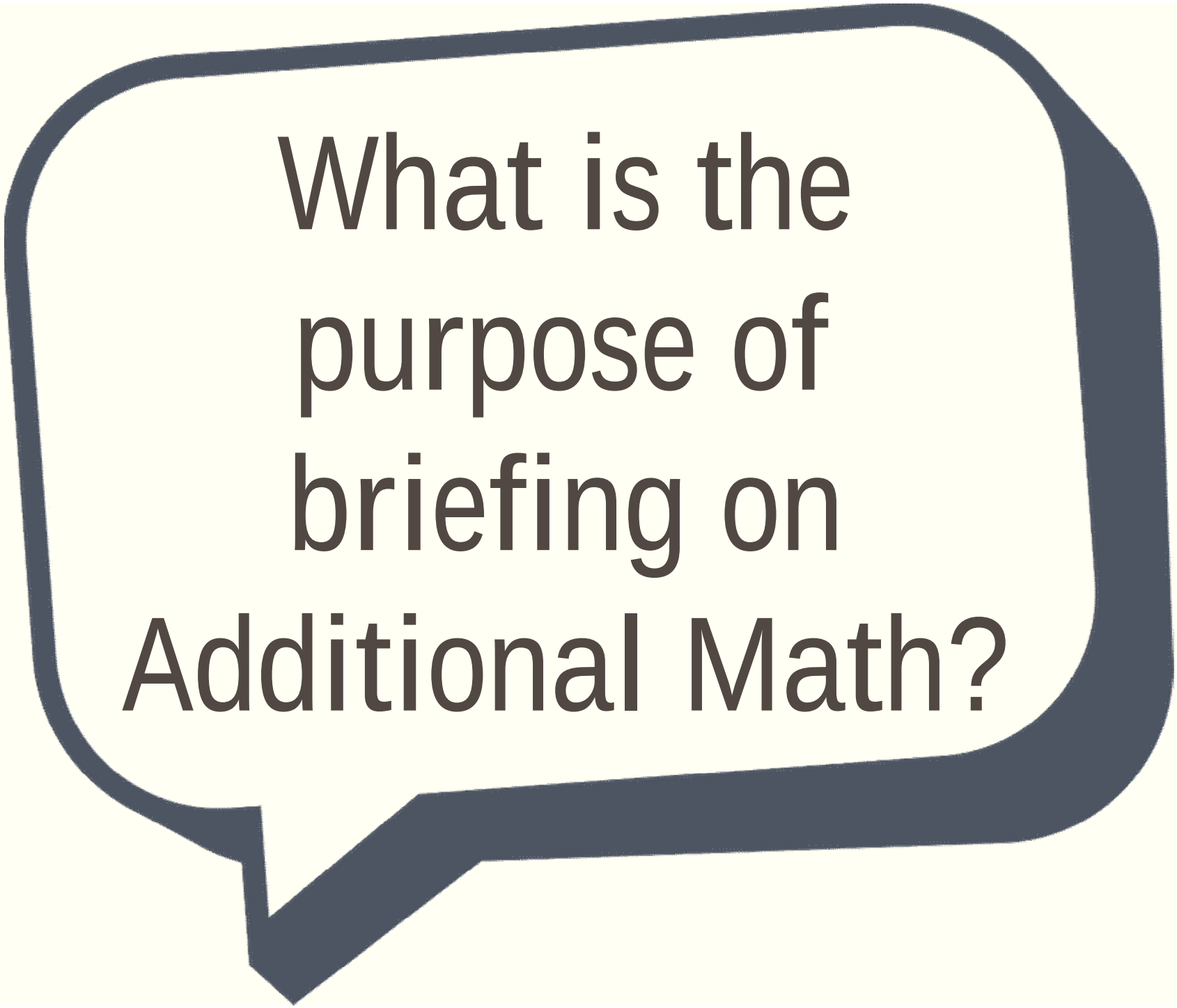
ADDITIONAL MATHEMATICS

SECONDARY 2 STREAMING BRIEFING

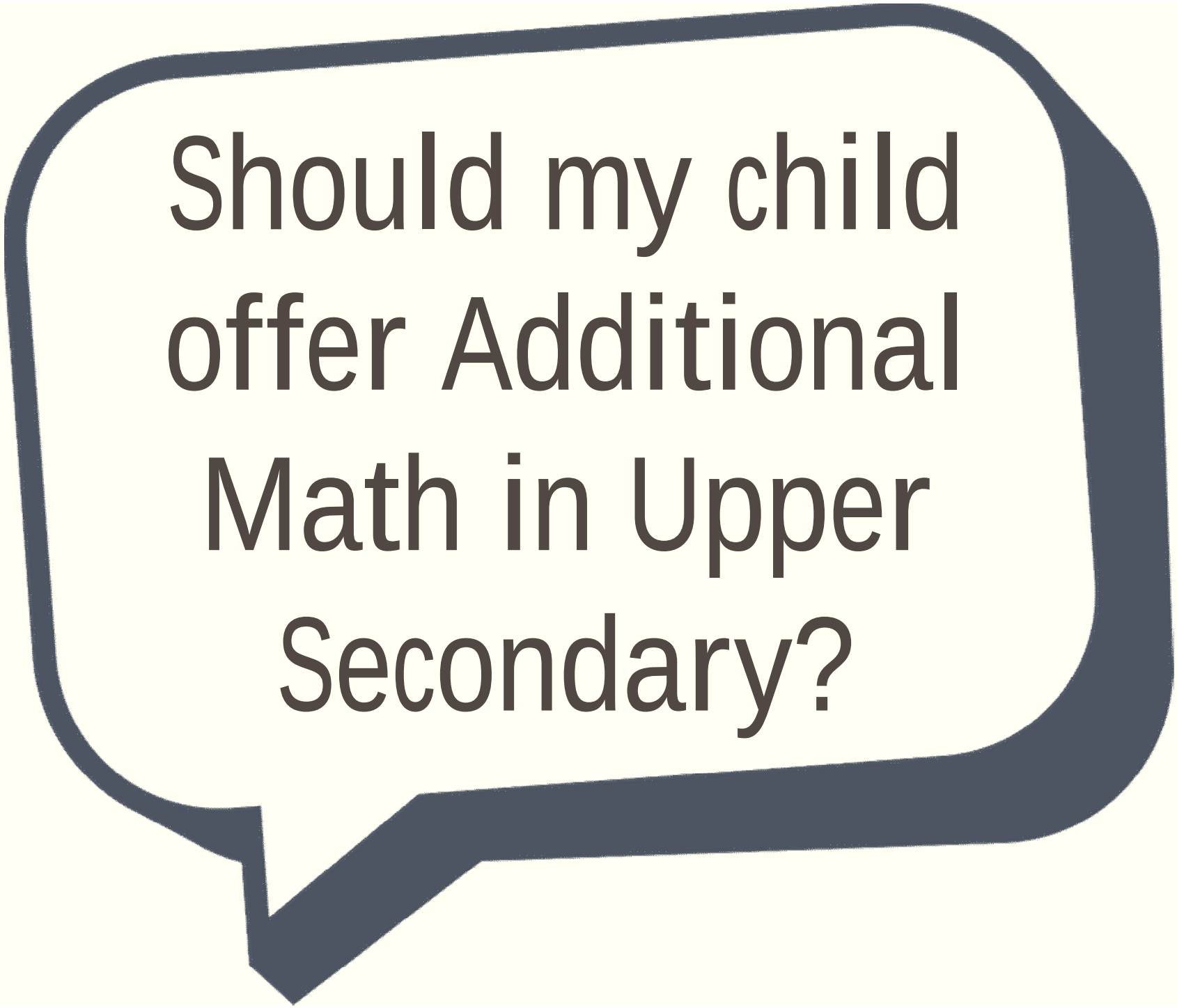
26 JANUARY 2018

BY HOD / MATH MS KOH SWEE KUN (XU RUIJUN)

FREQUENTLY ASKED QUESTIONS


What is the purpose of briefing on Additional Math?

make an INFORMED DECISION

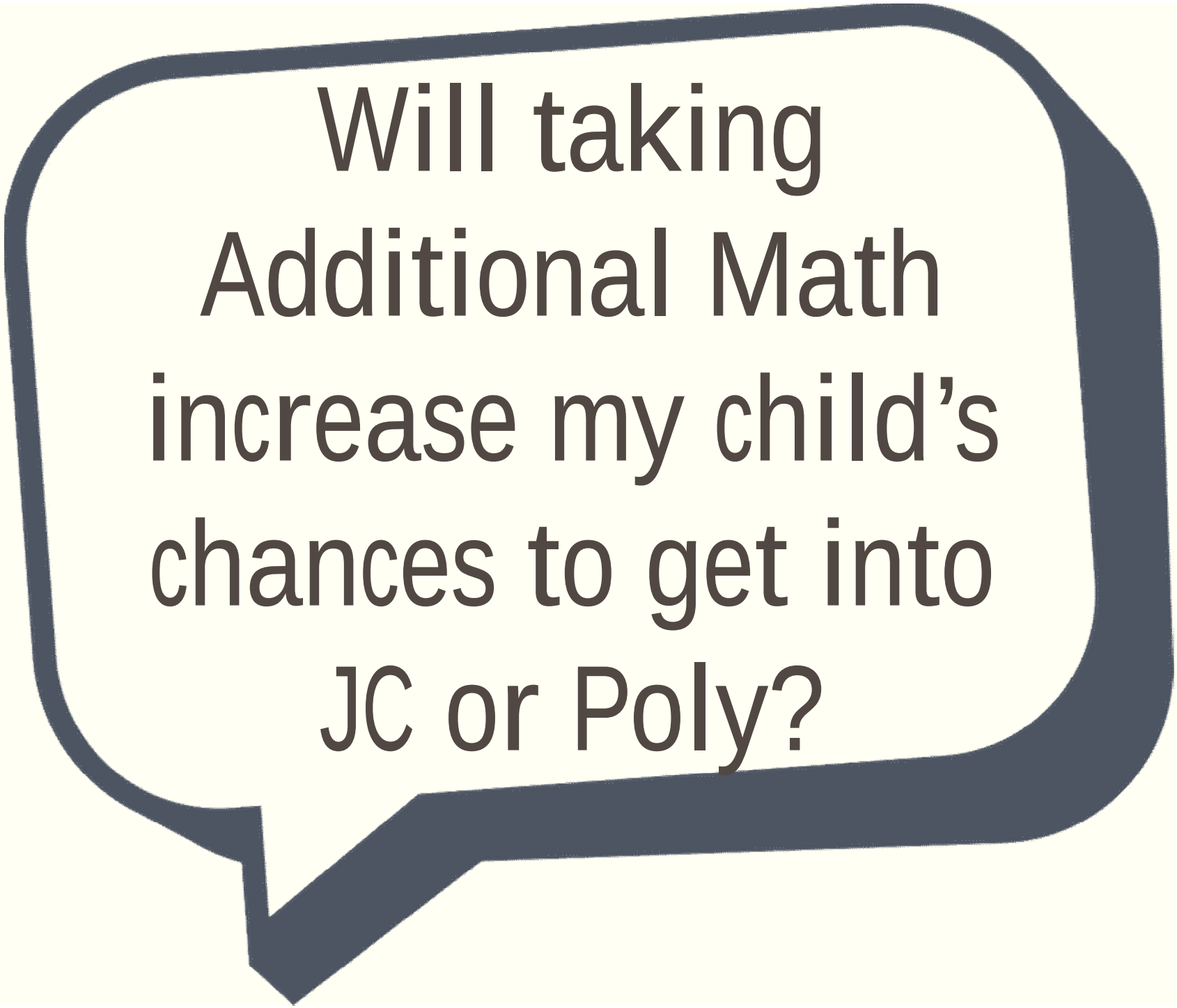

Should my child offer Additional Math in Upper Secondary?


what are you best at?


ASPIRATIONS


Passion


interest


Will taking Additional Math increase my child's chances to get into JC or Poly?

Requirement for Admission to Junior Colleges

- Additional Mathematics can be considered as one of the L1R5 subjects for admission to Junior Colleges (JC).

