



# monarch

Curriculum Catalog

Pre-calculus

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## Pre-calculus Course Overview

Pre-calculus is a full-year, high school credit course that is intended for the student who has successfully mastered the core algebraic and conceptual geometric concepts covered in the prerequisite courses: Algebra I, Geometry, and Algebra II. The course primarily focuses on the skills and methods of analytic geometry and trigonometry while investigating further relationships in functions, probability, number theory, limits, and the introduction of derivatives.

- **Relations and Functions:** Student will examine functions, inverses of functions and combine functions to verify inverses, as well as distinguish between linear and quadratic functions.
- **Functions:** Student will solve polynomials using the quadratic theorem, remainder theorem and factor theorem, identify graphs of different polynomial equations and inequalities, and understand complex numbers.
- **Trigonometric Functions:** Student will identify and solve for missing components of trigonometric functions, calculating trigonometric values for different angles and relate degrees to radians, and radians to degrees.
- **Circular Functions and their Graphs:** Student will use parametric equations with trigonometric operations to model and solve problems, and calculate amplitude, period, and phase shift for graphed trigonometric functions.
- **Identities and Functions of Multiple Angles:** Student will simplify trigonometric expressions utilizing trigonometric identities, and double and half-angle formulas, and combine the identities and angle formulas learned in this unit to prove trigonometric relationships.
- **Application of Trigonometric Functions:** Student will solve problems using trigonometric functions, and combine trigonometric functions and vectors to solve incline plane problems and navigation problems.
- **Inverse Trigonometric Functions and Polar Coordinates:** Student will solve for unknowns using inverse trigonometric functions, recognize their graphs, and convert equations from Cartesian to polar coordinates, and from polar to Cartesian coordinates.
- **Quadratic Equations:** Student will identify properties and equations of circles, ellipses, parabolas and hyperbolas, and calculate point rotations and apply them to equations.
- **Counting Principles:** Student will distinguish between mutually exclusive, independent and dependent events, and between combination and permutation, and use the explicit formula and the recursive formula to find the  $n$ th term as well as the general term of an arithmetic sequence, or geometric sequence.
- **Calculus:** Student will solve functions involving numbers and conditions, understand limit notation, and evaluate limits using the limit theorems, and find the slope of curves, and calculate the angle between two curves

Unit 1: Relations and Functions	
Assignments	
Pre-calculus	1. Course Overview
	2. Ordered-Pair Numbers: Relations
	3. Ordered-Pair Numbers: Functions
	4. Ordered-Pair Numbers: Rules of Correspondence
	5. Quiz 1: Relations and Functions
	6. Algebra of Functions: Notation
	7. Algebra of Functions: Arithmetic
	8. Algebra of Functions: Composition
	9. Algebra of Functions: Inverse
	10. Quiz 2: Relations and Functions
	11. Special Project*
	12. Test
	13. Alternate Test*
	14. Glossary and Credits

Unit 2: Functions			
Assignments			
Pre-calculus	1. Linear Functions: Graphs	14. Conjugates and Polynomial Identities	
	2. Linear Functions: Equations	15. Distance and Midpoint	
	3. Quiz 1: Linear Functions	16. Quiz 4: Complex Numbers	
	4. 2nd-Degree Functions: Solutions	17. Rational Inequalities	
	5. Relationships Between Zeros and Coefficients	18. Greatest Integer Function	
	6. Quadratic Inequalities	19. Exponential Function	
	7. Quiz 2: Second-Degree Functions	20. Logarithmic Function	
	8. Polynomial Functions	21. Function Combinations	
	9. Nth-Degree Equations	22. Quiz 5: Special Functions	
	10. Solving Polynomial Equations	23. Special Project*	
	11. Quiz 3: Polynomial Functions	24. Test	
	12. Complex Numbers	25. Alternate Test*	
	13. Operations with Complex Numbers	26. Glossary and Credits	
	Unit 3: Trigonometric Functions		
	Assignments		
	Pre-calculus	1. Definition of the Trigonometric Functions	10. Quiz 5: Quadrantal Angles
		2. Quiz 1: Trigonometric Functions	11. Special Angles
		3. Evaluation of Functions	12. Quiz 6: Special Angles
		4. Quiz 2: Evaluation of Functions	13. Radian Measure
		5. Angle Location	14. Quiz 7: Radian Measure
		6. Quiz 3: Angle Location	15. Special Project*
		7. Reduction Formulas	16. Test
		8. Quiz 4: Reduction Formulas	17. Alternate Test*
		9. Quadrantal Angles	18. Glossary and Credits
		Unit 4: Circular Functions and Their Graphs	
		Assignments	
Pre-calculus		1. Circular Functions	12. Amplitude of Circular Functions
		2. Quiz 1: Circular Functions	13. Quiz 6: Amplitude of Circular Functions
		3. Circular Functions of Special Angles	14. Period of Circular Functions
		4. Quiz 2: Circular Functions of Special Angles	15. Quiz 7: Period of Circular Functions
		5. Graphs of Sin and Cos	16. Phase Shift of Circular Functions
		6. Quiz 3: Graphs of Sin and Cos	17. Quiz 8: Phase Shift of Circular Functions
		7. Other Graphs	18. Special Project*
	8. Quiz 4: Other Graphs	19. Test	
	9. Applications	20. Alternate Test*	
	10. Parametric Equations	21. Glossary and Credits	
	11. Quiz 5: Applications		

