



# Academic Strategies Sharing 2018

## JC1 Mathematics



# Agenda

1. Overview of Math Syllabuses
2. Assessment Objectives
3. Study Skills & Good Learning Habits
4. How to Prepare for a Math Exam?
5. How to Ace a Math Exam?



# H1 Math vs H2 Math

H1 Math	H2 Math
Provides a foundation in Math for students who intend to enroll in university courses such as <i>Business, Economics and Social Sciences</i>	Prepares students adequately for university courses where more <b>in-depth math content</b> is required such as <i>Sciences and Engineering</i>
Exam Format: 1 Paper (3hrs)	Exam Format: 2 Papers (3hrs x 2)
Pure Math (40%) Statistics (60%)	Pure Math (70%) Statistics (30%)

# H2 Math vs H2 Further Math

H2 Math	H2 Further Math
Prepares students adequately for university courses where more in-depth math content is required such as <i>Sciences</i> and <i>Engineering</i>	Provides students who are <i>mathematically-inclined</i> and intend to <i>specialise</i> in <i>Math</i> , <i>Science</i> or <i>Engineering</i> with a head start in learning a wider range of mathematical methods and tools
Exam Format : 2 Papers (3hrs x 2)	Exam Format : 2 Papers (3hrs x 2)
Pure Math (70%) Statistics (30%)	Pure Math (75%) Statistics (25%)

# Assumed Knowledge for H2 Math

Algebra	Geometry & Trigonometry	Calculus
Equations & Inequalities	Coordinate Geometry	Differentiation
Indices & Surds	Trigo identities and equations	Integration
Exponential, Log & Modulus Functions		Application problems: Connected rates of change; Maxima & Minima Stationary Points
Polynomials & Partial Fractions		





# Assessment Objectives



# ASSESSMENT OBJECTIVES (AO)

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There are three levels of assessment objectives for the examination.

The assessment will test candidates' abilities to:

- A01** Understand and apply mathematical concepts and skills in a variety of problems, including those that may be set in unfamiliar contexts, or require integration of concepts and skills from more than one topic.
- A02** Formulate real-world problems mathematically, solve the mathematical problems, interpret and evaluate the mathematical solutions in the context of the problems.
- A03** Reason and communicate mathematically through making deductions and writing mathematical explanations, arguments and proofs.



# Application Questions

## H1 Math:

There will be **at least two questions**, with at least one in each section, on application of Mathematics in **real-world contexts**, including those from **Business and the Social Sciences**.

Each question will carry **at least 12 marks** and may require concepts and skills from **more than one topic**.

## H2 Math & H2 FM:

There will be **at least two questions** from each paper on the application of Mathematics in **real-world contexts**, including those from **Sciences and Engineering**.

Each question will carry **at least 12 marks** and may require concepts and skills from **more than one topic**.





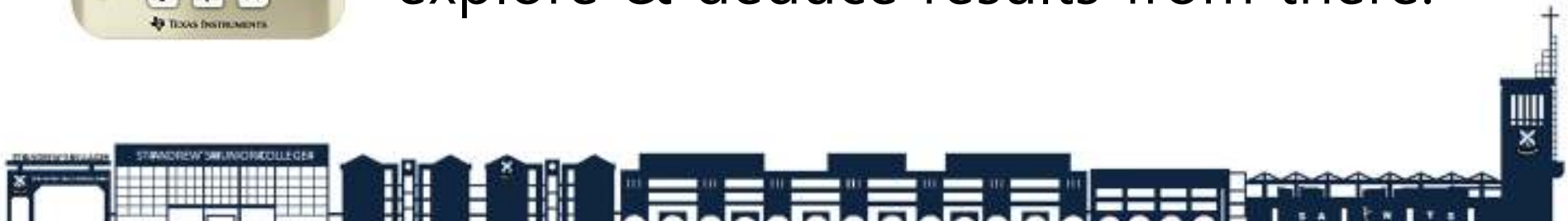
# Graphing Calculator

**A graphing calculator (GC) is a powerful learning tool and should not be left at home!**



With the introduction of GC, the way math problems are being designed changes as well.

There are many more unknowns in the problems and students are expected to use their Graphing calculator to explore & deduce results from there.



# Differential Equations

## 2017 9758 H2 Math Paper 1 Q11

11 Sir Isaac Newton was a famous scientist renowned for his work on the laws of motion. One law states that, for an object falling vertically in a vacuum, the rate of change of velocity,  $v \text{ m s}^{-1}$ , with respect to time,  $t$  seconds, is a constant,  $c$ .

(i) (a) Write down a differential equation relating  $v$ ,  $t$  and  $c$ . [1]

(b) Initially the velocity of the object is  $4 \text{ m s}^{-1}$  and, after a further  $2.5 \text{ s}$ , the velocity of the object is  $29 \text{ m s}^{-1}$ . Find  $v$  in terms of  $t$  and state the value of  $c$ . [3]

For an object falling vertically through the atmosphere, the rate of change of velocity is less than that for an object falling in a vacuum. The new rate of change of  $v$  is modelled as the difference between the value of  $c$  found in part (i)(b) and an amount proportional to the velocity  $v$ , with a constant of proportionality  $k$ .

