HSC Stage 6 2026 Mathematics Extension I Syllabus Comments

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This is a document containing my observations, notes and opinions regarding the HSC Mathematics Extension I 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 Extension I

1.1 Further work with functions

- The new syllabus has removed the $y = \sqrt{f(x)}$, $y^2 = f(x)$ transformations and also removed multiplication of ordinates $y = f(x)g(x)$. The remaining transformations are $y = f(x) \pm g(x)$, $y = \frac{1}{f(x)}$, $y = f(|x|)$ and $y = |f(x)|$.
- Graphs of $\sec x$, $\operatorname{cosec} x$ and $\cot x$ considered in this section.
- Extra clarity given on the teaching of Inverse Functions.
- Teaching considerations highlight the need to consider restrictions on functions and relations defined parametrically, by considering the domain and range of each parametric equation.
- Inequalities involving factorised cubics, unknown on denominator of rational expressions and absolute values are still in the course. There is now an extra note to use algebraic and graphical methods, as well as a *geometric* understanding of absolute values as distance, to solve absolute value inequalities.

1.2 Polynomials

- The technical definition of polynomials is now changed from that of an algebraic expression to a polynomial function.[1]

[1] The only problem I see with this change is for students pursuing further education in tertiary Mathematics where polynomials (agnostic of domain and range) and functions defined by polynomials are not the same.

- While roots of multiplicity is defined in Year 11, the use of differential calculus to study roots of multiplicity has been moved to Year 12.[2]
- Vieta's formulas explicitly given in the syllabus now for sums and products of roots of polynomials up to degree 4.

1.3 Further trigonometry

- The sequencing of trigonometry concepts is significantly changed.
- Inverse trigonometry is now in Year 12.
- 3D trigonometry moved from Mathematics Advanced to Mathematics Extension I. The Engagement Report states that this is to group all 3D concepts together into the Extension I course.
- t-results moved to Extension II under Further Integration.
- Trigonometric products as sums and differences moved to Extension II under Further Integration.
- $a\cos x + b\sin x = R\cos(x \pm \alpha)$ or $R\sin(x \pm \alpha)$ moved from Year 12 to Year 11.

1.4 Permutations and combinations

- Working with combinatorics topic now separated into "Permutations and Combinations" and "Binomial Theorem".
- Pigeonhole principle removed.[3]
- This section has been expanded with more clarity and prescription of concepts.

1.5 The binomial theorem

- This section is much more expanded and clear. Removed vague language such as 'simple' and 'small'.
- Proof of general identities by equating coefficients or substituting values, and applications of these, are back in the syllabus.[4]
- Using differential and integral calculus on binomial expansions to prove identities is labeled as beneficial extension content for students to learn but is inessential.
- Teaching considerations advise that greatest coefficient problems are not within the scope of the syllabus.

[2]This makes sequential sense when most school programs have not yet covered differential calculus in Mathematics Advanced concurrently with the Polynomials topic.

[3]Some pigeonhole principle questions could get into competition territory. Removing it from the syllabus and leaving it for competitions is appropriate.

[4]Question 14 of the 2020 paper is now fair in the 2026 syllabus and a repeat of a question like this falls clearly under an appropriate dotpoint.

2 Year 12 Mathematics Extension I

2.1 Proof by mathematical induction

- More clarity in the 2026 syllabus, with examples moved out of the dotpoint statement and into an Examples drop down.
- Teaching considerations suggest that appropriate conclusions to each critical step of an induction proof should be given.[5]

2.2 Introduction to vectors

- 3D vectors moved from Extension II to Extension I.
- More clarity provided in the 2026 syllabus compared to the 2017 syllabus.
- Definition of the zero vector now in the syllabus.
- Definition of a scalar now in the syllabus. It is a real number that is used to multiply (scale) a vector.[6]
- There is a mistake in the syllabus about $\begin{pmatrix} a \\ -b \end{pmatrix}$ and $\begin{pmatrix} -a \\ b \end{pmatrix}$ being perpendicular to $\begin{pmatrix} a \\ b \end{pmatrix}$. The intended statement should be:

  "Identify $\begin{pmatrix} a \\ -b \end{pmatrix}$ and $\begin{pmatrix} -a \\ b \end{pmatrix}$ as vectors perpendicular to $\begin{pmatrix} b \\ a \end{pmatrix}$ and with equal magnitude."
- Unit vector hat notation $\hat{\mathbf{a}} = \frac{1}{|\mathbf{a}|}\mathbf{a}$ to be used.
- Many more prescribed vector facts to be taught as part of the syllabus.
- Vector projections clarified further, including the use of the notation $\text{proj}_{\mathbf{b}}\,\mathbf{a}$ and associated formulas, including perpendicular components.
- 2D motion and projectile motion concepts, using vectors, is retained in the 2026 syllabus. The types of considerations are more prescribed in comparison to the 2017 syllabus. For example, features of projectile motion such as time of flight, maximum height, range, instantaneous velocity and impact velocity are explicitly mentioned now. The Cartesian equation of the projectile's path also has its own dedicated dotpoint.

[5] However, this does not imply that the last conclusive statement to an induction proof should carry any marks in assessment. The consensus seems to be that HSC markers don't award (or remove) marks for it.

[6] This is an essential addition to the syllabus. Misconceptions about scalars being non-directional versions of their vector counterparts is rife.

2.3 Inverse trigonometric functions

- Inverse trigonometric functions moved from Year 11 to Year 12.
- The 2026 syllabus sections inverse trigonometric functions into a definitions focused subsection and graphs focused subsection.
- Previously, a single dotpoint on graphs of trigonometric functions has now been expanded into many dotpoints and its own subsection in the 2026 syllabus. Notably, including graphical transformations of reflections, dilations and translations.
- Graphs of the zigzag functions such as $y = \sin^{-1}(\sin(x))$ as well as the restricted diagonal functions such as $y = \sin\left(\sin^{-1}(x)\right)$ are explicitly mentioned now.

2.4 Further calculus skills

- In the 2017 syllabus, this section started with integration skills. Now, it is split into the two subsections of further derivatives of functions and techniques of integration.
- Finding the derivative of a function defined parametrically using the chain rule is now explicitly a Year 12 Extension I concept.[7]
- Derivatives of inverse functions and problems associated with them now made more clear, with the formula for the derivative of $f^{-1}(x)$ provided.
- Derivatives of inverse trigonometric functions found here now.
- Integral techniques largely unchanged.

2.5 Further applications of calculus

- Differential calculus to study roots of multiplicity moved to this section in Year 12.
- Related rates of change moved from Year 11 to Year 12 here.
- Newtown's law of cooling also moved from Year 11 to Year 12 here.
- Definition and identification of the order of a differential equation now in syllabus.
- The term "initial value problem" now in syllabus.
- The logistic model explicitly stated in the form $\frac{dP}{dt} = kP\left(1 - \frac{P}{C}\right)$.

[7] Previously, I taught this as part of the Mathematics Advanced course. This is now an explicit dotpoint in Year 12 Extension I.

2.6 The binomial distribution and sampling distribution of the mean

- This section represents the most significant change in the syllabus and will require many educators to revise or seek professional development in, regarding the Central Limit Theorem.
- The notation $X \sim \text{Bin}(n, p)$ to be used for binomial distributions. Corresponding notation for Bernoulli distribution is given in the teaching considerations as $X \sim \text{Bernoulli}(p)$.
- The 2026 syllabus explicitly denies the use of normal approximation to the binomial distribution in favour of using computational tools:

  "Solve practical problems involving binomial distributions and binomial probabilities with and without online computational applications, excluding the normal approximation to the binomial distribution".

  The teaching considerations states: "Binomial distributions can be approximated by the normal distribution; however, the use of computational applications has made this process unnecessary as these applications can work with large numbers of trials."

  As a result, students should purchase the Casio FX-8200AU calculator to perform these calculations in examinations.[8]
- Normal approximations to sample proportions is gone, but replaced with Central Limit Theorem. Teachers need to do their own due diligence with this concept.

[8]This poses a potential equity issue. The review of these calculators is mixed with some users, myself included, that the user interface is inferior to that of the Casio FX-82AU or Casio FX-100AU. Purchasing two models of calculators may become a reality for some students, and potentially some questions are out of reach if they do not own the FX-8200AU.