O Level Mathematics

↓

A Level H1 Mathematics

O Level Mathematics & Additional Mathematics

↓

A Level H2 Mathematics

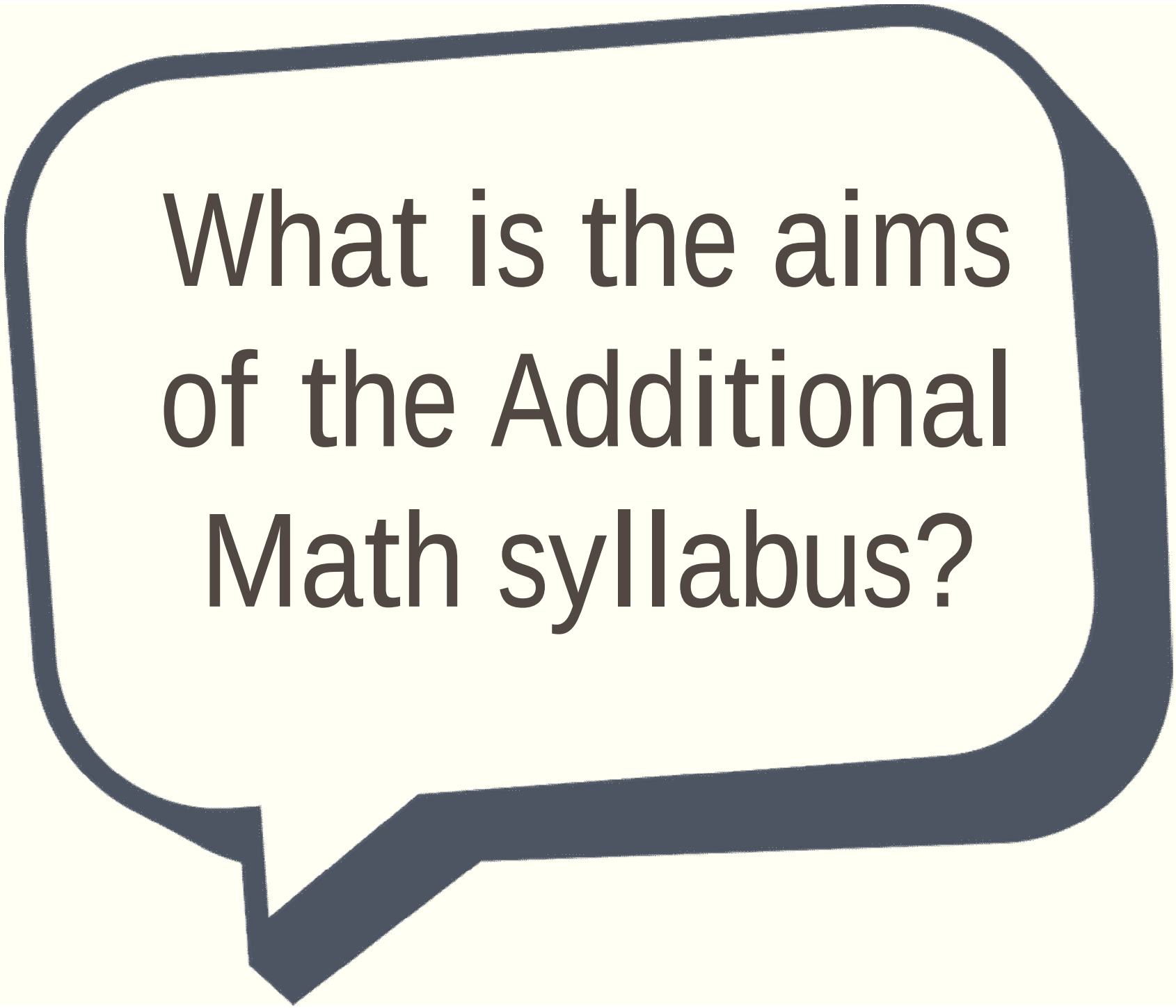
↓

A Level H2 Further Mathematics

A Level H3 Mathematics

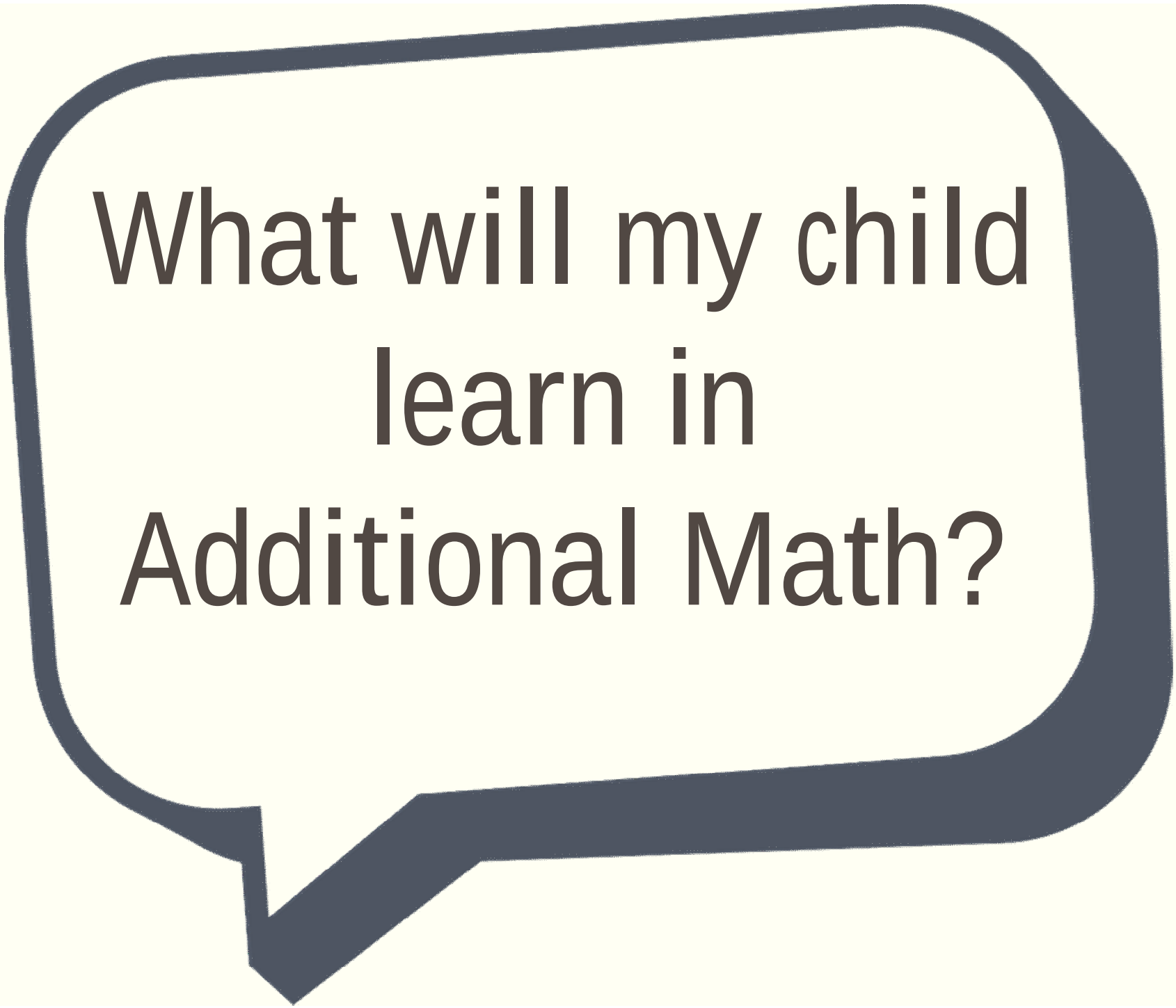
Requirement for Admission to Polytechnics

