HSC Stage 6 2026 Mathematics Advanced Syllabus Comments

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September 19, 2024

This is a document containing my observations, notes and opinions regarding the HSC Mathematics Advanced syllabus for implementation in 2026.

I have attempted to be impartial in the main dotpoints listed and placed my (sometimes critical) opinions in the footnotes.

1 Year 11 Mathematics Advanced

1.1 Working with functions

1.1.1 Algebraic techniques

- There is now more detail and clarity in the Algebraic Techniques subsection in comparison to the 2017 syllabus, drawing attention to specific skills in the topics of index laws, algebraic expressions, surds and quadratics.

- In comparison to the draft document, the 2026 syllabus corrected a technicality. One can only rationalise the denominators of expressions of the form $\frac{a}{\sqrt{b}\pm\sqrt{c}}$ or $\frac{\sqrt{a}\pm\sqrt{d}}{\sqrt{b}\pm\sqrt{c}}$ where $a, b, c, d \in \mathbb{Q}_{>0}$ (as opposed to $\mathbb{R}$ which was in the draft). This is an important distinction to make since one cannot actually rationalise the denominator of, for example, the expression $\frac{1}{\sqrt{\pi}+1}$.

- Suppose that $\sqrt{a}$ and $\sqrt{b}$ are not rational. Depending on which ground field is extended, $\mathbb{Q}$ or $\mathbb{Q}(\sqrt{a})$[1] or $\mathbb{Q}(\sqrt{b})$, the conjugates of $\sqrt{a} \pm \sqrt{b}$ are either $\{\sqrt{a}+\sqrt{b}, \sqrt{a}-\sqrt{b}, -\sqrt{a}+\sqrt{b}, -\sqrt{a}-\sqrt{b}\}$ or $\{\sqrt{a}+\sqrt{b}, \sqrt{a}-\sqrt{b}\}$ or $\{\sqrt{a}+\sqrt{b}, -\sqrt{a}+\sqrt{b}\}$ respectively. So identifying *the* conjugate of $\sqrt{a} \pm \sqrt{b}$ does not make sense unless working in $\mathbb{Q}(\sqrt{a})$ or $\mathbb{Q}(\sqrt{b})$. Reading in context, the syllabus probably means the latter scenario.

- The use of the discriminant to identify whether roots of a quadratic equation are rational or not is a new addition to the syllabus: if the discriminant is a perfect square (in $\mathbb{Q}$) then the roots are rational.

[1] $\mathbb{Q}(\sqrt{a})$ means the field formed by adjoining the element $\sqrt{a}$ to $\mathbb{Q}$.

1.1.2 Introduction to functions and relations

- There is a set theoretical focus in defining relations and functions. However, the content outcomes related to sets is placed in the Probability and Data section[2]. Teachers will need to sequence their units of work to include the content outcomes related to sets from Probability and Data.

- Identifying relations as (one/many)-to-(one/many) is no longer in the course.

- The syllabus now defines a real function f of a real variable x as a relation where each element of a given set is associated with exactly one element of the second set, but fails to mention that the sets involved must be subsets of the real numbers. This is a clear oversight.

- One of the content outcomes states "Define the domain of a function f as the set of real numbers on which f is defined". It should be noted that this is in the context of a *real* function f of a real variable, and not in the general case of all functions.

  Furthermore, it should be noted that the domain of a function f is the first given set in the definition given. This fact was present in the draft document but has now been omitted.

- No mention of the second set's name as the co-domain.[3]

1.1.3 Specific functions

- A lot of these subsections should be revision on work in Stage 5 Path outcomes.

- Quadratic identities are now in the 2026 syllabus, i.e. "Use the fact that two quadratic functions are equal for all values of x if and only if the corresponding coefficients are equal to solve related problems". The example given in the syllabus is: Find the values of a, b and c if the quadratic functions $f(x) = x^2 - x$ and $f(x) = a(x+3)^2 + bx + c - 1$ have the same graph.

