

## 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.

Upon successfully completing the course, students should have mastered the following concepts:

- Perform operations on functions including composition and inverses.
- Graph, evaluate, and solve exponential and logarithmic functions and equations.
- Utilize the unit circle in evaluating trigonometric identities; prove trigonometric identities; graph trigonometric functions and their inverses.
- Solve application problems involving right triangle trigonometry, special right triangles, and law of sines and cosines.
- Convert between Cartesian and polar forms; graph equations in polar coordinates.
- Graph and solve quadratic equations that include conic sections.
- Calculate probabilities, combinations, and permutations.
- Calculate summations and limits of functions.
- Relate analytical operations of limits, slope of a tangent line, and the definition of a derivative.

| UNIT 1: RELATIONS AND FUNCTIONS |  |
|---------------------------------|--|
| PRE-CALCULUS                    | <b>Assignment Titles</b>                         |
|                                 | 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             |   |
|-------------------------------|---|
| PRE-CALCULUS                  | <b>Assignment Titles</b>                        |
|                               | 1. Linear Functions: Graphs                     |
|                               | 2. Linear Functions: Equations                  |
|                               | 3. Quiz 1: Linear Functions                     |
|                               | 4. 2nd-Degree Functions: Solutions              |
|                               | 5. Relationships Between Zeros and Coefficients |
|                               | 6. Quadratic Inequalities                       |
|                               | 7. Quiz 2: Second-Degree Functions              |
|                               | 8. Polynomial Functions                         |
|                               | 9. Nth-Degree Equations                         |
|                               | 10. Quiz 3: Polynomial Functions                |
|                               | 11. Greatest Integer Function                   |
|                               | 12. Exponential Function                        |
|                               | 13. Logarithmic Function                        |
| 14. Function Combinations     |   |
| 15. Quiz 4: Special Functions |   |
| 16. Special Project*          |   |
| 17. Test                      |   |
| 18. Alternate Test*           |   |
| 19. Glossary and Credits      |   |

## UNIT 3: TRIGONOMETRIC FUNCTIONS

PRE-CALCULUS

## Assignment Titles

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|----|---|-----|---------------------------|
| 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

PRE-CALCULUS

## Assignment Titles

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|-----|--|-----|---|
| 1.  | Circular Functions                           | 11. | Amplitude of Circular Functions           |
| 2.  | Quiz 1: Circular Functions                   | 12. | Quiz 6: Amplitude of Circular Functions   |
| 3.  | Circular Functions of Special Angles         | 13. | Period of Circular Functions              |
| 4.  | Quiz 2: Circular Functions of Special Angles | 14. | Quiz 7: Period of Circular Functions      |
| 5.  | Graphs of Sin and Cos                        | 15. | Phase Shift of Circular Functions         |
| 6.  | Quiz 3: Graphs of Sin and Cos                | 16. | Quiz 8: Phase Shift of Circular Functions |
| 7.  | Other Graphs                                 | 17. | Special Project*                          |
| 8.  | Quiz 4: Other Graphs                         | 18. | Test                                      |
| 9.  | Applications                                 | 19. | Alternate Test*                           |
| 10. | Quiz 5: Applications                         | 20. | Glossary and Credits                      |

## UNIT 5: IDENTITIES AND FUNCTIONS OF MULTIPLE ANGLES

PRE-CALCULUS

## Assignment Titles

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

## UNIT 6: SEMESTER REVIEW AND EXAM

PRE-CALCULUS

## Assignment Titles

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|----|--------|----|--------------------------|
| 1. | Review | 3. | Alternate Exam - Form A* |
| 2. | Exam   | 4. | Alternate Exam - Form B* |

## UNIT 7: APPLICATION OF TRIGONOMETRIC FUNCTIONS

PRE-CALCULUS

## Assignment Titles

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

## UNIT 8: INVERSE TRIGONOMETRIC FUNCTIONS AND POLAR COORDINATES

PRE-CALCULUS

## Assignment Titles

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

## UNIT 9: QUADRATIC EQUATIONS

PRE-CALCULUS

## Assignment Titles

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|---------------------------------------|---------------------------------|
| 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: PROBABILITY

PRE-CALCULUS

## Assignment Titles

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|--|--------------------------|
| 1. Definitions, Sample Spaces, and Probability | 8. Circular Permutations |
| 2. Addition of Probabilities                   | 9. Combinations          |
| 3. Multiplication of Probabilities             | 10. Quiz 2: Probability  |
| 4. Quiz 1: Probability                         | 11. Special Project*     |
| 5. Definitions                                 | 12. Test                 |
| 6. Permutation of N Things: Different          | 13. Alternate Test*      |
| 7. Permutation of N Things: Not All Different  | 14. Glossary and Credits |

| UNIT 11: CALCULUS AND REVIEW |                   |                                  |     |                                  |
|------------------------------|-------------------|----------------------------------|-----|----------------------------------|
| PRE-CALCULUS                 | Assignment Titles |                                  |     |                                  |
|                              | 1.                | Summation                        | 12. | Review Mathematics 1201 and 1202 |
|                              | 2.                | Proofs by Mathematical Induction | 13. | Review Mathematics 1203 and 1204 |
|                              | 3.                | Quiz 1: Calculus                 | 14. | Review Mathematics 1205 and 1206 |
|                              | 4.                | Functional Notation              | 15. | Review Mathematics 1207 and 1208 |
|                              | 5.                | Difference Quotient              | 16. | Review Mathematics 1209 and 1210 |
|                              | 6.                | Limits                           | 17. | Quiz 4: Calculus                 |
|                              | 7.                | Quiz 2: Calculus                 | 18. | Special Project*                 |
|                              | 8.                | Slope of a Curve                 | 19. | Test                             |
|                              | 9.                | Slope of a Line*                 | 20. | Alternate Test*                  |
|                              | 10.               | Angle Between Curves             | 21. | Glossary and Credits             |
| 11.                          | Quiz 3: Calculus  |                                  |     |                                  |

| UNIT 12: SEMESTER REVIEW AND EXAM |                   |        |    |                          |
|-----------------------------------|-------------------|--------|----|--------------------------|
| PRE-CALCULUS                      | Assignment Titles |        |    |                          |
|                                   | 1.                | Review | 3. | Alternate Exam - Form A* |
|                                   | 2.                | Exam   | 4. | Alternate Exam - Form B* |

| UNIT 13: FINAL EXAM |                   |                          |    |                          |
|---------------------|-------------------|--------------------------|----|--------------------------|
| PRE-CALCULUS        | Assignment Titles |                          |    |                          |
|                     | 1.                | Exam                     | 3. | Alternate Exam - Form B* |
|                     | 2.                | Alternate Exam - Form A* |    |                          |

(\*) Indicates alternate assignment