



Precalculus Syllabus

Textbook

Advanced Math: An Incremental Development (Saxon)

Materials

Advanced Math textbook

Homeschool Packet: Form A Tests, Answers to Problem Sets and Form A Tests

Schedule of Assignments

As an independent study student, you can complete this course at your own pace. Some students benefit from doing every single problem in the problem sets while others prefer to do all the even numbered problems, and then go back and do the odd numbered problems for skills that need extra practice. By checking your answers after each problem set, you can gauge how well you are grasping the material and adjust your work load accordingly.

There is a proposed schedule of assignments on the back that will help you move through the course in 31 weeks. Feel free to adjust this schedule to suit your needs and learning style.

We wish you a challenging and successful year of Precalculus!

Precalculus Assignment Sheet

Lesson	Problem Sets	Tests
1	1–4	1
2	5–8	2
3	9–12	3
4	13–16	4
5	17–20	5
6	21–24	6
7	25–28	7
8	29–32	8
9	33–36	9
10	37–40	10
11	41–44	11
12	45–48	12
13	49–52	13
14	53–56	14
15	57–60	15
16	61–64	16
17	65–68	17
18	69–72	18
19	73–76	19
20	77–80	20
21	81–84	21
22	85–88	22
23	89–92	23
24	93–96	24
25	97–100	25
26	101–104	26
27	105–108	27
28	109–112	28
29	113–116	29
30	117–120	30
31	121–125	31

Advanced Mathematics

An Incremental Development

Second Edition

John H. Saxon, Jr.

Contents

	Preface	xi
Lesson 1	Geometry Review	1
Lesson 2	More on Area • Cylinders and Prisms • Cones and Pyramids • Spheres	14
Lesson 3	Pythagorean Theorem • Triangle Inequalities (1) • Similar Polygons • Similar Triangles	26
Lesson 4	Construction	36
Lesson 5	Exponents and Radicals • Complex Numbers • Areas of Similar Geometric Figures • Diagonals of Rectangular Solids	43
Lesson 6	Fractional Equations • Radical Equations • Systems of Three Linear Equations	49
Lesson 7	Inductive and Deductive Reasoning • Logic • The Contrapositive • Converse and Inverse	54
Lesson 8	Statements of Similarity • Proportional Segments • Angle Bisectors and Side Ratios	61
Lesson 9	Congruent Figures • Proof Outlines	67
Lesson 10	Equation of a Line • Rational Denominators • Completing the Square	74
Lesson 11	Circles • Properties of Circles • The Quadratic Formula	83
Lesson 12	Angles and Diagonals in Polygons • Proof of the Chord-Tangent Theorem	90
Lesson 13	Intersecting Secants • Intersecting Secants and Tangents • Products of Chord Segments • Products of Secant and Tangent Segments	97
esson 14	Sine, Cosine, and Tangent • Angles of Elevation and Depression • Rectangular and Polar Coordinates • Coordinate Conversion	108
esson 15	Assumptions • Proofs	115
esson 16	Complex Fractions • Abstract Equations • Division of Polynomials	122
esson 17	Proofs of the Pythagorean Theorem • Proofs of Similarity	127
esson 18	Advanced Word Problems	133

vi Contents

Lesson 19	Nonlinear Systems • Factoring Exponentials • Sum and Difference of Two Cubes	138
Lesson 20	Two Special Triangles	145
Lesson 21	Evaluating Functions • Domain and Range • Types of Functions • Tests for Functions	150
Lesson 22	Absolute Value • Reciprocal Functions	160
Lesson 23	The Exponential Function • Sketching Exponentials	166
Lesson 24	Sums of Trigonometric Functions • Combining Functions	172
Lesson 25	Age Problems • Rate Problems	178
Lesson 26	The Logarithmic Form of the Exponential • Logarithmic Equations	183
Lesson 27	Related Angles • Signs of Trigonometric Functions	188
Lesson 28	Factorial Notation • Abstract Rate Problems	193
Lesson 29	The Unit Circle • Very Large and Very Small Fractions • Quadrantal Angles	197
Lesson 30	Addition of Vectors • Overlapping Triangles	205
Lesson 31	Symmetry • Reflections • Translations	211
Lesson 32	Inverse Functions • Four Quadrant Signs • Inverse Trigonometric Functions	219
Lesson 33	Quadrilaterals • Properties of Parallelograms • Types of Parallelograms • Conditions for Parallelograms • Trapezoids	233
Lesson 34	Summation Notation • Linear Regression • Decomposing Functions	242
Lesson 35	Change in Coordinates • The Name of a Number • The Distance Formula	249
Lesson 36	Angles Greater Than 360° • Sums of Trigonometric Functions • Boat-in-the-River Problems	256
Lesson 37	The Line as a Locus • The Midpoint Formula	262
Lesson 38	Fundamental Counting Principle and Permutations • Designated Roots • Overall Average Rate	269
Lesson 39	Radian Measure of Angles • Forms of Linear Equations	277
Lesson 40	The Argument in Mathematics • The Laws of Logarithms • Properties of Inverse Functions	286
Lesson 41	Reciprocal Trigonometric Functions • Permutation Notation	293
Lesson 42	Conic Sections • Circles • Constants in Exponential Functions	301
Lesson 43	Periodic Functions • Graphs of $\sin \theta$ and $\cos \theta$	308
Lesson 44	Abstract Rate Problems	315
Lesson 45	Conditional Permutations • Two-Variable Analysis Using a Graphing Calculator	319