- Solving quadratic inequalities has been moved from Year 11 Extension 1/Year 12 Advanced to Year 11 Advanced. The method is up to teacher's discretion.

- Piecewise-defined functions have their own dedicated subsection. It was missing in the 2017 syllabus.

- The syllabus informally defines continuity at a point as a curve that can be drawn through the point without lifting the pen off the paper.

  Formal definitions will of course be deferred to university tertiary mathematics courses.

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[2] In my opinion, placing the introduction to set theory in Probability and Data is akin to the 2017 syllabus placing Series and Sequences under the title of Financial Mathematics. Set Theory is a foundational mathematical concept, not something that arises only in Probability and Data.

[3] This is still considered too esoteric for Mathematics Advanced.

Contrast this pen and paper definition of continuity at a point with the draft document's: "Define continuity at a point informally, where a function $f(x)$ is continuous at the point $x = a$ and when a sufficiently small change in x above or below a produces an arbitrarily small change in $f(x)$ above or below $f(a)$."[4]

Furthermore, it should be noted that these new content outcomes do not require the classification of functions as continuous or discontinuous - only the continuity at *points*.

- Perpendicular distance of a point to a line formula $d = \dfrac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$ is in the teaching considerations but is labeled as inessential content.[5]

1.2 Trigonometry and measure of angles

1.2.1 Trigonometry with angles of any magnitude

- The circle definitions of trigonometric functions have been generalised to circles of any radius, and sequenced before the cosine rule, sine rule, area of a triangle formula.

1.2.2 Radians

- The definition of radian measure is now officially in the syllabus as the ratio of arc length to radius of a circle. This was a missing detail in the previous syllabuses including the draft document.
- Problems involving arc lengths and areas specifically include both cases of major and minor sectors and segments.
- The teaching considerations call for careful attention to the notation of angles in degrees or in radians. The example given highlights the difference between $\sin 3$ versus $\sin 3°$.

1.3 Trigonometric identities and equations

- The main focus at the start of this section is on the reciprocal trigonometric functions but their graphs are to be covered in Extension I under the Further work with functions topic.

[4] For a curriculum that the Education Minister describes as rigorous, the informal definition of continuity involving the words 'pen' and 'paper' does not support that sentiment but of course a balance must be found between over-simplification with informalities and technically incorrect definitions versus over-the-top rigour for the secondary schooling level. I would personally prefer the draft version.

[5] I am slightly concerned about the labelling of content as inessential. Will examiners assess inessential content since it appears in the syllabus? If it is inessential content, why is it in the teaching considerations?

- The note on the identities $\sec A = \frac{1}{\cos A}$, $\operatorname{cosec} A = \frac{1}{\sin A}$ and $\cot A = \frac{1}{\tan A}$ to identify the angles to be excluded is an important addition to the syllabus. Take for example, $\cot 90°$ which has the value 0, but $\frac{1}{\tan 90°}$ is undefined.

- Language made clearer and examples are given to provide an idea of the depth of the use of trigonometric identities. Content-wise, largely unchanged from the 2017 syllabus.

1.4 Introduction to differentiation

- Limit calculations were placed into the draft syllabus documents but the 2026 final versions have removed them once again. There is no definition of the concept yet limits are referenced by other content outcomes in the syllabus.[6]

- A classically Physics approach to introducing differentiation occupies the Estimating Change section by starting with distance and speed-time graph considerations.[7]

- The use of Δ notation to denote change (already in science courses) is now in the Mathematics syllabuses. This motivates the notation $\dfrac{dy}{dx}$ as $\lim\limits_{\Delta x \to 0} \dfrac{\Delta y}{\Delta x}$.

- Using first principles to find the derivative of functions restricted to quadratic functions in this section. In the 2017 syllabus and draft document, it was up to cubic. In the teaching considerations, x^3, $\sqrt{x}$ and $\frac{1}{x}$ are listed as beneficial questions to extend students' understanding, but is labeled as inessential content.

- $m = \tan\theta$ was originally removed in the draft but is retained in the final version.