- Additional Math is **NOT** compulsory for all Polytechnic Courses, including Engineering courses.
- Can be included as one of two Relevant Subjects for ELR2B2 (Need only **one** Mathematics Subject – can be either Elementary Mathematics or Additional Mathematics)

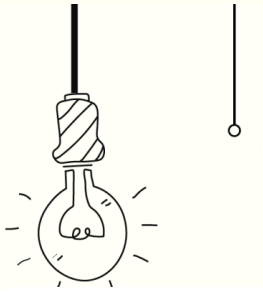

What is the aims of the Additional Math syllabus?

Additional Mathematics Course Aims

- Acquire Math concepts and skills for **higher studies in Math** and to support learning in the other subjects, in particular, the **Sciences**;
- Develop thinking, reasoning and metacognitive skills through a mathematical approach to problem-solving
- Connect ideas within Math and between **Math and the Sciences** through applications of Math
- Appreciate the **abstract nature** and power of Mathematics.


What will my child learn in Additional Math?

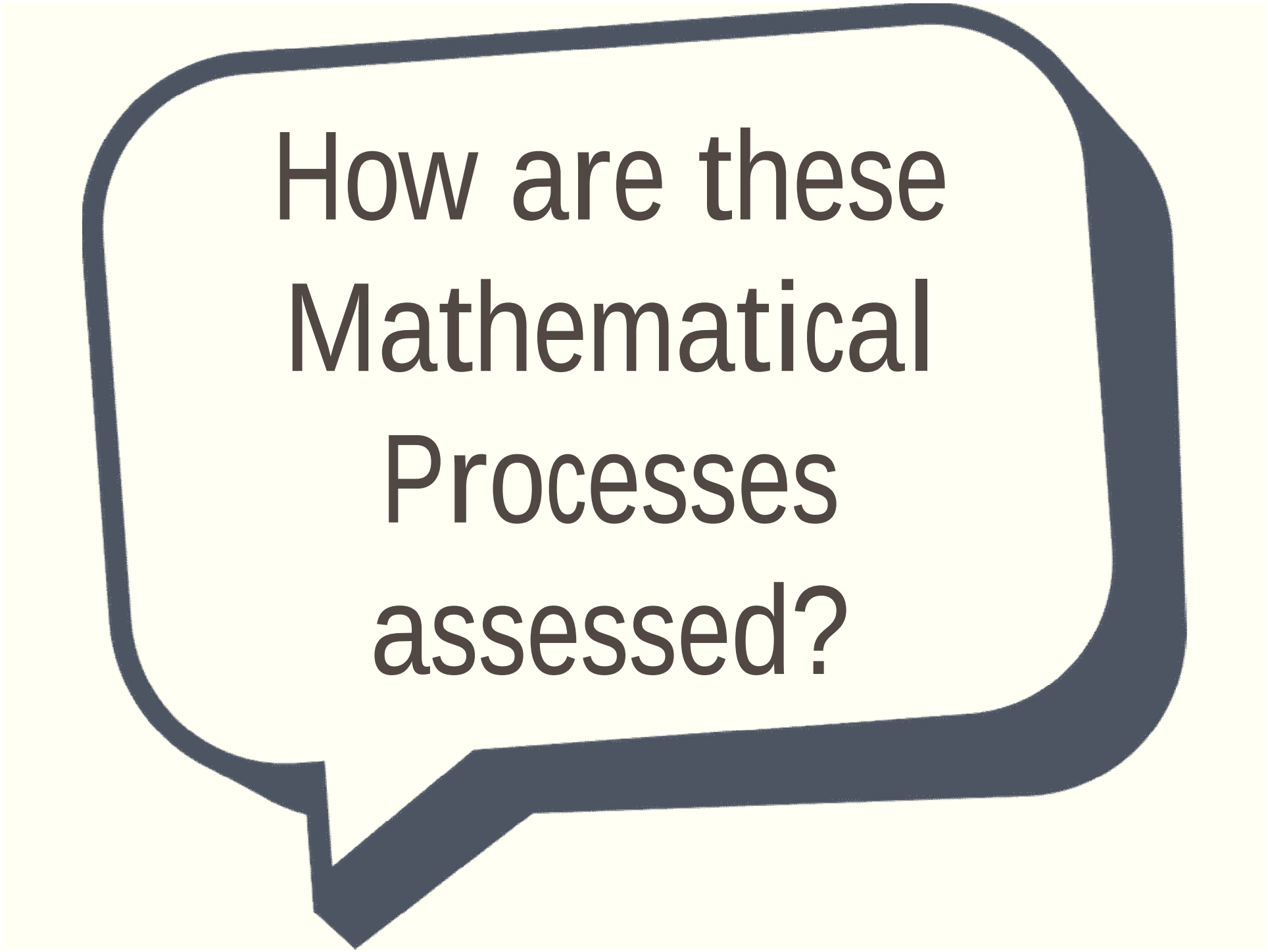
Syllabus Organisation



A **strong foundation and proficiency in algebra** is required for Additional Math!

