# MAC 1147  Pre-Calculus Algebra/Trigonometry

**Course Description:**
This course covers all the topics in MAC1114 (Trigonometry) and MAC1140 (Pre-Calculus Algebra). Please refer to the Course Description for those two courses for additional information. (5-hour lecture)

<table>
<thead>
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<th>Course Competency</th>
<th>Learning Outcomes</th>
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| **Competency 1:** The student will demonstrate knowledge of piecewise defined functions by: | • Numbers / Data  
• Critical thinking  
• Information Literacy |
| 1. Graphing advanced piecewise defined functions. | |
| **Competency 2:** The student will demonstrate knowledge of exponential and logarithmic functions, their properties and their graphs by: | • Numbers / Data  
• Critical thinking  
• Information Literacy |
| 1. Defining the exponential and logarithmic functions and their inverse relationship.  
2. Evaluating exponential and logarithmic expressions.  
3. Graphing the exponential and logarithmic functions with and without transformations.  
4. Identifying the domain and range of an exponential or logarithmic function.  
5. Applying properties of logarithms to expand and condense logarithmic expressions.  
7. Applying modeling techniques to solve problems of exponential growth and decay. | |
| **Competency 3:** The student will demonstrate knowledge of polynomial functions by: | • Numbers / Data  
• Critical thinking  
• Information Literacy |
1. Analyzing the graph of a polynomial function, its behavior near its zeros and its end behavior.
2. Stating the Fundamental Theorem of Algebra.
3. Using appropriate rules or theorems to determine the existence, multiplicity, location, and classification of real and complex zeros of a polynomial function.
4. Sketching the graph of a polynomial function.
5. Building a polynomial function given its zeros and their multiplicity or its graph.

**Competency 4:** The student will demonstrate knowledge of rational functions by:

- Numbers / Data
- Critical thinking
- Information Literacy

1. Finding vertical, horizontal and oblique asymptotes.
2. Determining domain of rational functions.
4. Analyzing the behavior of a rational function near the point of discontinuity and the end behavior.

**Course Competency 5:** The student will demonstrate knowledge of polynomial and rational equations and inequalities by:

- Numbers / Data
- Critical thinking
- Information Literacy

1. Solving systems of non-linear equations.
2. Solving linear and non-linear inequalities.
3. Graphing their solution set.

**Course Competency 6:** The student will demonstrate knowledge of conic sections by:

- Communication
- Numbers / Data
- Critical thinking
- Information Literacy
- Social Responsibility

1. Identifying conic sections as the result of intersecting a plane with a cone.
2. Identifying and graphing the different conic sections.
3. Writing an equation for a conic in standard or general form where applicable, by identifying the corresponding parts of the conic.
4. Solving application problems involving parabolas, ellipses, and hyperbolas.

**Course Competency 7:** The student will demonstrate knowledge of matrices and determinants by:

- Numbers / Data
- Critical thinking
- Information Literacy

1. Defining matrices and dimensions of matrices.
2. Performing algebraic operations on matrices.
3. Evaluating determinants.
5. Identifying consistent and inconsistent systems.

**Course Competency 8:** The student will demonstrate knowledge of sequences and series by:

- Numbers / Data
- Critical thinking
- Information Literacy

1. Defining sequences and series (including arithmetic and geometric).
2. Writing the term of sequences.
3. Finding the sums of series (including arithmetic and geometric).
4. Defining sequences by using the general term or a recursive formula.
5. Using the summation notation properties to express and evaluate sums.