VII Contents

Lesson 46	Complex Roots • Factoring Over the Complex Numbers	324
Lesson 47	Vertical Sinusoid Translations • Arctan	328
Lesson 48	Powers of Trigonometric Functions • Perpendicular Bisectors	333
Lesson 49	The Logarithmic Function • Development of the Rules for Logarithms	338
Lesson 50	Trigonometric Equations	342
Lesson 51	Common Logarithms and Natural Logarithms	346
Lesson 52	The Inviolable Argument • Arguments in Trigonometric Equations	349
Lesson 53	Review of Unit Multipliers • Angular Velocity	353
Lesson 54	Parabolas	358
Lesson 55	Circular Permutations • Distinguishable Permutations	363
Lesson 56	Triangular Areas • Areas of Segments • Systems of Inequalities	367
Lesson 57	Phase Shifts in Sinusoids • Period of a Sinusoid	375
Lesson 58	Distance from a Point to a Line • "Narrow" and "Wide" Parabolas	381
Lesson 59	Advanced Logarithm Problems • The Color of the White House	387
Lesson 60	Factorable Trigonometric Equations • Loss of Solutions Caused by Division	392
Lesson 61	Single-Variable Analysis • The Normal Distribution • Box-and-Whisker Plots	397
Lesson 62	Abstract Coefficients • Linear Variation	405
Lesson 63	Circles and Completing the Square	409
Lesson 64	The Complex Plane • Polar Form of a Complex Number • Sums and Products of Complex Numbers	412
Lesson 65	Radicals in Trigonometric Equations • Graphs of Logarithmic Functions	416
Lesson 66	Formulas for Systems of Equations • Phase Shifts and Period Changes	422
Lesson 67	Antilogarithms	426
Lesson 68	Locus Definition of a Parabola • Translated Parabolas • Applications • Derivation	430
Lesson 69	Matrices • Determinants	437
Lesson 70	Percentiles and z Scores	441
Lesson 71	The Ellipse (1)	445
Lesson 72	One Side Plus Two Other Parts • Law of Sines	450
Lesson 73	Regular Polygons	455
Lesson 74	Cramer's Rule	458
Lesson 75	Combinations	461
Lesson 76	Functions of $(-x)$ • Functions of the Other Angle • Trigonometric Identities (1) • Rules of the Game	465

120.000 (Carlotte Carlotte Car	
viii Cont	tent

Lesson 77	Binomial Expansions (1)	472
Lesson 78	The Hyperbola	475
Lesson 79	De Moivre's Theorem • Roots of Complex Numbers	480
Lesson 80	Trigonometric Identities (2)	485
Lesson 81	Law of Cosines	489
Lesson 82	Taking the Logarithm of • Exponential Equations	495
Lesson 83	Simple Probability • Independent Events • Replacement	499
Lesson 84	Factorable Expressions • Sketching Sinusoids	504
Lesson 85	Advanced Trigonometric Equations • Clock Problems	508
Lesson 86	Arithmetic Progressions and Arithmetic Means	512
Lesson 87	Sum and Difference Identities • Tangent Identities	516
Lesson 88	Exponential Functions (Growth and Decay)	521
Lesson 89	The Ellipse (2)	526
Lesson 90	Double-Angle Identities • Half-Angle Identities	531
Lesson 91	Geometric Progressions	535
Lesson 92	Probability of Either • Notations for Permutations and Combinations	538
Lesson 93	Advanced Trigonometric Identities • Triangle Inequalities (2)	542
Lesson 94	Graphs of Secant and Cosecant • Graphs of Tangent and Cotangent	546
Lesson 95	Advanced Complex Roots	551
Lesson 96	More Double-Angle Identities • Triangle Area Formula • Proof of the Law of Sines • Equal Angles Imply Proportional Sides	553
Lesson 97	The Ambiguous Case	557
Lesson 98	Change of Base • Contrived Logarithm Problems	560
Lesson 99	Sequence Notations • Advanced Sequence Problems • The Arithmetic and Geometric Means	565
Lesson 100	Product Identities • More Sum and Difference Identities	570
Lesson 101	Zero Determinants • 3 \times 3 Determinants • Determinant Solutions of 3 \times 3 Systems • Independent Equations	574
Lesson 102	Binomial Expansions (2)	580
Lesson 103	Calculations with Logarithms • Power of the Hydrogen	582
Lesson 104	Arithmetic Series • Geometric Series	586
Lesson 105	Cofactors • Expansion by Cofactors	590
Lesson 106	Translations of Conic Sections • Equations of the Ellipse • Equations of the Hyperbola	595
Lesson 107	Convergent Geometric Series	600
Lesson 108	Matrix Addition and Multiplication	603

ix	Contents

Lesson 109	Rational Numbers	610
Lesson 110	Graphs of arcsine and arccosine • Graphs of arcsecant and arccosecant • Graphs of arctangent and arccotangent	613
Lesson 111	Logarithmic Inequalities: Base Greater Than 1 • Logarithmic Inequalities: Base Less Than 1	618
Lesson 112	Binomial Theorem	621
Lesson 113	Synthetic Division • Zeros and Roots	624
Lesson 114	Graphs of Factored Polynomial Functions	628
Lesson 115	The Remainder Theorem	635
Lesson 116	The Region of Interest	638
Lesson 117	Prime and Relatively Prime Numbers • Rational Roots Theorem	643
Lesson 118	Roots of Polynomial Equations	647
Lesson 119	Descartes' Rule of Signs • Upper and Lower Bound Theorem • Irrational Roots	651
Lesson 120	Matrix Algebra • Finding Inverse Matrices	656
Lesson 121	Piecewise Functions • Greatest Integer Function	662
Lesson 122	Graphs of Rational Functions • Graphs that Contain Holes	665
Lesson 123	The General Conic Equation	671
Lesson 124	Point of Division Formulas	675
Lesson 125	Using the Graphing Calculator to Graph • Solutions of Systems of Equations Using the Graphing Calculator • Roots	679
Appendix	Proofs	685
	Answers	691
	Index	741