PreCalculus Syllabus

Course Summary

This course is meant for students ages 14 to 17 who have completed, at a minimum, the Common Core (or equivalent) curriculum for Algebra 2 and Geometry. Students will be exposed to the Focus Areas section listed below, and we expect students to master the skills listed in the Expected Outcomes section listed below.

Focus Areas at this Level

Concepts, skills, and learning tools students see in this course include, but are not limited to:

- Trigonometric functions and identities
- Law of Sines, Law of Cosines
- Conversion between Parametric, Rectangular and Polar coordinate systems
- Complex numbers in trigonometric functions
- 2D and 3D Vectors and Matrices

Expected Outcomes

Students will be **expected to adequately perform in or explain** the following areas after course completion:

- Complex Numbers
    - Do arithmetic operations
    - Represent them and their operations on a complex plane
    - Graph and solve functions and equations involving complex numbers
    - Relate complex numbers to Trigonometry and Geometry
- Trigonometry
    - Graph and solve trigonometric functions and equations
    - Solve for missing pieces of a general triangle
    - Be comfortable recreating the Unit Circle with segments of 30 and 45 degrees
    - Simplify trigonometric expressions using identities
- Vectors and Matrices
    - Convert between different coordinate systems including parametric, rectangular and polar
    - Define and operate on vectors and matrices up to 3x3 comfortably
    - Model objects and shapes with vectors and matrices
    - Explain the determinant and inverse of a square matrix, up to 3x3

Pre Requisites

Students registering for this course should be **comfortable with the following Math**:

- Introductory Geometry of triangles and circles (perimeter, area, angle and arc relationships, The Pythagorean Theorem)
- Solving equations and systems of equations with 3 unknowns
- Derive and calculate volumes of 3D shapes with only straight edges
- Logarithms and exponents
- Polynomials (factoring, finding roots, behavior of graphs)
- Graphing functions on the Cartesian Plane
- Complex numbers (arithmetic with, simplifying)

Students should also be **willing and able to**:

- Communicate in English at a beginner's level
- Be respectful of other students in their classes
- Practice writing things down on paper
- Share their thoughts with the instructors to help them discover solutions to their problems
- Take constructive criticism when it comes to their learning habits

Course Materials (Required)

- All classes will be taught online, via **Zoom**. Your student will need a device with a microphone and camera.
- Homework will be assigned via the textbook:
  - The Art of Problem Solving: Pre-Calculus 2nd Edition by Richard Rusczyk
  - Purchasable here: https://artofproblemsolving.com/store ; **Mandatory purchase** required
  - Physical or eBook contain the same problems
- Parents are expected to have read and understood the Parent Handbook
  - Parents should review the expectations in class with their student(s)
  - Parents of this age group will need to help their students learn the technology used on the student's end

Students should also have access to:

- Ruler, Protractor, Compass (to make circles)
- Calculator with sin, cos and tan functions at a minimum
- Paper, Pencils and Erasers
- Colored pencils or markers
- Reliable internet connection and digital device

Homework Expectations

Homework at EMC is set up to be flexible for the needs of your student. Usually we feel students fall into three general categories:

- EMC is **replacing public school or** accelerating my student for **testing out of Math** in the future
  - All Homework is **mandatory**
- EMC is helping **improve my grades** or **skills**
  - Homework is **highly recommended**, we recommend concentrating on school homework first
- EMC is for **interest's sake** and/or for **exposure** to problem solving **before seeing it in school**
  - Homework is **recommended, yet optional**

Homework Delivery

Homework is delivered in a two main ways:

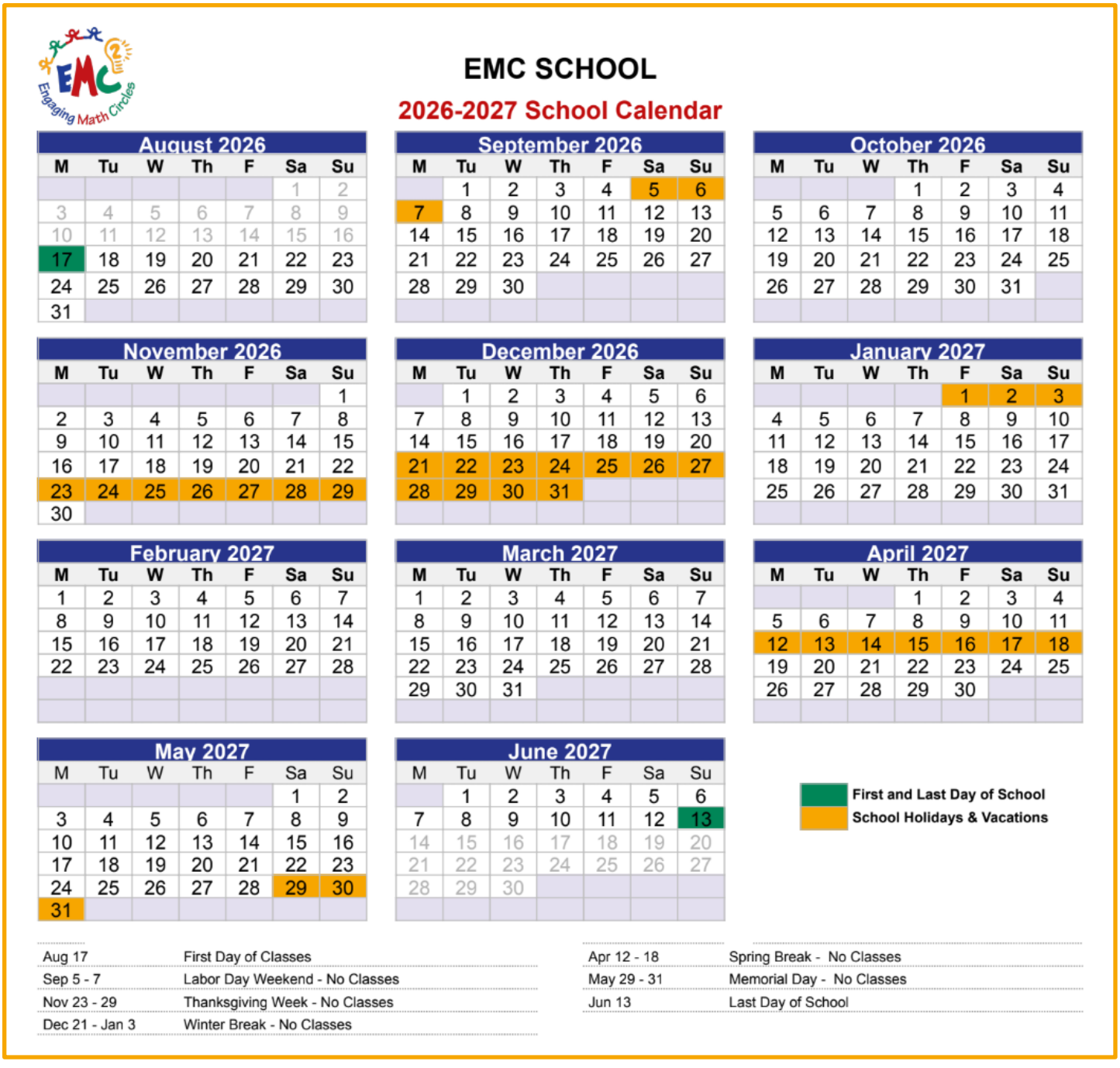
- **Practice Homework**
  - Assigned through the Art of Problem Solving (AoPS) Textbook
  - PDFs of our lesson slides are posted weekly and include extra questions not assigned
  - AoPS has challenging questions and an alternate learning style compared to EMC, outlined below:
    - Problem Section

        - Questions designed to teach, read all these solutions if you're self-paced learning outside of the class times
    - Exercises
        - Questions to demonstrate understanding of the content ; we recommend not reading these solutions until after you have your first answer or get completely stuck

- **Assessment Homework** (aka Quizzes, Tests)
    - Canvas, set of questions to show instructors a student's understanding of the content
    - Auto-graded upon submission
    - Instructors adjust grades after seeing results to give partial marks where appropriate, and plan to cover certain problem areas in the Homework Check portion of next class

Course Calendar

On yellow dates on the calendar below, no classes are held. Some days of the week (Sat, Sun, Mon) have less classes per year. These courses will have slightly condensed in-class schedules, and your instructor will let you know which homework assignments to do each week.



EMC SCHOOL

2026-2027 School Calendar

August 2026

M	Tu	W	Th	F	Sa	Su
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September 2026

M	Tu	W	Th	F	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

October 2026

M	Tu	W	Th	F	Sa	Su
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November 2026

M	Tu	W	Th	F	Sa	Su
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

December 2026

M	Tu	W	Th	F	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

January 2027

M	Tu	W	Th	F	Sa	Su
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February 2027

M	Tu	W	Th	F	Sa	Su
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March 2027

M	Tu	W	Th	F	Sa	Su
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April 2027

M	Tu	W	Th	F	Sa	Su
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May 2027

M	Tu	W	Th	F	Sa	Su
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June 2027

M	Tu	W	Th	F	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

First and Last Day of School

School Holidays & Vacations

Aug 17	First Day of Classes
Sep 5 - 7	Labor Day Weekend - No Classes
Nov 23 - 29	Thanksgiving Week - No Classes
Dec 21 - Jan 3	Winter Break - No Classes
Apr 12 - 18	Spring Break - No Classes
May 29 - 31	Memorial Day - No Classes
Jun 13	Last Day of School