- Classification of points on a function as differentiable or not has been moved from Year 11 content to the Year 12 Applications of calculus section, but the syllabus references 'differentiable functions' without definition of what they are in some Year 11 content dotpoints. When checking the teaching considerations, there is a note that sometimes $f'(x)$ fails to exist even for continuous functions such as $x^{\frac{1}{3}}$ at $x = 0$ or $y = |x|$ at $x = 0$ so some discussion about differentiability at a point can still occur in the classroom at this stage.

- No need to consider acceleration as a derivative in this introductory section on the derivative as a rate of change - only displacement and velocity. In the 2017 syllabus we had to consider acceleration.

- Explicit mention of distinguishing between displacement and distance, velocity and speed - this must be done outside of the context of vectors for a Year 11 Advanced audience.

[6] I'm not sure why this decision was made to remove limit calculations. Given the syllabus is happy to define concepts informally, an informal definition of a limit would have been sufficient.

[7] I am not opposed to this approach and can appreciate the pedagogical value of starting with real-world experiences to make differential calculus immediately applicable.

1.5 Exponential and logarithmic functions

- The 2026 syllabus uses calculus to quickly motivate Euler's number e but it should be noted that the discovery of the constant is due to Jacob Bernoulli in 1683 for solving the problem of continuous compound interest, i.e. $e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$.
- The sequencing of dotpoints has moved the introduction of Euler's number to the start, and reduced the number of subsections from four down to two. As a result, this section is a lot more concise than the 2017 syllabus.
- The example given on logarithmic equations suggests that domain considerations are important: Consider the equation $\log_2 x + \log_2(x-3) - \log_2(x+2) = 2$, which has the domain $x > 3$ and has only one solution, but $\log_2\left(\frac{x(x-3)}{x+2}\right) = 2$ has two solutions. The use of digital tools is encouraged to develop this understanding.

1.6 Graph transformations

- All graphical transformations from the 2017 syllabus, i.e. reflections in the axes (Year 11 in 2017 syllabus), horizontal and vertical dilations, translations (Year 12 in 2017 syllabus), are now consolidated into this one section in Year 11.
- The example for recognising that the order in which individual transformations are applied to functions is important seems to be a mistake. Currently it says "Recognise that $y = 3f(2x+8)$ represents a horizontal stretch with a factor of $\frac{1}{2}$; a shift left of 4 units; a vertical stretch with factor 3. Alternatively: a vertical stretch with factor 3; horizontal stretch with factor $\frac{1}{2}$; a shift left of 4 units."

  As it currently stands, keeping the order of the horizontal transformations unchanged and moving the vertical transformation from last to first fails to elucidate why the order is important. It should perhaps read: "Recognise that $y = 3f(2x+8)$ represents a horizontal stretch with a factor of $\frac{1}{2}$; a shift left of 4 units; a vertical stretch with factor 3. Alternatively: a shift left of 8 units; horizontal stretch with factor $\frac{1}{2}$; a shift left of 4 units; a vertical stretch with factor 3."
- Explicit exclusion of trigonometric functions. This is left for Year 12.

1.7 Probability and data

- A sufficiently detailed treatment of set theory is given here.[8]

[8] I believe this should be moved further up and placed in the Working with functions section. Teachers will have to sequence their teaching to include this section on sets anyway to cater to the set-theoretical framework of relations and functions. Many textbooks in Mathematics after high school start with a treatment on set theory as their first chapter. The relative complement notation $A\backslash B$ to denote the set of elements that are in A but not in B would have been useful to

- There is very little in the teaching considerations for this section on Probability and data.
- Very small part on random variables. Proper details moved to Year 12.[9]
- The subsection on Data has reintroduced graphing frequency, relative frequency, cumulative frequency histograms and polygons where it was not in the draft syllabus. The Engagement Report on page 12 rationalises this inclusion to ensure alignment with Stage 5.[10]

2 Year 12 Advanced

2.1 Further graph transformations and modelling

- Transformations of trigonometric functions with reflections, translations and dilations are now considered here in Year 12.
- Using logarithms to model practical problems has been moved from the Year 11 Exponentials and logarithms section to here in Year 12 Modelling with functions. This part of the syllabus is applications focused.