(ii) Given that in this case the initial velocity is zero, find  $v$  in terms of  $t$  and  $k$ . [5]

For an object falling through the atmosphere, the 'terminal velocity' is the value approached by the velocity after a long time.

(iii) A falling object has initial velocity zero and terminal velocity  $40 \text{ m s}^{-1}$ . Find how long it takes the object to reach 90% of its terminal velocity. [4]



# Examination Questions

For recent A-level examination questions, there is an increasing emphasis in the following aspects:

- 1) Rigor
- 2) Precision
- 3) Number of Unknowns/Variables
- 4) Integration of topics
- 5) Real-world contextual problems



# 2017 9758 P1 Q9 (Sequences & Series)

- 9 (a) A sequence of numbers  $u_1, u_2, u_3, \dots$  has a sum  $S_n$  where  $S_n = \sum_{r=1}^n u_r$ . It is given that  $S_n = An^2 + Bn$ , where  $A$  and  $B$  are non-zero constants.
- (i) Find an expression for  $u_n$  in terms of  $A, B$  and  $n$ . Simplify your answer. [3]
- (ii) It is also given that the tenth term is 48 and the seventeenth term is 90. Find  $A$  and  $B$ . [2]
- (b) Show that  $r^2(r+1)^2 - (r-1)^2r^2 = kr^3$ , where  $k$  is a constant to be determined. Use this result to find a simplified expression for  $\sum_{r=1}^n r^3$ . [4]
- (c) D'Alembert's ratio test states that a series of the form  $\sum_{r=0}^{\infty} a_r$  converges when  $\lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| < 1$ , and diverges when  $\lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| > 1$ . When  $\lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| = 1$ , the test is inconclusive. Using the test, explain why the series  $\sum_{r=0}^{\infty} \frac{x^r}{r!}$  converges for all real values of  $x$  and state the sum to infinity of this series, in terms of  $x$ . [4]

# Internal School Examinations

Components	Weightage	Scope
CA	10%	Lecture Test Learning Attitude
MSA	5%	
Common Test	20%	
Final Exams	65%	
Total	100%	



