Calculus required continuity, and continuity was supposed to require the infinitely little; but nobody could discover what the infinitely little might be." -- Bertrand Russell

Revised: 31 October 2012

Date Assigned	Textbook Section	Content	Assignment (due at the beginning of next class)
Thurs 10/18		Test; Unit 2 Short lesson on basic differentiation rules: constant, power, exponential, constant multiple, sum, difference	**#9:** p.189 (3-27 odd, 43, 45, 49, 52, 53) 3 Minute Quiz next class
Mon 10/22	3.2	3 Minute Quiz Product and Quotient Rules	**#10:** p.195 (3 – 25 odd, 31, 32, 33)
Wed 10/24	3.3 3.4	Practical Apps Rates of Change Derivatives of Trig (Circular) Functions	**#11:** p.205 (1 – 7 odd), p.213 (1 – 25 odd) **HW Quiz #5 on HW #9 to #11 next class**
Fri 10/26	3.5	**H/W Quiz #5 on HW #9 to #11** Chain Rule	**#12:** p.221, #7 -45 odd except #29, #51
Thurs 11/1	3.6	Implicit differentiation Derivatives of inverse trig functions	**#13:** p.230 (5, 7, 9, 11-21 odd, 25, 27, 41-47 odd)
Wed 11/7	3.7 3.7 3.8	Second and higher derivatives Liebniz and f'(x) notation Derivative of log and ln function	**#14:** p.237 (1 – 25 odd, 43), p.245 (3 – 13 odd, #35 to 47 odd) **HW Quiz #6 on HW #12 to #14 next class**
Fri 11/9	3.10	**HW Quiz #6 on HW #12 to #14** Related Rates (everybody's favorite!)	**#15:** Pg 257, 1 – 21 odd, 22, 23, 29
Tue 11/13		Review for Unit Test; Practice IB Problems	**#16:** Finish Practice IB Problems
Thurs 11/15		Unit 3 Test	**None**

IB Math HL ______ **Name:** ________________

Mix; Quiz B **18**

You have 3 minutes. Each question is worth 1 point. There is no partial credit. Go.

1. $\frac{d(\cos x)}{dx} =$	2. $\tan\frac{2\pi}{3} =$
3. $\frac{d(\sec x)}{dx} =$	4. $\sec\frac{2\pi}{3} =$
5. $\frac{d(\ln 2x)}{dx} =$	6. $\frac{d(\frac{1}{\tan x})}{dx} =$
7. Trig Identity: $\sin 2x =$	8. $\sin^2 x + \cos^2 x =$
9. $1 + \tan^2 x =$	10. $\frac{d(e^2)}{dx} =$
11. $\frac{d(\sin x)}{dx} =$	12. $\cos\frac{-\pi}{4} =$
13. $\cos^{-1}(-1.5) =$	14. $\frac{d(\cos\frac{\pi}{3})}{dx} =$
15. $\cos\frac{5\pi}{6} =$	16. $\tan\frac{-\pi}{2} =$
17. Simplify: $\frac{2x-4}{4} =$	18. $\sec(-\frac{\pi}{2}) =$
19. $0! =$	20. $\cos 5\pi =$

HW Quiz #6 on HW #12 to #14

HL1; Fri 9 Nov

Graded by:____________ ______ (Your number - no names!)

12

For the grader: If you make good corrections, I will add 1 point to your quiz!

1. Find the derivative: $y = e^{x\cos x}$ [3]

____

2. Find the derivative: $y = x^{\sin x}$ [3]

____

3. Find the derivative: $x^2y + xy^2 = 3x$ [3]

____

4. Find the derivative: $4\cos x \sin y = 1$ [3]

____