2.2 Sequences and series

- Sequences and series now appropriately divorced from the topic of Financial Mathematics.
- Summation notation $\sum$ has returned from Extension II to Mathematics Advanced.
- Although used to define arithmetic and geometric sequences, "recurrence relations" are not mentioned in the Mathematics Advanced syllabus, but are in Mathematics Extension II Further integration section.
- The term "partial sum" is to be used.
- The general factorisation of $x^n - 1$ to $(x-1)(x^{n-1} + x^{n-2} + \ldots + x^2 + x + 1)$ is now included. This has implications for the Extension II syllabus when working with complex roots.
- Teaching considerations include a small part on using neither arithmetic nor geometric sequences to help students develop an understanding of sequences.

include.

[9] I do not understand the skeletal treatment of random variables here to the point of superficial lip service. Why not just teach it properly in its entirety later in year 12.

[10] These dotpoints read like an afterthought compared with the other parts of the syllabus, keeping elementary Stage 4-5 statistics concepts while bivariate data and regression are removed.

2.3 Differential Calculus

- This section brings in the derivatives of exponential, logarithmic and trigonometric functions to be used with product, quotient and chain rule.

2.4 Integral Calculus

- This section encourages the narrative of first introducing primitives, in the absence of using the terms "integral", "integration", "integrate" or the $\int$ notation, followed by the theory of definite integrals to motivate the notation $\int_a^b f(x)dx = \lim_{\Delta x \to 0} \sum_a^b f(x)\Delta x$ before reaching the Fundamental Theorem of Calculus to connect primitives with integration.

  Contrast this approach with that of the 2017 syllabus which begins with using the indefinite integral $\int f(x)dx$ notation for primitives without any motivation for why that notation is sensible. The 2026 syllabus narrative is an improvement.

- The (First) Fundamental Theorem of Calculus states that $\frac{d}{dx}\int_a^x f(t)dt = f(x)$. This has been demoted from content dotpoint in the 2017 syllabus to a teaching consideration and labeled inessential content in the 2026 syllabus. What's been given in the syllabus as the Fundamental Theorem of Calculus is a corollary of this main theorem.

- All of the integration rules including their reverse chain rule forms are now in one section in the syllabus as opposed to spread out across separate exponential, logarithmic and trigonometric sections.

- Area problems bounded by the y-axis (not just x-axis) are now explicitly prescribed by the syllabus. Previously, teachers were unsure if it was assessable.

- The reflective property of logarithms and exponentials to calculate areas now explicitly in the syllabus.

- The graphic in the teaching considerations is not a vector graphic and needs to be upgraded to one by NESA.

2.5 Applications of calculus

- Classification of differentiability at a point is now introduced as a content dotpoint here.

- Classic stationary point, max/min, and concavity calculations to sketch curves in this section.

- Rates of change problems considered here including growth and decay problems as well as displacement, velocity and *acceleration* in motion problems. Acceleration was not considered in the introductory parts of the Year 11 course on differential calculus, but now makes its appearance in Year 12.

- Teaching considerations include an interesting idea for exploration using integral calculus on Lorenz curves and the Gini Coefficient, and an example question on this is given with the Integral calculus (previous section) examples.

2.6 Random Variables

- Both discrete and continuous random variables theory to be taught in Year 12.
- Calculations of expected value and variance for continuous random variables now included in the Mathematics Advanced course.

$$\mathrm{E}(X) = \int_a^b xf(x)\,dx$$

- Existing concepts in 2017 syllabus unchanged: expected value, variance, median and mode calculations, normal distribution.
- Normal distribution to use $X \sim N(\mu, \sigma^2)$ notation.

2.7 Financial Mathematics

- Reducing balance loans and annuities given their own section.
- No more table of interest factors as common content with Mathematics Standard has been removed.
- No more mention of recurrence relations to model annuities but is implied.