Math 139
Pre-Calculus II: Trigonometry

Course Description
Precalculus II is the study of the trigonometric functions using the unit circle approach and right triangle trigonometry. Topics of study include the following: graphs of trigonometric functions, inverse trigonometric functions, trigonometric identities, applications of trigonometric functions, polar coordinates, complex numbers in the trigonometric form, vectors and parametric equations. Both radian and degree measure will be used.

Illinois Articulation Initiative (IAI) number: N/A

Credit and Contact Hours:
Lecture	**4**
Lab	**0**
Credit Hours	**4**

Prerequisites: Appropriate placement score or minimum grade "C" in MATH 138 or equivalent.

Books, Supplies, and Supplementary Materials

A. **Required Textbooks**
    MyMathLab Direct Digital Access. The eText is included in MyMathLab so if you are comfortable reading the textbook on the computer, you may use the eText alone. **There is no need to purchase a physical textbook for this course; the direct digital access fee for the eText was included in your course fees. Registration instructions are posted in our iCampus/Canvas site.**

B. **Other Required Materials**
    TI-83+ or TI-84+ graphing calculator

C. **Methods of Instruction:**
    Lecture, Hybrid, or Online

General Education Student Learning Outcome
1. Quantitative Literacy: Students possess the ability to reason and solve quantitative problems from an array of contexts.

Course Learning Outcomes (CLOs)
1. Find exact and approximate trigonometric function values of angles.
2. Graph the 6 trigonometric functions with a variety of transformations.
3. Find exact and approximate inverse trigonometric function values.
4. Manipulate trigonometric identities.
5. Solve trigonometric equations.
6. Solve right and oblique triangles.
7. Graph vectors, polar equations, and parametric equations.

Lesson Learning Outcomes (LLOs)

Introduction to Trigonometric Functions
1. Define an angle and explain when angles are positive and negative.
2. Explain when an angle is in standard position and draw angles using degree and radian measure.
3. Convert between angles in degree, minutes, seconds and decimal form.
4. Convert angles between radian measure and degree measure.
5. Determine arc length and the area of the sector.
6. Find the linear speed of an object traveling in a circular motion.
7. Define the six basic trigonometric functions using the unit circle and a circle of radius.
8. Determine the domain, range, and period of the trigonometric functions.
9. Determine the sign of each trigonometric function in each of the four quadrants.
10. Find the trigonometric functions of an angle in terms of a function of its reference angle.
11. Use the fundamental identities to find the exact values of an angle.
12. Determine which of the trigonometric functions are even and which are odd.

Graphs of Trigonometric Functions
13. Draw one cycle of the graphs for the six trigonometric functions giving the properties of the graph.
14. State amplitude, period of variation, and phase shift of trigonometric functions.
15. Graph equations of the form $y = a\sin(bx + c)$, $y = a\cos(bx + c)$, $y = a\tan(bx + c)$, $y = a\csc(bx + c)$, $y = a\sec(bx + c)$, $y = a\cot(bx + c)$, using the graph transformations.
16. Given a sinusoidal graph, find its equation.

Inverse Trigonometric Functions
17. Define the inverse sine, cosine and tangent functions giving the domain and range.
18. Find the exact and approximate values of the inverse sine, cosine and tangent functions.
19. Find the exact value of expressions involving the inverse sine, cosine and tangent functions.
20. Use a calculator to evaluate the inverse secant, cosecant and cotangent functions.

Trigonometric Identities
21. Explain what is meant by an identity equation.
22. Use algebra and the fundamental identities to establish an identity.
23. Establish an identity involving inverse trigonometric functions.
24. Use the sum and difference formulas to find exact values and establish identities
25. Use the double-angle and half-angle formulas to find exact values and establish identities
26. Express products as sums and sums as products using the trigonometric formulas.

Trigonometric Equations
27. Solve equations involving a single trigonometric function.
28. Solve trigonometric equations quadratic in form.
29. Solve trigonometric equations using identities.
30. Solve trigonometric equations linear in sine and cosine.

Applications of Trigonometric Functions
31. Define the six basic trigonometric functions using right triangles.
32. Define the complementary angle theorem.
33. Solve right triangles.
34. Solve oblique triangles using the Law of Sines and the Law of Cosines.
35. Find the area of any triangle using the triangle area formulas.

Polar Coordinates and Equations
36. Plot points using polar coordinates.

37. Find several polar coordinates of a single point.
38. Convert between polar coordinates and rectangular coordinates.
39. Convert between polar equations and rectangular equations.
40. Graph and identify polar equations

Complex Numbers in Trigonometric Form
41. Define the complex plane and demonstrate how to graph complex numbers on the complex plane.
42. Define the magnitude and argument of the complex number.
43. Convert the algebraic form of a complex number to polar form and vice-versa.
44. Find the product and quotient of two complex numbers in polar form.
45. Find the nth power of complex numbers using DeMoivre's Theorem.
46. Find the nth complex roots of a complex number.

Vectors
47. Define a vector and its magnitude and direction.
48. Add, subtract and find the scalar multiples of a vector.
49. State the properties for vector addition, scalar multiplication and the equality of vectors. Write the algebraic vector with the vector components.
50. Find the position vector for any vector.
51. Determine the unit vector in the same direction as a given vector.
52. Write a vector from its direction and magnitude.
53. Determine the dot product of two vectors and state the properties of the dot product.
54. Determine the angle between two vectors.
55. Determine whether two vectors are orthogonal or parallel vectors.

Parametric equations
56. Graph parametric equations
57. Find a rectangular equation for a curve defined parametrically
58. Use time as a parameter in parametric equations
59. Find a parametric equation for curves defined by rectangular equations

Final Course Grading Scale

Grade	Percentage
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	lower than 60%

Faculty Commitment
Faculty members are committed to providing a quality learning experience through thoughtful planning, implementation, and assessment of course activities. They are also committed to being readily available to students throughout the semester by returning e-mails and phone calls within 48 hours and to returning graded course work within a week. Furthermore, they are committed to selecting appropriate course materials and making them available in an organized and timely manner.

Student Commitment
For every credit hour a student is enrolled in, they should expect to spend at least 2 hours outside of class studying, working on assignments, and preparing for class each week of the fifteen-week semester. For example, for this four credit-hour class, students can expect to spend four hours per week in class actively engaged in learning the material by participating in face-to-face classes or viewing lectures and instructional material online. In addition, students should expect to spend

another eight hours per week outside of class completing homework and assignments, posting to discussion boards online, or studying for quizzes and tests. This means students should spend a minimum of 12 hours per week engaged in achieving the learning outcomes for this course. If you are not achieving your desired results in this class, you should consider increasing your prep time outside of class, in addition to using available resources such as instructor office hours and tutoring services.

By registering for this course, you commit yourself to active participation in course activities as well as the submission of all assignments and exams on time. Furthermore, you commit to accessing the course site and checking your JJC e-mail several times a week.