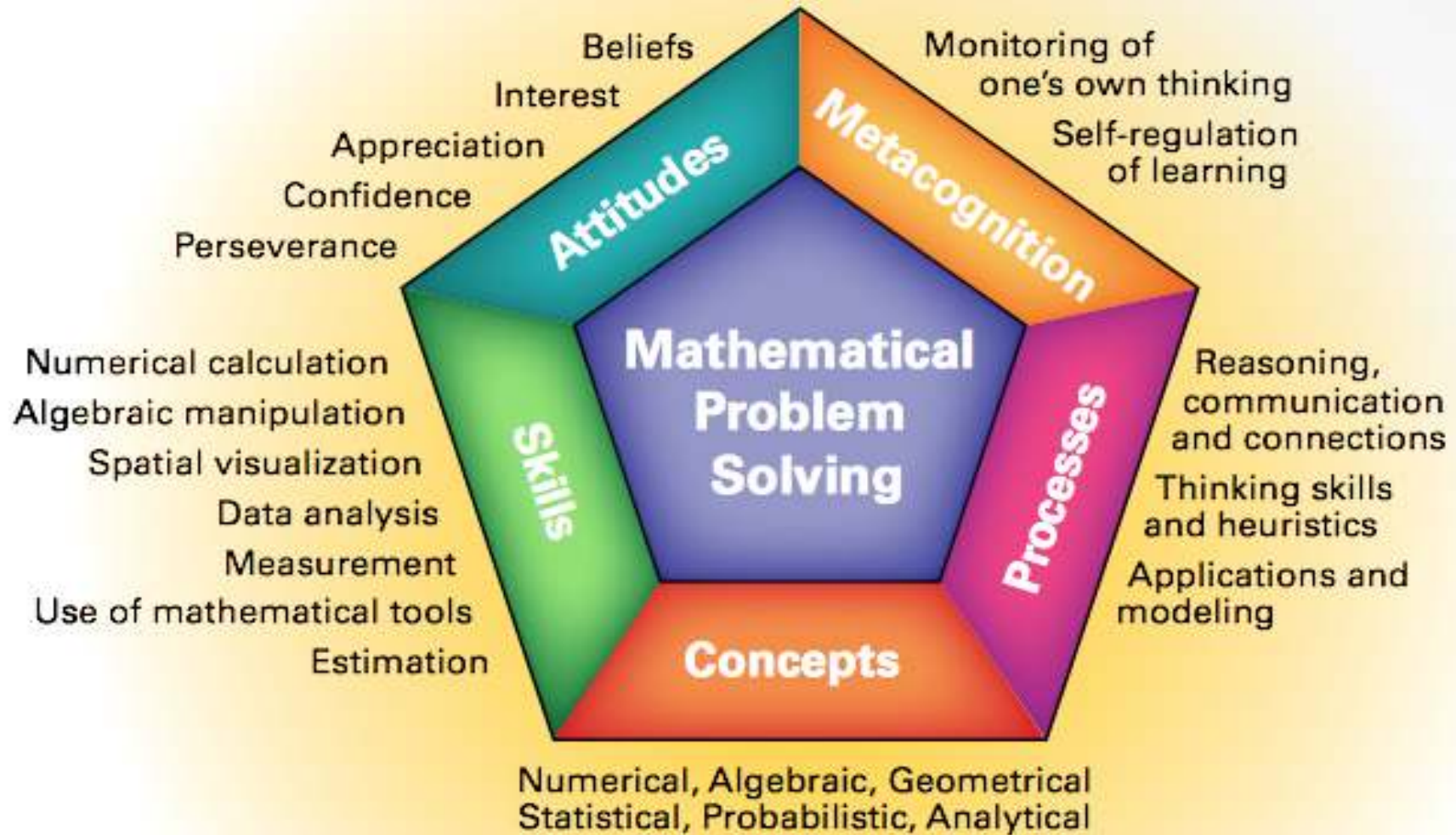


# MATHEMATICS SKILLS





# Singapore Mathematics Framework



*From the Singapore Ministry of Education*



# Math Skills to be Attained

1. Be proficient in problem solving
2. Mastering the Mathematical language
3. Learning how to use mathematical notations correctly
4. Making connections among topics
5. Be equipped with good execution functions





## The Right Approach towards Problem Solving

- Read the question carefully and distil the necessary information.
- There is ***no one-size-fits-all method*** to solve all Math problems. Be open to explore alternative approaches.
- Always make an effort to write out complete solutions, as if you were taking a test. Do not attempt to solving problems using mental gymnastics!
- Reflect on the problem solving approaches. Keep track of own mistakes.

## Solving an Application Question

- Convert the problem into Mathematics
- Draw a picture or table, define variables, formulate
- equations to establish a relationship between variables.
- Verify the answers to check whether it is mathematically sound, logical and feasible.





# Good Learning Habits



# Good Learning Habits

1. Be present for all lectures and tutorials.
2. Take notes during lectures and tutorials
3. Learn to organize information
4. Practise basic skills
5. Take responsibility for learning by completing all assigned work
6. Participate actively in lessons by asking questions, discussing and explaining ideas.
7. Use feedback from assessment.
8. Set learning goals





# How to Prepare for a Math Exam?



# How to Prepare for a Math Exam?

1. Start and plan revision early
2. Review the notes & summarise the key concepts
3. Re-work the lecture examples and tutorial questions if necessary
4. Put yourself in a test-like situation & work problems from revision packages
5. Go through the checklist of concepts & skills relevant to each topic
6. Seek help early from teachers.



# How to Prepare for a Math Exam?

## 7. Support from Teachers

**Make good use of available resources & support from teachers:**

- **Remedial lessons & consultations** are provided for students who need help
- **Teaching Videos** for selected tutorial questions
- **Revision Packages** is prepared well ahead before Major Examinations
- **Worked solutions with markers' comments** are provided for all major exams





# How to Ace a Math Exam?



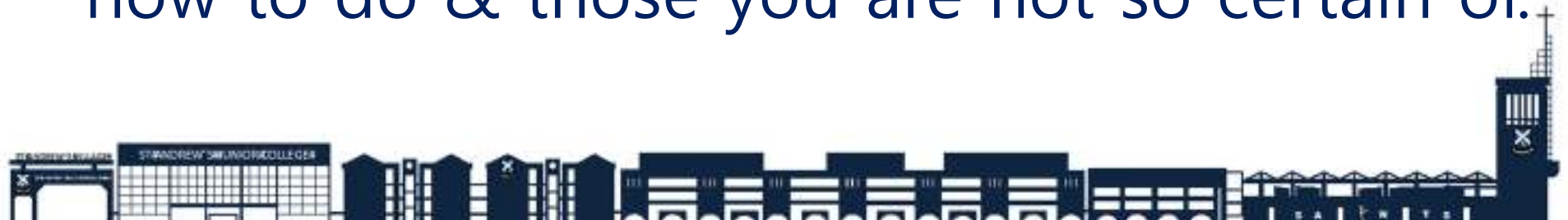
**Good exam strategies can make a huge difference !**

A typical 3-hour Math paper consists of **10-13** questions.

**Tips:**

**1) Scan the whole paper** to get a sense of the difficulty level of the questions.

**Identify** those problems you definitely know how to do & those you are not so certain of.





## Tips:

### 2) Read the questions carefully

Identify the information & keywords (eg: deduce, prove, verify etc) given.

### 3) Work by the clock: **1-1.5 rule**

1.5 mins for every 1 mark – typically 15 mins for a 10-mark question



## Tips:

**4) Verify the answers** – does each answer make mathematical sense given the context of the question?

Can you use the graphing calculator to check the answers?

**5) Do not give up easily**

For a multi-step problem, do not give up the entire question just because you cannot do the first part!



Students should **NEVER** do **last minute** study.

To do well, one must put in conscientious effort throughout the year:

- **P**repare well for all lessons and examinations
- **P**ractise with understanding  
(**NOT** rote learning!)
- **P**ersevere while solving problems  
(**DO NOT** give up easily!)



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