

Mathematics Study Skills: A process, not an event

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“How many times do you have to fold a piece of paper in half until it reaches the moon?”

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Syllabus Content: What Is “Project Maths”?

- An initiative recommended in 2006 and implemented since 2009-2010.
- A re-structuring of the course in terms of material (small change) and presentation (bigger change)
- 5 Strands
- Increased attention on Statistics & Probability (applications in almost any field of third level study)
- Larger course (Course not finished until March/April of 6th Year for HL)
- No choice

Syllabus Content: What Is “Project Maths”?

- More “wordy” questioning
- Still 2 papers of 2.5 hours (Concepts & Skills 50% (first 6 questions), Context & Applications 50% (2-3 questions))
- 25 extra points for HL
- Same key skills, applied (slightly) differently
- Work in progress

Syllabus Content: Old Course

- (ii) Find the two complex numbers $a + ib$ such that

$$(a + ib)^2 = 15 - 8i.$$

- (c) Use De Moivre's theorem

- (i) to prove that $\cos 3\theta = 4\cos^3\theta - 3\cos\theta$

- (ii) to express $(-\sqrt{3} - i)^{10}$ in the form $2^n(1 - i\sqrt{k})$ where $n, k \in \mathbb{N}$.

National Statistics - The Numbers Game

- “Some 27 per cent of students took the higher paper, up from 16 per cent in 2011. With more than 95 per cent passing the exam, there will be 13,660 students earning 25 bonus points for CAO courses, nearly 1,100 more than last year.”

The Irish Times

- We currently have over 50% of our students sitting higher level mathematics in 5th and 6th year.
- The expectation on these students is significant.

Higher Level vs. Ordinary Level - Pick and Stick

- Things we need to consider when deciding whether to do HL or OL
 - A student's time and energy is finite
 - 25 points extra is not always "extra"
 - If HL is not for your son, an early move rather than a late one is advisable
 - Decision should be made by 2nd Module Exams of 5th Year
(Wed 11th - Fri 13th March)

Ordinary Level Study Requirements - Routine Is Key

- Homework: Expect approximately 30 minutes of homework EVERY NIGHT (hour on weekends). Keep up with homework and the vast majority of work is done. (NOTE: Even in times of practicals, projects etc)
- Mostly problem solving: In order to get better at problem solving, we need to solve problems. (NOTE: Geometric Constructions & Definitions)
- Start basic, slowly increase difficulty level.
- Don't leave work behind. Mathematical learning is cumulative.
- Learn the subject first, then exam technique. (Exam paper revision begins approximately January for OL)

Higher Level Study Requirements - Dealing With The Unknown

- Approximately twice as much material to cover as OL
- Homework: Expect approximately 45 minutes of homework EVERY NIGHT (1.5 hours on weekend 5th year, 2 hours on weekend 6th year). Keep up with homework and the vast majority of work is done. (NOTE: Even in times of practicals, projects etc.)
- Mostly problem solving: In order to get better at problem solving, we need to solve problems. (NOTE: Geometric Constructions, Proofs* & Definitions)
- Start basic, slowly increase difficulty level. (Keep JC HL textbook)
- Don't leave work behind. Mathematical learning is cumulative.
- Learn the subject first, then exam technique. (Exam paper revision begins approximately late March for HL) Continuous revision throughout 6th year.

Higher Level Study Requirements - Dealing With The Unknown

- Every year there will always be *at least* one question in the HL paper that will cause controversy (it's a disgrace, Joe) as no one will have seen anything *quite* like it before. We are teachers, not clairvoyant. Remember there is no choice.
- The best way to prepare for HL is by developing such a bank of experience that your skill set is applicable to any situation. Get your hands on as many questions as possible. Old textbooks, alternative textbooks, etc.
- Record observations about particularly difficult/interesting questions.
- Labour of love: As hard as a student might work at mathematics, they will work harder and more effectively if they get a *grá* for the subject.

Useful Tips: Skills Audits, Cheat Sheets, Materials

- Outside of completing all homework, and attempting more questions either from other textbooks or exam papers, there are two ways of analysing and collating what a student knows and what they need to know.
- Skills audits: It is best practice to concentrate on the various skills that we need to be able to perform in any individual question rather than chapters (too broad).
- Cheat sheets: Before an exam, it is a good idea to create a cheat sheet; a list of all tips, rules and observations that you have made from attempting questions of the same type. After creating your first cheat sheet you then try to refine the contents and make a smaller cheat sheet next time. Builds confidence.
- Materials: Every student always needs a ruler, multiple pens, log table*, calculator*, A4 pad, geometry set. Sounds simple, but so vital.
- KEEP ALL OF YOUR COPIES: Neatness matters for “future you”.