Unit 5: Identities and Functions of Multiple Angles		
Assignments		
Pre-calculus	1. Reciprocal Relations	12. Quiz 6: Additional Sum and Difference Formulas
	2. Quiz 1: Reciprocal Relations	13. Double- and Half-Angle Formulas
	3. Pythagorean Relations	14. Quiz 7: Double- and Half-Angle Formulas
	4. Quiz 2: Pythagorean Relations	15. Identities
	5. Quotient Relations	16. Quiz 8: Identities
	6. Quiz 3: Quotient Relations	17. Trigonometric Equations
	7. Trigonometric Identities	18. Quiz 9: Trigonometric Equations
	8. Quiz 4: Trigonometric Identities	19. Special Project*
	9. Cosine of the Sum of Two Angles	20. Test
	10. Quiz 5: Cosine of the Sum of Two Angles	21. Alternate Test*
	11. Additional Sum and Difference Formulas	22. Glossary and Credits

  

Unit 6: Semester Review and Exam		
Assignments		
Pre-calculus	1. Review	3. Alternate Exam—Form A*
	2. Exam	4. Alternate Exam—Form B*

  

Unit 7: Application of Trigonometric Functions		
Assignments		
Pre-calculus	1. Trigonometric Functions of Any Angle	12. Applications of Vectors
	2. Quiz 1: Trigonometric Functions of Any Angle	13. More Applications
	3. More Trigonometric Functions of Any Angle	14. Quiz 5: More Applications
	4. Quiz 2: Trigonometric Functions	15. Inclined Plane Application
	5. Applied Problems	16. Navigation Application
	6. Law of Cosines	17. Quiz 6: Additional Application Problems
	7. Quiz 3: Law of Cosines	18. Special Project*
	8. Law of Sines	19. Test
	9. Quiz 4: Law of Sines	20. Alternate Test*
	10. Vectors	21. Glossary and Credits
	11. Operations with Vectors	

## Unit 8: Inverse Trigonometric Functions and Polar Coordinates

## Assignments

Pre-calculus	1.	The Inverse Sine Function	15.	Converting Cartesian Equations to Polar Equations
	2.	Quiz 1: The Inverse Sine Function	16.	Quiz 8: Converting Cartesian Equations to Polar Equations
	3.	The Inverse Cosine Function	17.	Converting Polar Equations to Cartesian Equations
	4.	Quiz 2: The Inverse Cosine Function	18.	Quiz 9: Converting Polar Equations to Cartesian Equations
	5.	The Inverse Tangent Function	19.	Graphing Polar Equations
	6.	Quiz 3: The Inverse Tangent Function	20.	Quiz 10: Graphing Polar Equations
	7.	Other Inverse Functions	21.	Project: De Moivre's Theorem
	8.	Quiz 4: Other Inverse Functions	22.	Special Project*
	9.	Graphs of Inverse Functions	23.	Test
	10.	Quiz 5: Graphs of Inverse Functions	24.	Alternate Test*
	11.	Graphing Polar Coordinates	25.	Glossary and Credits
	12.	Quiz 6: Graphing Polar Coordinates		
	13.	Converting Coordinates		
	14.	Quiz 7: Converting Coordinates		

## Unit 9: Quadratic Equations

## Assignments

Pre-calculus	1.	The Circle	13.	The Parabola Applied
	2.	The Circle Continued	14.	The Hyperbola
	3.	Equation from Three Points	15.	Quiz 2: Quadratic Equations
	4.	Equation from Three Points Applied	16.	Translation
	5.	The Ellipse	17.	Translation of Equations
	6.	The Ellipse: Standard Form	18.	Rotation
	7.	The Ellipse: General Form	19.	Rotation of Equations
	8.	The Ellipse Applied	20.	Quiz 3: Quadratic Equations
	9.	Quiz 1: Quadratic Equations	21.	Special Project*
	10.	The Parabola	22.	Test
	11.	The Parabola Continued	23.	Alternate Test*
	12.	The Parabola: Standard Form	24.	Glossary and Credits

## Unit 10: Counting Principles

## Assignments

Pre-calculus	1.	Definitions, Sample Spaces, and Probability	11.	Quiz 2: Probability
	2.	Addition of Probabilities	12.	Arithmetic and Geometric Sequences
	3.	Multiplication of Probabilities	13.	Summation
	4.	Quiz 1: Probability	14.	Arithmetic and Geometric Series
	5.	Definitions	15.	Quiz 3: Sequences and Series
	6.	Permutation of N Things: Different	16.	Proofs by Mathematical Induction
	7.	Permutation of N Things: Not All Different	17.	Special Project
	8.	Circular Permutations	18.	Test
	9.	Combinations	19.	Alternate Test
	10.	Binomial Theorem	20.	Glossary and Credits

Unit 11: Calculus and Review	
Pre-calculus	<b>Assignments</b>
	1. Functional Notation
	2. Difference Quotient
	3. Limits
	4. Quiz 1: Limits
	5. Slope of a Curve
	6. Slope of a Line
	7. Angle Between Curves
	8. Quiz 2: Slopes and Curves
	9. Review: Relations and Functions
10. Review: Trigonometric and Circular Functions	
11. Review: Identities, Multiple Angle Functions	
12. Review: Inverse Trig Functions; Polar Coordinates; Quadratics	
13. Review: Probability and Calculus	
14. Quiz 3: Reviews	
15. Special Project	
16. Test	
17. Alternate Test	
18. Glossary and Credits	

  

Unit 12: Semester Review and Exam	
Pre-calculus	<b>Assignments</b>
	1. Review
	2. Exam
	3. Alternate Exam—Form A*
4. Alternate Exam—Form B*	

  

Unit 13: Final Exam	
Pre-calculus	<b>Assignments</b>
	1. Exam
	2. Alternate Exam—Form A*
3. Alternate Exam—Form B*	

(\*) Indicates alternative assignment