



*ACADEMIC
STRATEGIES
SHARING
2017*

**MATHEMATICS
DEPARTMENT**

Agenda:

- An Overview of Math Syllabuses
- Study Skills and Good Learning Habits
- How to Prepare for a Math Exam?
- 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 in-depth math content 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%)

H1 Math, H2 Math & H2 FM

H1 Math	H2 Math	H2 Further Math
<p><i>Pure Math:</i></p> <p>Functions & Graphs Calculus</p>	<p><i>Pure Math :</i></p> <ul style="list-style-type: none">• Functions & Graphs• Calculus• Sequences & Series• Vectors• Complex numbers	<p><i>Pure Math :</i></p> <ul style="list-style-type: none">• Mathematical induction• Vectors• Complex numbers• Polar curves and conic sections• Applications of definite integrals• Differential equations• Recurrence relations• Matrices and linear spaces• Numerical methods

H1 Math, H2 Math & H2 FM

H1 Math	H2 Math	H2 Further Math
<p><i>Statistics:</i></p> <p>Probability</p> <p>Binomial distribution</p> <p>Normal distribution</p> <p>Sampling</p> <p>Hypothesis Testing</p> <p>Correlation & Linear Regression</p>	<p><i>Statistics:</i></p> <p>Probability</p> <p>Permutations & Combinations</p> <p>Discrete RVs</p> <p>Binomial distribution</p> <p>Continuous RVs</p> <p>Normal distribution</p> <p>Sampling</p> <p>Hypothesis Testing</p> <p>Correlation & Linear Regression</p>	<p><i>Statistics:</i></p> <p>Discrete RVs</p> <p>Poisson & Geometric distributions</p> <p>Continuous RVS</p> <p>Uniform & Exponential distributions</p> <p>Hypothesis testing & confidence intervals, include chi-square distribution</p> <p>Non parametric tests :</p> <p>Sign test • Wilcoxon matched-pair signed rank test</p>

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 (AO)

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.

New Syllabus Requirements

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**.

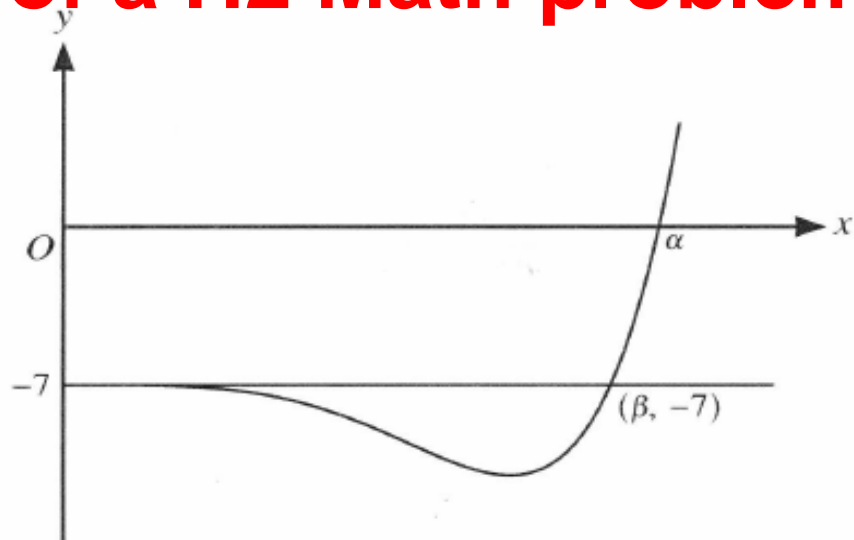
Each question will carry **at least 12 marks** and may require concepts and skills from **more than one topic**.

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
- 4) Integration of topics
- 5) Real-world contextual problems

7 Example of a H2 Math problem



It is given that $f(x) = x^6 - 3x^4 - 7$. The diagram shows the curve with equation $y = f(x)$ and the line with equation $y = -7$, for $x \geq 0$. The curve crosses the positive x -axis at $x = \alpha$, and the curve and the line meet where $x = 0$ and $x = \beta$.