Useful Tips: Skills Audits

You need to be able to use these skills for the January Monthly Test.

Skills	Straight Forward	More Difficult	Very Difficult
Number Systems: Identifying the correct number system for a number			
Solve linear inequalities with the number line			
Solve double inequalities with the number line			
Changing the subject of the formula			
Simplify indices			x
Solve index equations			
Converting regular numbers into index notation representation and vice versa			
Operate with index notation			
Find the reciprocal of a number			x
Use $(D=S \times T)$ to solve distance, speed and time questions	!	!	!
Use a distance-time graph to solve distance, speed and time questions	!	!	!
Identify what type of data a data set is possessing		x	x

Useful Tips: Cheat Sheet

CO-ORD GEOMETRY OF THE LINE

Equation of a line: point, slope, $y - y_1 = m(x - x_1)$

$d = \text{Pythagoras' Theorem}$
 $\tan \theta = \text{slope}$

2 points → Verify a point on line
 2 points → Graphing a line (2 points only)
 Co-ordinate Plane:


- x - horizontal } alphabetic order
- y - vertical }


∥ to a line
 ⊥ to a line → 90°
 → perp.
 → $M_1 \times M_2 = -1$
 → ~~2 points~~

absolute values
 → length positive
 $|d| = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$

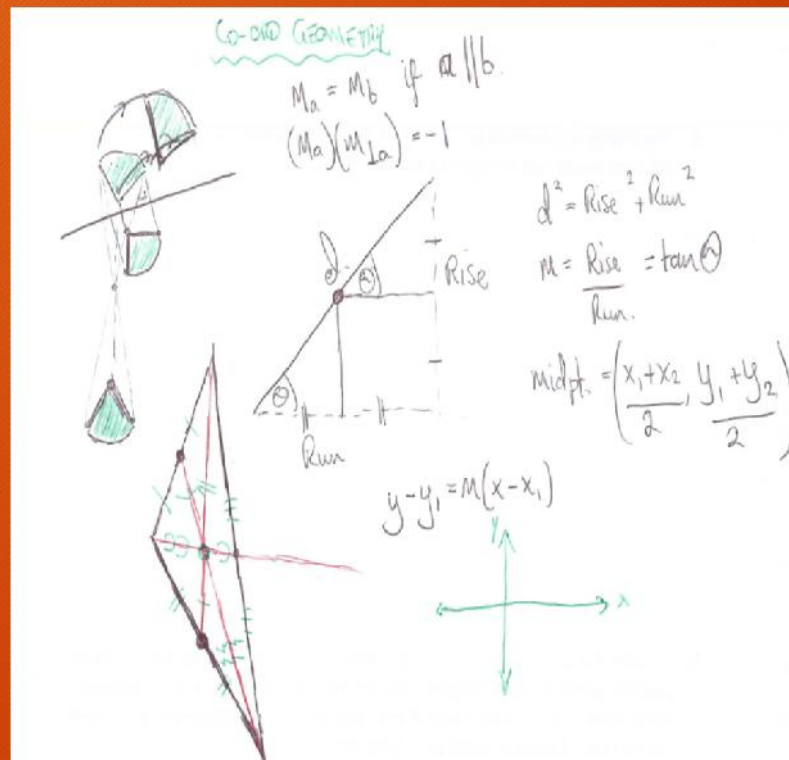
$\frac{\sin(A-B)}{\cos(A-B)} = \tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$
 unit circle

$A_{\text{triangle}} = \frac{1}{2} |x_1 y_2 - x_2 y_1|$ ← translate 1 point to (0,0)
 Vector movements of entire lines

Axial symmetry:
 

Central Symmetry:
 

Useful Tips: Cheat Sheet



Other Resources

- <http://www.projectmaths.ie/>
- <http://www.geogebra.org/>
- <http://www.geogebra.org/>
- <https://www.examinations.ie/>
- <http://www.wolframalpha.com/>
- <http://www.themathstutor.ie/>*
- Other students: Collaborative learning is more enjoyable, and, in the long run, more beneficial.

Maths Anxiety, Grinds and Crash Courses - Calling In The Cavalry

- Maths anxiety has been likened to a mild form of Post Traumatic Stress Disorder. We can make a big deal out of trying to maintain HL or indeed OL, but consistently failing is not good for anyone.
- Our first response is to help in any way we can when our wards are in trouble. Since most people are lacking in either the time or expertise, grinds are often considered the solution. It is my experience that a grind is a useful aid less than half the time.
- New teaching style (often conflicting), too vague in direction, made too routine. Student often slacks off in class.

Parental Support - How You Can Help

- Emphasise routine: It's not about June, it's about today
- 25 points and their opportunity cost
- “Oh maths wasn't really my thing”
- A happy student will work harder and more effectively than an unhappy one. The converse is also true