Pre-calculus syllabus: the ten units as a checklist, and what calculus will use

A traditional course is two-thirds Algebra 2 done deeper and one-third trigonometry done properly. The right-hand column is the honest answer to 'will calculus use this?': spend scarce time on the units marked ALWAYS.

Unit	Skills to tick	Calculus uses it	Weeks
1. Functions and their analysis	[ ] domain and range [ ] even and odd [ ] increasing, decreasing, extrema [ ] average rate of change [ ] transformations [ ] compositions and domains [ ] inverses [ ] piecewise	ALWAYS	3
2. Polynomial and rational functions	[ ] end behaviour, zeros, multiplicity [ ] remainder and factor theorems [ ] complex zeros [ ] vertical, horizontal, slant asymptotes, holes [ ] polynomial and rational inequalities	ALWAYS	4
3. Exponential and logarithmic	[ ] the families and transformations [ ] e and continuous growth [ ] laws of logs [ ] every equation type [ ] compound interest, half-life, Newton's cooling, logistic	ALWAYS	3
4. Trigonometric functions	[ ] radians, arc length, sector area [ ] unit circle from the special triangles [ ] six functions of any angle [ ] graphs: amplitude, period, phase, shift [ ] inverse trig and restricted domains	ALWAYS	4
5. Identities and equations	[ ] Pythagorean, reciprocal, quotient, cofunction, even-odd [ ] sum and difference [ ] double and half angle [ ] prove identities [ ] solve on an interval and in general	Pythagorean, double and half angle: ALWAYS	3-4
6. Applications of trigonometry	[ ] law of sines (ambiguous case), law of cosines [ ] area [ ] vectors, dot product [ ] polar coordinates and graphs [ ] complex numbers in polar form, De Moivre [ ] parametric equations	occasionally (BC, Calc 3, physics)	3-4
7. Conic sections	[ ] parabola, ellipse, hyperbola from equations [ ] completing the square to standard form	barely (the circle)	2
8. Sequences, series, binomial theorem	[ ] arithmetic and geometric [ ] sigma [ ] infinite geometric [ ] induction [ ] binomial theorem	occasionally (BC, Calc 2)	2
9. Matrices and systems	[ ] 3+ equation systems [ ] Gaussian elimination [ ] determinants, inverses [ ] partial fractions	barely	2
10. Introduction to limits	[ ] limits from graphs and tables [ ] limit laws [ ] one-sided [ ] at infinity [ ] continuity	ALWAYS: the first page of calculus	1-2

AP Precalculus (first exam May 2024)

AP unit	Covers	Share
1. Polynomial and rational	rates of change, zeros, end behaviour, asymptotes, modelling	30-40%
2. Exponential and logarithmic	sequences as functions, growth and decay, inverses, semi-log plots	27-40%
3. Trigonometric and polar	unit circle, sinusoids, tangent and reciprocals, inverse trig, equations, polar graphs	30-35%
4. Parameters, vectors, matrices	parametric and implicit functions, conics in parametric form, vectors, matrices	taught, not examined

The exam is three hours: 40 multiple-choice (28 without, 12 with a graphing calculator) and 4 free-response questions in a fixed form (function concepts; a non-periodic model; a periodic model; symbolic manipulation).

From sciencewithshobha.com/blog/pre-calculus-syllabus-every-unit-in-order-ap-precalculus-compared-what-calculus-will-use-and-where-students-lose-it/ ·

1-on-1 online maths, Grades 3 to 12, free 30-minute first class.

Where the course is lost, the readiness check, and CBSE Classes 11 and 12

Lost at	What goes wrong	The fix
The unit circle	48 memorised facts, gone by November	two special triangles and the symmetry of the circle: built in a minute from a sketch
Identities	twenty on a list	eight are enough (three Pythagorean forms, two quotient forms, sine and cosine of a sum, the double angle); derive the rest
The algebra underneath	an algebra slip in every third line hides whether the trig is understood	rational expressions, factoring and exponent laws checked first

Readiness check from Algebra 2 (no calculator)

1. $f(x) = x^2 + 1$, $g(x) = 2x - 3$: find $f(g(x))$.
2. Inverse of $f(x) = (x - 4)/3$.
3. How does $y = -2(x + 1)^2 + 5$ relate to $y = x^2$?
4. Zeros of $x^3 - 4x^2 + x + 6$, given 2 is one.
5. Asymptotes of $y = (3x + 1)/(x - 2)$.
6. Solve $5 \cdot 2^x = 80$.
7. $\log_3 81$ as a number; $\log a + 2 \log b$ as one log.
8. 150° in radians; $5\pi/4$ in degrees.
9. Exact $\sin 120°$ and $\cos(-\pi/3)$.
10. Simplify $(1 - \cos^2\theta)/\sin\theta$.
11. First four terms of $a_n = 3 \cdot 2^{(n-1)}$, and the sum of the first ten.
12. Solve $x + y + z = 6$, $x - y = 1$, $y + z = 4$.

Answers

1. $4x^2 - 12x + 10$. 2. $3x + 4$. 3. left 1, stretched by 2, reflected in the x-axis, up 5. 4. 2, 3, -1. 5. $x = 2$ and $y = 3$. 6. $x = 4$. 7. 4; $\log(ab^2)$. 8. $5\pi/6$; 225°. 9. $\sqrt{3}/2$; 1/2. 10. $\sin\theta$. 11. 3, 6, 12, 24; 3,069. 12. $x = 2$, $y = 1$, $z = 3$. Ten or more: ready. Seven to nine: ready, with the missed ones as warm-ups. Fewer than seven: four weeks on Algebra 2 functions, logarithms and the unit circle first.

Pre-calculus against CBSE

Unit	CBSE	The student from India is
Functions	Class 11, 12	ahead on definitions; behind on analysis from graphs and modelling
Polynomial, rational	Class 9, 10, 11	ahead on algebra; behind on graphing, asymptotes, inequalities
Exponential, log	Class 11 (limited)	behind on the functions and modelling
Trig functions, identities	Class 11	ahead, usually by a wide margin
Vectors, polar, complex	Class 11, 12	ahead on complex numbers and vectors; behind on polar and parametric
Conics; sequences; induction; matrices	Class 11, 12	ahead or level
Limits	Class 11	ahead

For AP Precalculus the first term should go to the modelling questions and the free-response form: reading a function from a table or graph, choosing a model, interpreting a rate of change in a sentence.