

Scholars Math 10 is a full-year Precalculus curriculum for highly motivated students willing to face hard problems. The course covers a full honors precalculus curriculum, plus many advanced problem-solving applications not found in a standard precalculus class. Topics covered in the class include evaluation of trigonometric functions, trigonometric identities, complex numbers, exponential form of complex numbers, de Moivre's Theorem, geometric representation of complex numbers, roots of unity, applications of complex numbers to geometry, two-dimensional and three-dimensional vectors and matrices, determinants, dot and cross product, and applications of vectors and matrices to geometry.

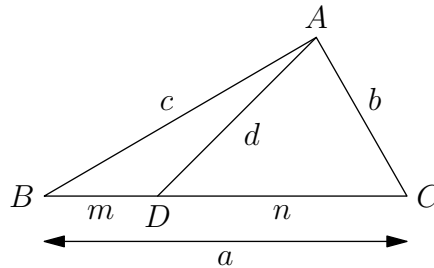
Textbook(s):

Scholars Math 10 requires *Precalculus*, by Richard Rusczyk.

Scholars Math 10 will also integrate problems from *the Art of Problem Solving, Volume 2: and Beyond* by Richard Rusczyk and Sandor Lehoczky, but this text is not required.

Sample Problems:

- ▶ Given $\triangle ABC$ with side lengths a, b, c , let point D be on side \overline{BC} , and let $d = AD, m = BD$, and $n = CD$.



Stewart's Theorem states that $a(d^2 + mn) = mb^2 + nc^2$. Using trigonometry, prove Stewart's Theorem.

- ▶ Find a 3×3 matrix N such that $N\mathbf{v}$ is the projection of \mathbf{v} onto the graph of $x + y + z = 0$ for any three-dimensional vector \mathbf{v} .

Common Core State Standards (High School):

Domain	Subdomain	Standards
Number and Quantity	The Complex Number System	1, 2, 3, 4, 5, 6
	Vector and Matrix Quantities	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Functions	Trigonometric Functions	1, 2, 3, 4, 6, 7, 8, 9
Geometry	Similarity, Right Triangles, and Trigonometry	9, 10, 11

Time Commitment: 22 lessons, 1.5 in-class hours + 4–5 hours of homework per lesson.

Content:

Lesson	Scholars Topic
1	Basic Trigonometry
2	Graphing Trig and Inverse Trig Functions
3	Trigonometric Identities I
4	Trigonometric Identities II
5	Law of Cosines and Law of Sines
6	More Geometry with Trigonometry
7	Parametric Equations
8	Polar, Cylindrical, and Spherical Coordinates
9	Introduction to Complex Numbers and the Complex Plane
10	Trigonometry and Complex Numbers
11	Roots of Unity
12	Geometry Using Complex Numbers I
13	Geometry Using Complex Numbers II: Roots of Unity
14	Vectors in Two Dimensions
15	Vectors and Matrices in Two Dimensions
16	Matrices in Two Dimensions
17	Matrices in Two Dimensions II
18	Determinants of 2x2 Matrices and Introduction to 3D Vectors
19	Matrices in Three Dimensions
20	Lines and Planes in Three Dimensions
21	Cross Product and Determinant
22	Applications of Vectors to Euclidean Geometry