3 Content + 1 Process Strand		
Algebra	Geometry and Trigonometry	Calculus
Mathematical Processes		

MP1: Reasoning, Communication and Connection
MP2: Application and Modelling
MP3: Thinking Skills and Heuristics


How are these Mathematical Processes assessed?

Learning & Assessment Emphasis

Mathematical Reasoning	Ability to analyse mathematical situations and construct logical arguments Developed through application of mathematics in different contexts
Communication	Ability to use mathematical language to express mathematical arguments precisely, concisely and logically
Connections	Ability to see and make meaningful linkages among mathematical ideas, between mathematics and other subjects, and between mathematics and the real world

- Questions in examinations requiring students to "**Prove**", "**Determine with explanations**", "**Explain**", "**Justify**" and "**Deduce**".
- **Contextual questions** (real world or scientific contexts) that assess aspects of the **Mathematical Modelling** process.

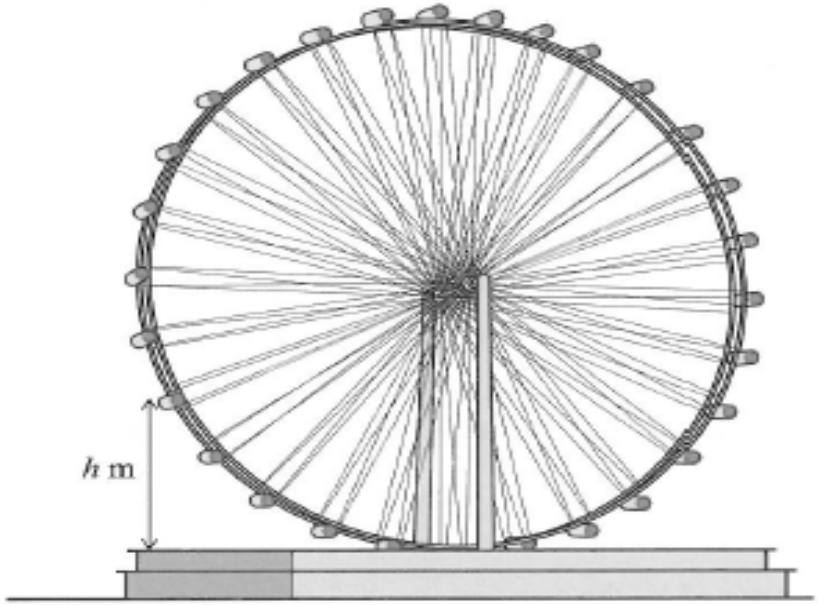
Examples of Calculus questions that require students to "Deduce", "Explain"

Two particles P and Q travel in a straight line pass through a fixed point O.
The velocities of P and Q with respect to time t, are given by $V_P = 4t - 20$ and $V_Q = 6 - 2t$. Given that the initial displacement of Q from O is -6 m and when $t = 2\,s$, the displacement from P to Q is -24 m.

(a) Find an expression for the displacement of particle Q,
(b) Find an expression for the displacement of particle P.
(c) Find the time when the 2 particles meet for the second time.
(d) Find the distance travelled by particle P for this time.
(e) Find the accelerations for each particle.
(f) Deduce which particle has a higher acceleration.

A particle moves along a straight line with a velocity $v\,\text{ms}^{-1}$ given by $v = 6 - 6\sin 2t$, where t seconds is the time after passing a fixed point O.
(a) Find the acceleration of the particle when it first comes to rest.
(b) Find the distance of the particle from O when it first comes to rest.
(c) Explain why the particle does not change its direction of motion at all.

Example of a Contextual Question in Specimen Paper for Add Math



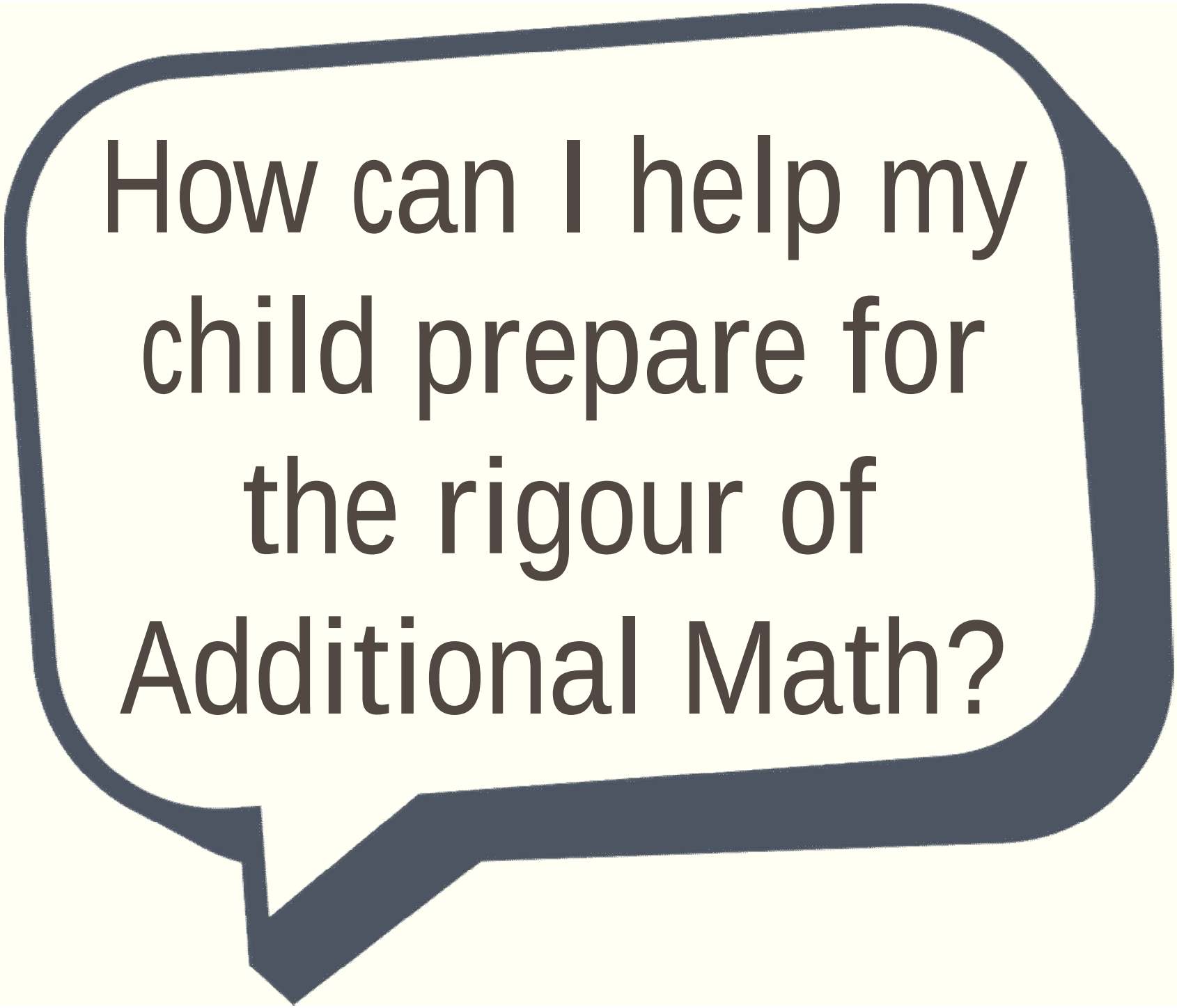
The height above ground level, h m, of a capsule on the Singapore Flyer is modelled by the equation, $h = 80(1 - \cos kt)$, where k is a constant and t is the time in minutes after starting the ride at ground level. The total time to complete one revolution is 30 minutes.