Course Itinerary

Chapter	Lesson	Class Dates	Homework Assigned
Chapter 1: Functions	**1) Functions, and Composition**	Aug 17- Aug 23	**1.1 Function Basics:** 1.1.1 to 1.1.5 **1.3 Composition:** 1.3.1 to 1.3.3
	2) Graphing Functions	Aug 24 - Aug 30	**1.2 Graphing Functions:** 1.2.1 to 1.2.3
	3) Inverse Functions and Review	Aug 31 - Sept 6 OFF Sat Sept 5, Sun Sept 6 Labor Day	**1.4 Inverse Functions**: 1.4.1 to 1.4.3 **Review Problems:** 1.27, 1.28, 1.30
Chapter 2: Trig Functions	**4) Unit Circle & Radians**	Sept 7 - Sept 13 OFF Mon Sept 7 Labor Day	**2.1 The Unit Circle:** 2.1.1 to 2.1.5 **2.2 Radians:** 2.2.1 to 2.2.4
	5) Graphing Trig Functions	Sept 14 - Sept 20	**2.3 Graphs of Trigonometric Functions**: 2.3.1 to 2.3.2 **2.4 Transformations of Trig Functions**: 2.4.1 to 2.4.5
	6) Inverse Trig Functions and Review	Sept 21 - Sept 27	**2.5 Inverse Trig Functions**: 2.5.1 to 2.5.4 **Review Problems:** 2.39, 2.40, 2.43, 2.44, 2.50, 2.57, 2.60, 2.61 & 2.62
Chapter 3: Fraction Operations	**7) Simple Trig Identities**	Sept 28 - Oct 4	**3.1 Introduction to Trig Identities:** 3.1.1 to 3.1.4 **3.2 Sums and Differences of Angles:** 3.2.1 to 3.2.5
	8) Advanced Trig Identities	Oct 5 - Oct 11	**3.3 Double & Half Angles**: 3.3.1 to 3.3.4 **3.4 Sum-to-product and Product-to-sum**: 3.4.2, 3.4.4
	9) Chapter Review	Oct 12 - Oct 18	**3.5★ Problem Solving with Identities:** 3.5.1 & 3.5.5 **Review Problems:** 3.36, 3.37, 3.40, 3.42
Chapter 4: Geometry Applications	**10) Right Triangles**	Oct 19 - Oct 25	**4.1 Right Triangle Trigonometry**: 4.1.3 to 4.1.7
	11) Trig Laws	Oct 26 - Nov 1	**4.2 Law of Cosines**: 4.2.1 to 4.2.6 **4.3 Law of Sines**: 4.3.1, 4.3.2, 4.3.4, 4.3.5
	12) Advanced Relationships + Review	Nov 2 - Nov 8	**4.4 More Triangle Relationships:** 4.4.1 to 4.4.3. **Review Problems:** 4.28, 4.29, 4.31, 4.45, 4.49

Chapter 5: Coordinate Systems	**13) Parameterization**	Nov 9 - Nov 15	**5.1 Parameterization:** 5.1.1 to 5.1.4
	14) Polar Coordinates	Nov 16 - Nov 22	**5.2 Polar Coordinates:** 5.2.1 to 5.2.3 **5.3 Coordinates in Three Dimensions:** 5.3.1, 5.3.2, 5.3.4, 5.3.6
Holiday	**Thanksgiving**	**OFF** Nov 23 - Nov 29	**Have a great week!**
Chapter 6: Complex Numbers	**15) Arithmetic and Graphing of**	Nov 30 - Dec 6	**6.1 Complex Number Arithmetic:** 6.1.1 to 6.1.4 **6.2 The Complex Plane:** 6.2.1 to 6.2.4
	16) Real and Imaginary	Dec 7 - Dec 13	**6.3 Real and Imaginary Parts:** 6.3.1 to 6.3.2 **6.4 Nonreal Roots of Polynomials:** 6.4.1 to 6.4.4
17) Midterm Review		Dec 14 - Dec 20	• Review of Chapters 1 through 4
Holiday	**Winter Break**	**OFF 2 WEEKS** Dec 21 - Jan 3	**Have a great break!**
Chapter 6: Complex Numbers	**18) Chapter Review**	Jan 4 - Jan 10	**Review Problems:** 6.29, 6.32, 6.33, 6.36, 6.37
Chapter 7: Complex Trig	**19) Non-Rectangular Forms**	Jan 11 - Jan 17	**7.1 Polar Form of Complex Numbers:** 7.1.1 to 7.1.4 **7.2 Exponential Form of Complex Numbers:** 7.2.1 to 7.2.6
	20) Roots of Unity	Jan 18 - Jan 24	No homework ; but do read through Exercises and their solutions: **7.3 Roots of Unity** **7.4 Problems Involving Roots of Unity** **MIDTERM DUE**
	21) Chapter Review	Jan 25 - Jan 31	**Review Problems:** 7.33, 7.34, 7.36
Chapter 8: Complex Geometry	**22) Transformations and Graphing**	Feb 1 - Feb 7	**8.1 Transformations of the Complex Plane:** 8.1.1 to 8.1.5 **8.2 Parallel and Perpendicular Lines:** 8.2.1, 8.2.2