**Course Competency 9:** The student will demonstrate knowledge of mathematical induction by:

- Communication
- Numbers / Data
- Critical thinking
- Information Literacy
- Social Responsibility

1. Proving that a given formula is true through the Principle of Mathematical Induction.

**Course Competency 10:** The student will demonstrate knowledge of the Binomial Theorem by:

- Numbers / Data
- Critical thinking
- Information Literacy

1. Expanding a binomial using the Binomial Theorem.
2. Finding the nth term of a binomial sequence.
**Course Competency 11:** The student will demonstrate an understanding of the trigonometric functions by:

1. Defining the trigonometric functions in three different ways: as ratios of sides of a right triangle, as functions of an angle in standard position in a Cartesian plane, and as functions of a real number, as represented by an arc length along the unit circle.
2. Finding the domain and range of the trigonometric functions.
3. Graphing the trigonometric functions both with and without transformations.
4. Finding approximate values of the trigonometric functions using a calculator.
5. Finding exact values of select trigonometric functions and their equivalent radians.

- Numbers / Data
- Critical thinking
- Information Literacy

**Course Competency 12:** The student will demonstrate an understanding of the trigonometric functions by:

1. Defining the inverse of trigonometric functions and stating their domains and ranges.
2. Evaluating the inverse of trigonometric functions.

- Numbers / Data
- Critical thinking
- Information Literacy

**Course Competency 13:** The student will demonstrate an understanding of trigonometric identities by:

1. Simplifying trigonometric expressions.
2. Finding exact values of trigonometric functions of sum of angles, differences of angles, double angle, and half-angle formulas.
3. Using fundamental identities and sum of angles, differences of angles, double angle, half-angle, product to sum, and sum to product formulas to establish identities.
4. Using inverse trigonometric functions to solve equations.

- Numbers / Data
- Critical thinking
- Information Literacy
| Course Competency 14: The student will demonstrate an ability to solve trigonometric equations by: | • Numbers / Data  
• Critical thinking  
• Information Literacy |
|---|---|
| 1. Finding all real solutions over a given interval.  
2. Finding all real solutions (general solution) when a specified interval is not given.  
3. Using fundamental identities and sum of angles, differences of angles, double angle, half-angle, product to sum, and sum to product formulas to solve equations. |  |

**Course Competency 15:** The student will demonstrate knowledge of solving triangles by:

| • Numbers / Data  
• Critical thinking  
• Information Literacy |
|---|---|
| 1. Solving right triangles.  

**Course Competency 16:** The student will demonstrate an understanding of complex numbers in trigonometric form by:

| • Numbers / Data  
• Critical thinking  
• Information Literacy |
|---|---|
| 1. Converting a complex number from standard form (a + bi) to trigonometric form and vice versa.  
2. Multiplying and dividing complex numbers in trigonometric form.  
3. Raising complex numbers to positive integer powers using DeMoivre’s Theorem.  
4. Finding the nth complex roots of a complex number. |  |

**Course Competency 17:** The student will demonstrate an understanding of vectors by:

| • Numbers / Data  
• Critical thinking  
• Information Literacy |
|---|---|
| 1. Graphing vectors.  
2. Performing operations with vectors that include adding and subtracting vectors algebraically and geometrically and scalar multiples of vectors.  
3. Resolving vectors into components.  
4. Adding vectors algebraically, both in components form and when expressed as a linear combination. |  |
| Course Competency 18: The student will demonstrate an understanding of parametric equations by: | • Numbers / Data  
• Critical thinking  
• Information Literacy |
|---|---|
| 1. Sketching the graphs of curves defined parametrically.  
2. Finding rectangular equations for curves defined parametrically and vice versa. | |

| Course Competency 19: The student will demonstrate an understanding of polar coordinates by: | • Numbers / Data  
• Critical thinking  
• Information Literacy |
|---|---|
| 1. Converting from rectangular coordinates to polar coordinates and vice versa.  
2. Transforming rectangular equations into polar equations and vice versa.  

| Course Competency 20: The student will demonstrate an understanding of applications of trigonometry by: | • Communication  
• Numbers / Data  
• Critical thinking  
• Information Literacy  
• Social Responsibility |
|---|---|
| 1. Solving applications with arc lengths and areas of circular sectors.  
2. Solving applications with right triangles.  
3. Solving applications with oblique triangles.  
4. Solving applications with vectors. | |