- (i) Find the value of α , giving your answer correct to 3 decimal places, and find the exact value of β . [2]
- (ii) Evaluate $\int_{\beta}^{\alpha} f(x) dx$, giving your answer correct to 3 decimal places. [2]
- (iii) Find, in terms of $\sqrt{3}$, the area of the finite region bounded by the curve and the line, for $x \geq 0$. [3]
- (iv) Show that $f(x) = f(-x)$. What can be said about the six roots of the equation $f(x) = 0$? [4]

Real-World Context Problems

Increasingly more Math problems require the platform of a real-world context. Students should therefore enrich themselves with the knowledge of real life contexts:

Applications & Contexts	Topics
Kinematics & dynamics	Vectors, Calculus & Functions
Optimisation Problems	Inequalities, System of Linear Eqns and Calculus
Electrical Circuits	Complex Nos, Calculus
Financial Maths	Sequences & Series, Probability, Sampling distributions
Population Growth, radioactive decay, heating & cooling problems	Differential Equations
Market research, Clinical research	Sampling distributions, Hypo testing, Correlation and regression
Standardised Testing	Normal distribution, Probability

Example: Differential Equations (Population Growth)

The population of rabbits, P , on an island in t years can be modelled by a differential equation
$$\frac{dP}{dt} = kP\left(1 - \frac{P}{M}\right),$$

where k and M are positive constants. Assuming that there are no human interference factors such as rabbit hunting.

Given that the **initial** population of rabbits was found to be A ,

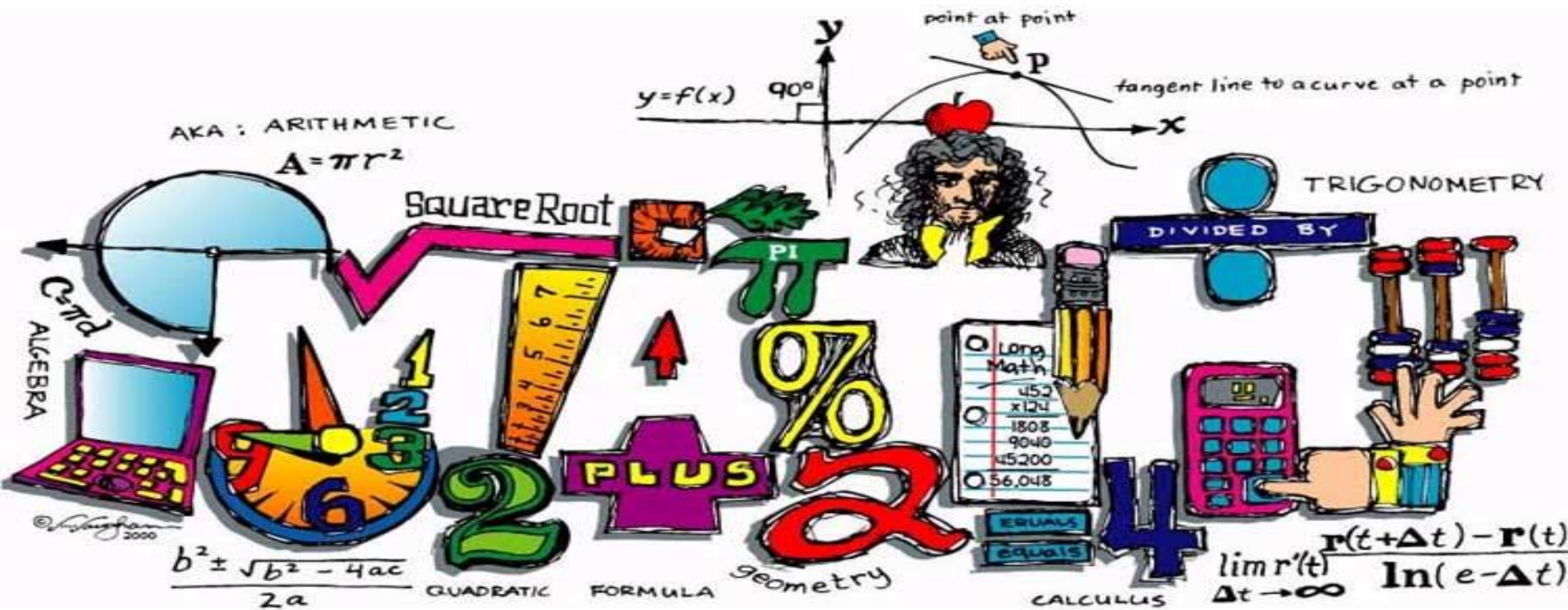
(i) show that
$$P = \frac{MA}{A + (M - A)e^{-kt}}$$