(i) Explain why this model suggests that the height of the Singapore Flyer is 160 m. [1]

(ii) Show that the value of k is $\frac{\pi}{15}$ radians per minute. [2]

It is possible for a person riding in a capsule to see a certain landmark, provided the capsule is at least 100 m above ground level.

(iii) Find the length of time for which the landmark will be in view during one revolution. [5]


How can I help my child prepare for the rigour of Additional Math?

Topics covered under each Strand.

Algebra

- Equations & Inequalities
- Indices & Surds
- Polynomials & Partial Fractions
- Binomial Expansions
- Power, Exponential, Logarithmic, and Modulus Functions

Geometry & Trigonometry

- Trigonometric functions, identities and equations
- Coordinate Geometry in two dimensions
- Proofs in Plane Geometry

Calculus

- Differentiation & Integration

Pre-requisites of Additional Math Topics

ALGEBRA STRAND	
Equations & Inequalities	Secondary 1 Topics: • Basic Algebra and Algebraic Manipulation • Linear Equations and Simple Inequalities Secondary 2 Topics: • Linear Graphs and Simultaneous Linear Equations • Expansion and Factorisation of Quadratic Expressions • Further Expansion and Factorisation of Algebraic Expressions • Quadratic Equations and Graphs • Algebraic Fractions and Formulae
Indices & Surds	
Polynomials & Partial Fractions	
Binomial Expansions	

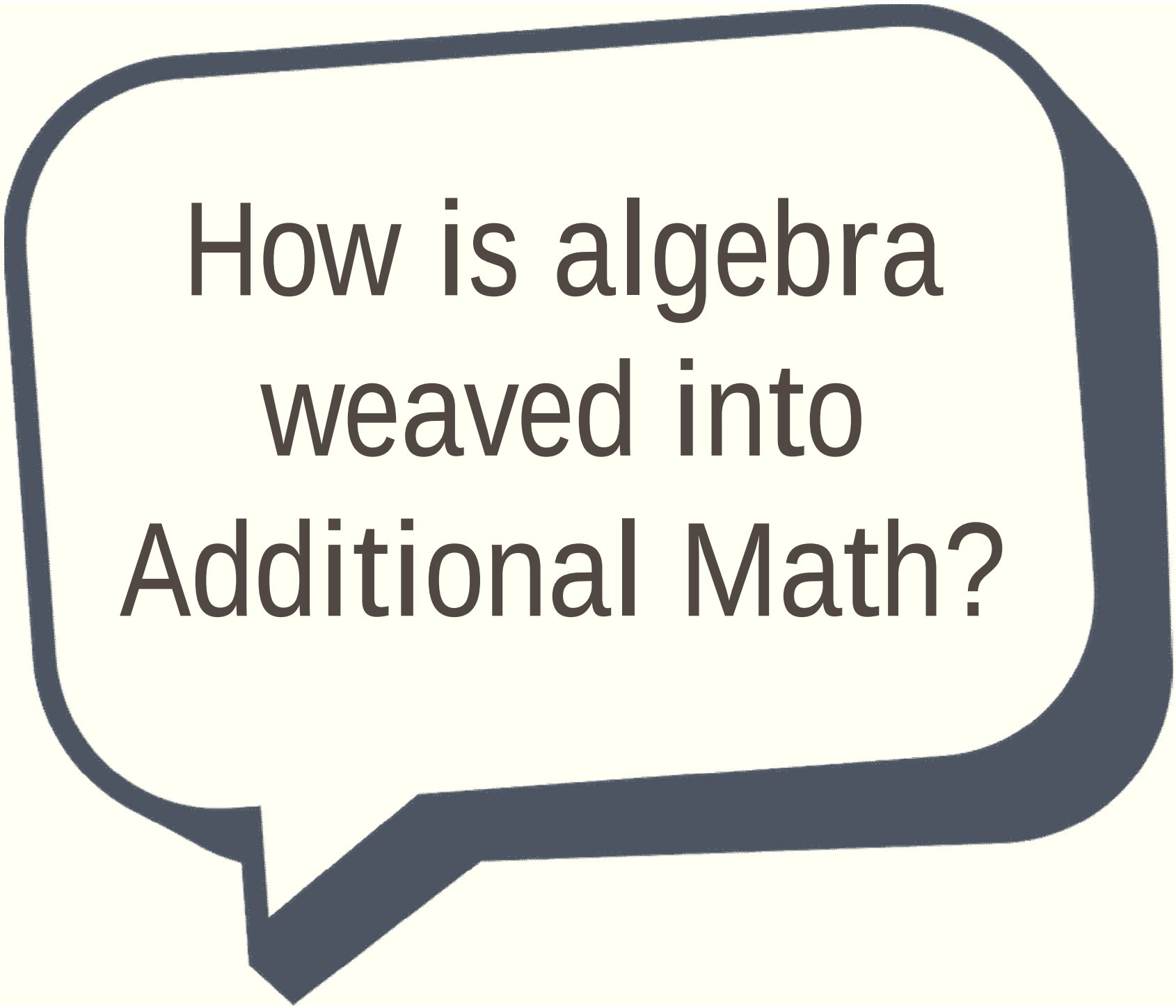
Pre-requisites of Additional Math Topics

