» Mathematics Program Summary | **Prelim Extension 1 Course**

» TOPIC 3: **TRIGONOMETRY EXPANSIONS**

Write down basic identities	
Prove the expansion formulae	
Use formulae in 'both directions'	
Prove the double-angle results	

» TOPIC 9: **CIRCLE GEOMETRY**

Understand and use definitions	
Prove circle properties:	
› Equal angles at the centre stand on equal chords	
› Perpendicular from the centre to a chord bisects the chord	
› Equal chords in equal circles are equidistant from the centres	
› Any 3 non-collinear points lie on a unique circle whose centre is the point of intersection between the perpendicular bisectors of the intervals joining pairs of non-collinear points	
› Angle at the centre is twice the angle at the circumference subtended by the same or equal arcs	
› Angles at the circumference in the same segment are equal	
› Angle in a semi-circle is a right angle	
› Opposite angles of a cyclic quadrilateral are supplementary (this is also a sufficiency condition for a cyclic quadrilateral)	
› Exterior angle of a cyclic quadrilateral equals the interior opposite angle (this is also a sufficiency condition for a cyclic quadrilateral)	
› If an interval subtends equal angles at 2 points on the same side of it, then the endpoints of the interval and the 2 points are concyclic	
› If the product of intercepts on intersecting chords are equal, then the ends of the interval are concyclic	
› The angle between a tangent and a chord through the point of contact is equal to the angle in the alternate segment	
› Tangents to a circle from an external point are equal	
› When circles touch, the line of centres passes through their point of contact	
› The line joining the centres of two intersecting circles is the perpendicular bisector of their common chord	
› The products of intercepts on intersecting chords/secants are equal	
› The square of the length of the tangent from an external point is equal to the product of the intercepts on the secant	

» TOPIC 10: **FURTHER TRIGONOMETRY**

Solve simple linear equations	
Find the values of trigonometric expressions expressed as surds by use of trigonometric expansions	
Find the acute angle between two lines	
State the sine and cosine rule	

» TOPIC 11: **POLYNOMIALS**

Define the following terms:	
Polynomial of degree n	
Coefficients of polynomials	
Monic polynomials	
Zeroes of polynomials	
Graph polynomials (linear, quadratic, cubic, quartic)	
Know the significance of multiple roots of a polynomial	
Prove that $P(x) = (x - a)^2 Q(x)$ is tangent to the x-axis at $x = a$	
Graph rational functions	
Discuss natural domain	
Prove and use the Remainder Theorem	
Prove and use the Factor Theorem	
Solve and graph polynomial equations	
Deduce properties of polynomials from the factor theorem	
Consider a polynomial as a product of linear and quadratic factors	
Construct a polynomial from a given set of data	
Recognise the relationship between roots and coefficients for quadratic, cubic and quartic polynomials	

» TOPIC 12: **TRIGONOMETRIC EQUATIONS & IDENTITIES**

Prove the double-angle results	
Prove the triple-angle results	
Know and use the t-results	
Eliminate parameters for simple cases	
Derive and use the general solution	
Solve equations involving sin and cos by rewriting in terms of tan	
Solve quadratic equations involving one trigonometric function	
Solving equations that require the use of trigonometric identities	
Use the auxiliary angle to rewrite trigonometric expressions	
Solve equations by using the auxiliary angle method or t method	

» TOPIC 13: **ARRANGEMENTS (PERMUTATIONS & COMBINATIONS)**

Determine the number of arrangements:	
› Of unlike elements in a line	
› Of unlike elements in a line involving special conditions	
› Of unlike elements in a line involving groups	
› That involve complementary events	
› Of unlike elements in a circle	
› Of objects some of which must be separated	
› Of objects some of which are alike	
Use the nPr and nCr results	

» TOPICS 15: **GEOMETRY OF THE PARABOLA (PARAMETRICS)**

Convert parametric equations to a Cartesian equation	
Find the gradient of a curve for curves given in parametric form	
Find the equation of a tangent/normal to a curve given in parametric form	
Write down the parametric co-ordinates of a point on a standard parabola	
Derive the equation of:	
› The chord	
› The tangent to a parabola (given parametric co-ordinates)	
› The normal to a parabola	
› The tangent to a parabola (given Cartesian co-ordinates)	
› The chord of contact of tangents drawn from an external point	
Prove simple geometrical properties such as:	
› The tangent to a parabola at a given point is equally inclined to the axis and the focal chord through the point	
› The tangents at the extremities of a focal chord intersect at right angles on the directrix	
Solve exercises on simple geometrical properties	
Find the locus of a point where only one parameter is involved	
Find the locus where two parameters are involved and either one parameter becomes a constant or there is a relationship between the two parameters that allows one parameter to be eliminated	
Find the locus of a point that involves a restriction on the equation of the locus	

» TOPIC 16: **INEQUALITIES**

Graph inequalities on the number plane (including intersections and unions)	
Solve inequalities	
Define $a > b$ and $a < b$	
Understand the theorems on equalities	
Know the special rules for inequalities that only involve positive numbers	
Prove simple inequalities	

The Extension 1 course includes a lot of material from the 2U Mathematics course. Here is how the topics from each course relate to each other:

- ▶ **Topics 1-2** are 2U topics with some additional harder questions for 3U
- ▶ **Topics 4-8** and **topic 14** are reproduced from the 2U course
- ▶ **Topics 3, 9-13** and **15-16** are part of the 3U course only

Items with an asterisk (*) next to them are <u>not examinable</u>. Use this program summary together with the full program in order to make sure you understand all the prescribed knowledge and skills.