(ii) sketch the graph of P against t for two cases

a) $M > A$ (b) $M < A$

(iii) find the population of rabbits in the long run and hence comment on the significance of M .

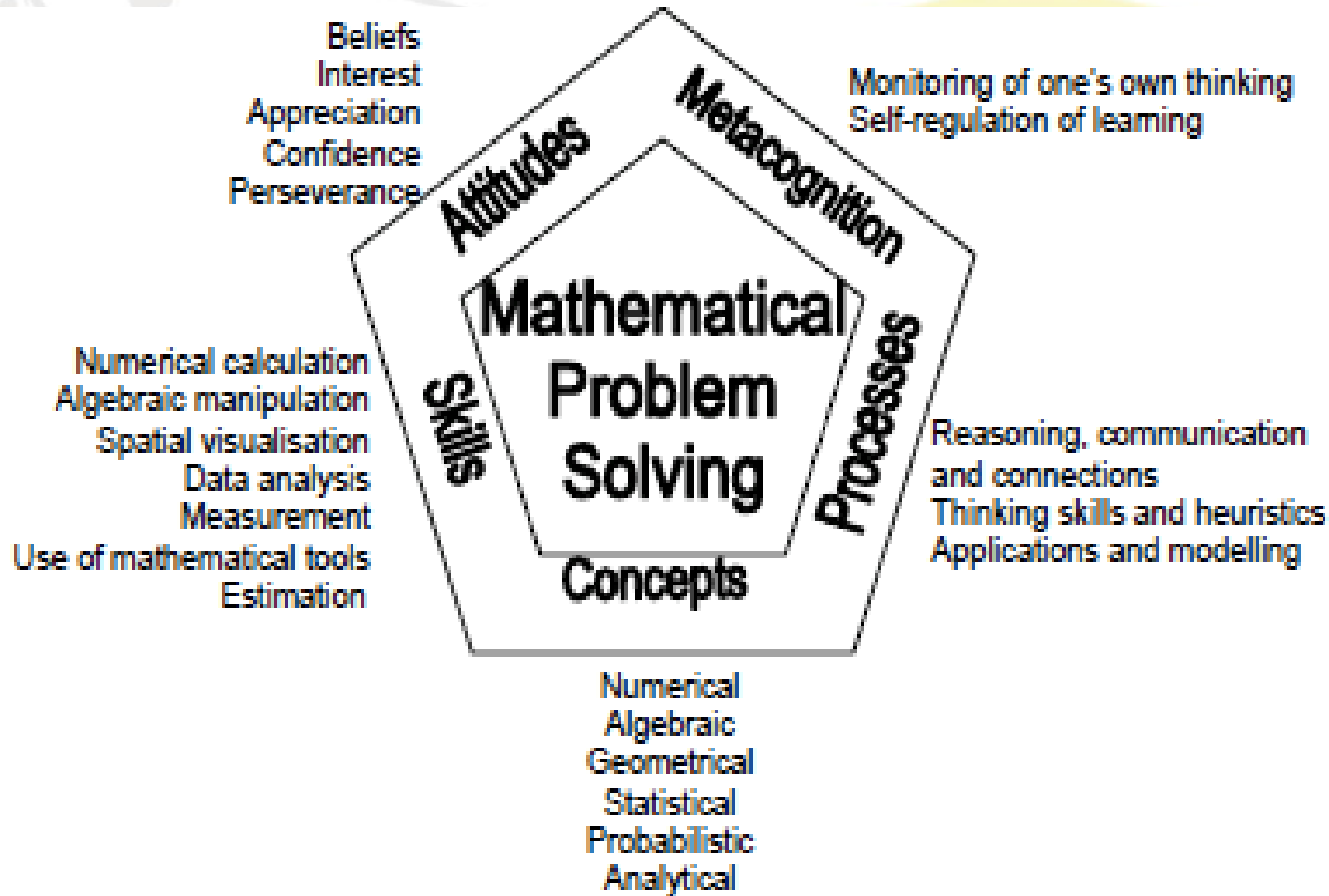
MATH SKILLS



Math Skills to be Attained

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

MOE Mathematics Curriculum Framework



Problem Solving in Math

- ❖ There is ***no one-size-fits-all method*** to solve all Math problems.