GEOMETRY	
Trigonometric Functions, Identities & Equations	Secondary 1 Topics: • Basic Algebra and Algebraic Manipulation • Linear Equations and Simple Inequalities Secondary 2 Topics: • Trigonometric Ratios • Pythagoras Theorem
Coordinate Geometry in Two Dimensions	Secondary 2 Topic: • Linear Graphs
Proofs in Plane Geometry	Secondary 1 Topics: • Basic Geometry • Triangles, Quadrilaterals and Polygons

Pre-requisites of Additional Math Topics

CALCULUS

Differentiation and Integration	Secondary 1 Topics: • Basic Algebra and Algebraic Manipulation Secondary 2 Topics: • Expansion and Factorisation of Quadratic Expressions • Further Expansion and Factorisation of Algebraic Expressions • Algebraic Fractions and Formulae


How is algebra weaved into Additional Math?

Example of Algebra Questions in Lower Sec Math, Sec 3 Math vs Additional Math

- **In Secondary 2...**

Simplify

1. $x^3 \times x^2$

2. $\dfrac{y^8}{y^3}$

- **In Secondary 3 Math...**

Simplify $\dfrac{6a^4}{a^{-5}b} \times \dfrac{(-a^{-3}b)^2}{2\sqrt{b}}$, expressing your answer in the form ka^mb^n

- **In Secondary 3 Add Math...**

Simplify $\dfrac{16^{x+1} + 48(4^{2x})}{2^{x+3} \times 8^{x+2}}$.

Example of a Trigonometry question that requires Algebraic Manipulation to prove Identities

- **In Secondary 3 Add Math...**

Show that $\sin 2x(5\tan x + 2\cot x) = 4 + 6\sin^2 x$.

$$\sin 2x(5\tan x + 2\cot x) = \sin 2x(5\tan x + 2\cot x)$$

$$= 2\sin x \cos x\left(5\frac{\sin x}{\cos x} + 2\frac{\cos x}{\sin x}\right)$$

$$= 2\sin x \cos x\left(\frac{5\sin^2 x + 2\cos^2 x}{\cos x \sin x}\right)$$

$$= 10\sin^2 x + 4\cos^2 x$$

$$= 10\sin^2 x + 4(1 - \sin^2 x)$$

$$= 4 + 6\sin^2 x \text{ (shown)}$$

Example of a Calculus question that requires Algebraic Manipulation to solve

(a) Find $\frac{d}{dx}(x^4 \ln x)$.

(b) Hence, find $\int x^3 \ln x \ dx$.

(a)

$$\frac{d}{dx}(x^4 \ln x) = x^4\left[\frac{1}{x}\right] + \ln x\left[4x^3\right]$$

$$= x^3 + 4x^3 \ln x$$

(b)

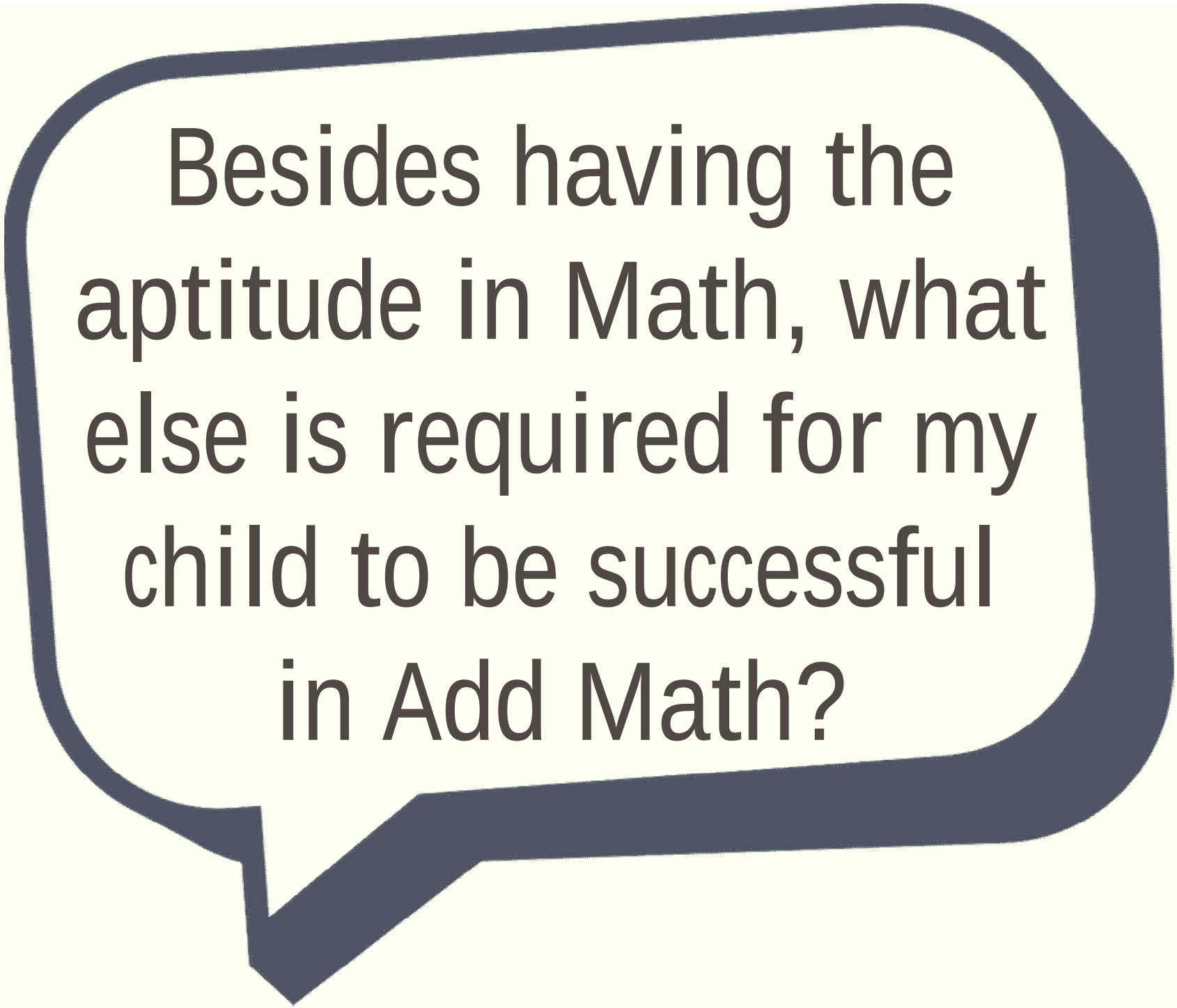
$$\int (x^3 + 4x^3 \ln x)dx = x^4 \ln x + c$$