	23) Classic Applications	Feb 8 - Feb 14	**8.3 Distance:** 8.31. to 8.3.4 **8.4 Regular Polygons:** 8.4.1 to 8.4.4
	24) Classic Theorems and Chapter Review	Feb 15 - Feb 21	**8.5★ Classic Theorems:** None **Review Problems:** 8.35, 8.38, 8.41, 8.47
Chapter 9: 2D Vectors	**25) Vectors and Dot Products**	Feb 22 - Feb 28	**9.1 What's a Vector?:** 9.1.2 to 9.1.4 **9.2 The Dot Product:** 9.2.1 to 9.2.5
	26) Projections and Chapter Review	Mar 1 - Mar 7	**9.3 Lines and Linear Dependence:** 9.3.1 to 9.3.3 **9.4 Projections:** 9.4.1 & 9.4.2 **Review Problems:** 9.29, 9.35, 9.40, 9.42
27) Spring Review		Mar 8 - Mar 14	• Review of Chapters 6 through 9 • **Math Map** Where does this go?
Chapter 10: 2D Matrices	**28) The Matrix**	Mar 15 - Mar 21	**10.1 What is a Matrix?** 10.1.1, 10.1.3 **10.2 Multiplying Matrices** 10.2.1, 10.2.5 **10.4 The Determinant** 10.4.2, 10.4.3
	29) Geometry of Matrices	Mar 22 - Mar 28	**10.3 Matrices as Transformations** 10.3.2, 10.3.4 (10.16) **10.5 Geometric Interpretation of the Determinant** 10.5.1, 10.5.2
	30) Inverting Matrices	Mar 29 - Apr 4	**10.6 Inverting a Matrix** 10.6.2, 10.6.4
	31) Chapter Review	Apr 5 - Apr 11	**Review Problems:** 10.42, 10.43, 10.51, 10.54, 10.58
Holiday	**Spring Break**	**OFF** **Apr 12 - Apr 18**	**Have a great week!**
Chapter 11: 3D Vectors and Matrices	**32) 3D & More Determinants**	Apr 19 - Apr 25	**11.1 Vectors in Three Dimensions** 11.1.1 to 11.1.3 **11.2 3x3 Matrices** 11.5, 11.2.1, 11.2.2 **11.3 Determinants of 3x3 Matrices** 11.15, 11.3.1
	33) Higher Orders	Apr 26 - May 2	**11.4 More Than Just 2x2 and 3x3** 11.4.1, 11.4.2 **Review Problems:** 11.29 to 11.32, 11.37, 11.41
	34) Lines, Planes, and Cross Product	May 3 - May 9	**12.1 Lines and Planes in Three Dimensions** 12.1.2 (graph your solution), 12.1.4 **12.2 More Planes in Three Dimensions** 12.2.1, 12.2.3 **12.3 The Cross Product** 12.3.1, 12.3.2

	35) Geometric Determinant, & 3D Inverses	May 10 - May 16	**12.4 Geometric Interpretation of the Determinant** 12.4.1 **12.5 Inverse of a 3x3 Matrix** 12.5.2, 12.5.4
	36) Chapter Review	May 17 - May 23	**Review Problems:** 12.35, 12.3.4, 12.37, 12.40, 12.42, 12.50
Chapter 12: Vector Geometry	**37) Using Vectors**	May 24 - May 30 **OFF Sat Sun May 29 and 30 Memorial Day**	**13.1 Introduction** 13.1.3, 13.1.5 **13.2 Vectors in the Triangle** 13.2.1, 13.2.5
	38) Using Complex Vectors	May 31 - June 6 **OFF Mon May 31 Memorial Day**	**13.3★ Vectors, Complex Numbers, and Challenging Problems** Read all Solutions to Problems **Challenge Problems:** 13.19, 13.22, 13.24
39) Final Review		June 7 - June 13	● Review of Chapters 5 through 10