- ❖ Do not try too hard to exhaust “all kinds” of novel problems. Focus more on understanding the concepts.
- ❖ Be open to explore alternative approaches
- ❖ Reflect on, not just memorise the solutions
- ❖ Keep track of own mistakes.

■ **The Right Approach towards Problem Solving**

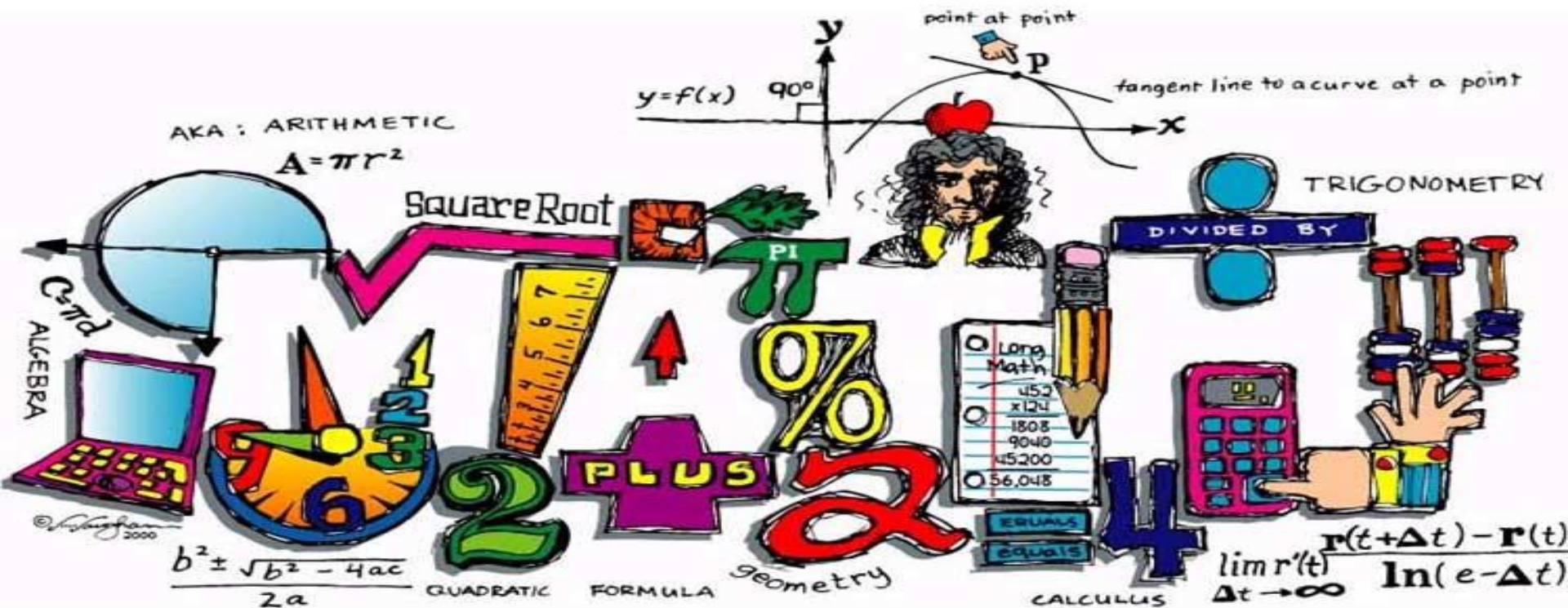
Always make an effort to write out complete solutions, as if you were taking a test.