$$\int x^3 dx + \int (4x^3 \ln x)dx = x^4 \ln x + c$$

$$\left[\frac{x^4}{4}\right] + 4\int (x^3 \ln x)dx = x^4 \ln x + C$$

$$4\int (x^3 \ln x)dx = x^4 \ln x - \left[\frac{x^4}{4}\right] + C$$

$$\int (x^3 \ln x)dx = \frac{1}{4}x^4 \ln x - \frac{x^4}{16} + C$$


Besides having the aptitude in Math, what else is required for my child to be successful in Add Math?

FROM Aspiration TO Action

Diligent

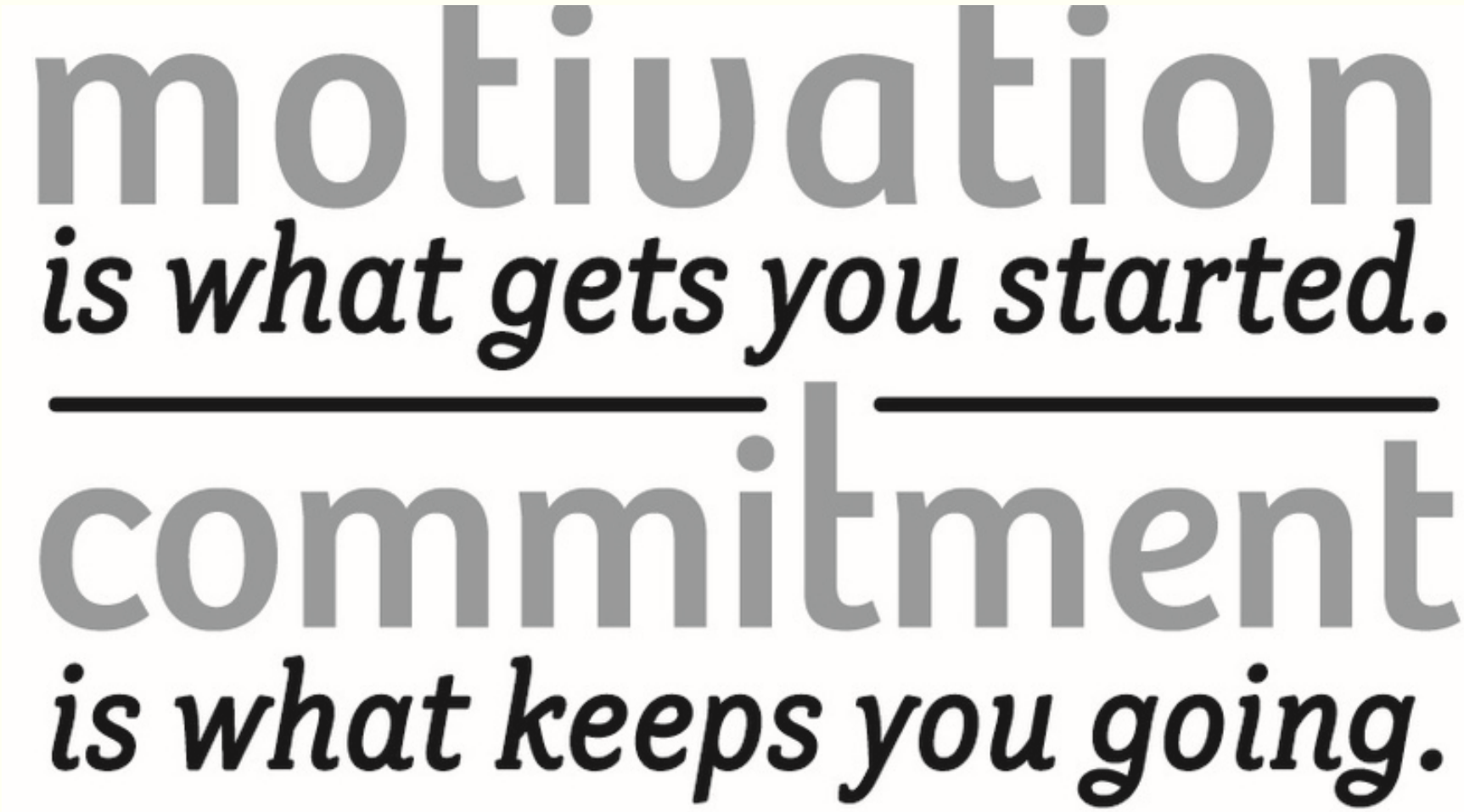
adjective dil - i - gent

characterized by steady, earnest and energetic effort

Attentive

INDEPENDENT

self discipline


motivation
is what gets you started.
commitment
is what keeps you going.

SECONDARY 3 NORMAL ACADEMIC STUDENTS OFFERING ADDITIONAL MATHEMATICS & O LEVEL MATHEMATICS

Normal Academic students being offered O Level Math