Do not attempt to solving problems using mental gymnastics!

■ **Solving an Applied Problem**

- 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.

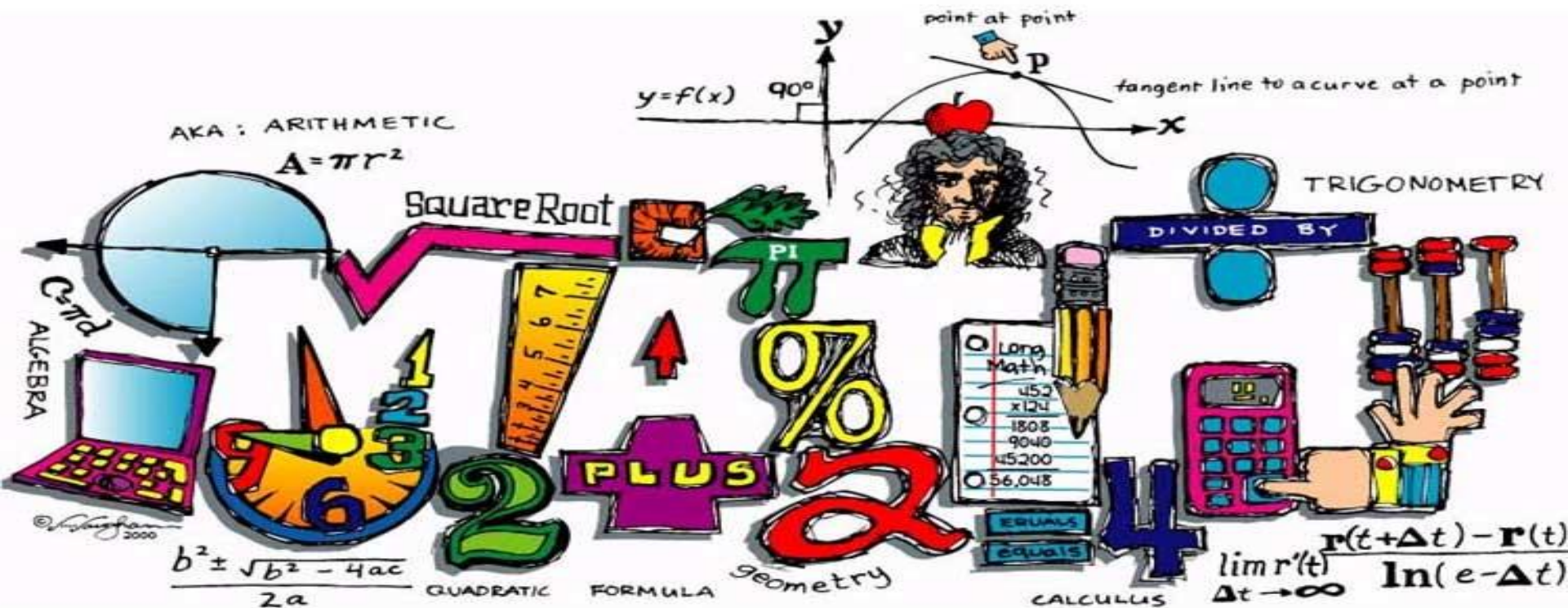
Good Learning Habits



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?



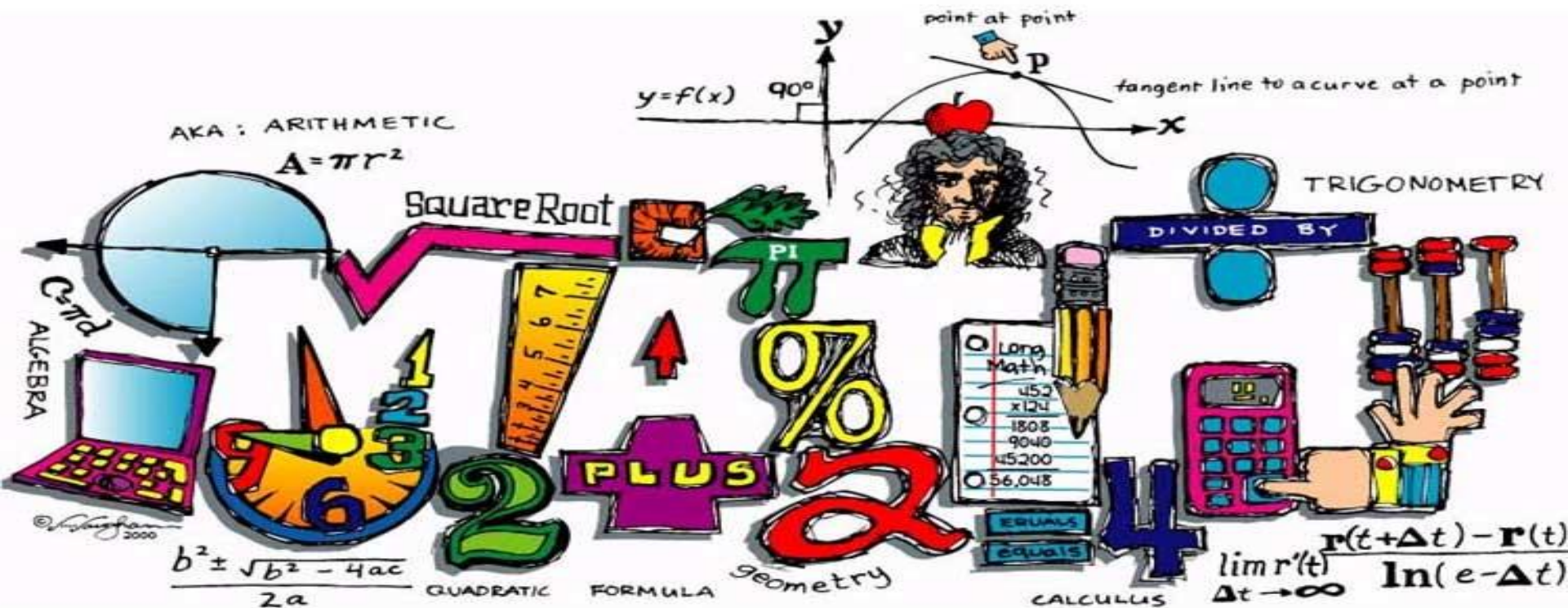
How to prepare For Math Exam?

1. Start 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. Make good use of available resources & support from teachers.

- ❖ **Videos** for selected tutorial problems & lectures
- ❖ Recommended **reference books**
- ❖ **Revision Packages** (including mock exam) are prepared for students well ahead before Major Examinations
- ❖ **Examiners' reports** with complete worked solutions with markers' comments are provided for all Major Examinations.
- ❖ **Remedial lessons** are organised for students who need help

How to Ace a Math Exam?



Good exam strategies can make a huge difference !

A typical 3-hour Math paper consists of **12-13** 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: 1-15 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!)

For Enquiries:

- 1) Ms. Chan Wai Yee (Head of Mathematics)
Email: chan_wai_yee@moe.edu.sg
- 2) Mr. Er Heow Hui (JC1 Math)
Email: er_heow_hui@moe.edu.sg
- 3) Mr. Pio Pereira (JC2 Math)
Email : pio_pereira@moe.edu.sg

