COLLIN COLLEGE EXPANDED GENERIC COURSE SYLLABUS

COURSE INFORMATION

Course Number: MATH 2412
Course Title: Pre-Calculus Math
Credit Hours: 4
Lecture Hours: 3
Lab Hours: 2

Prerequisite
MATH 1314 with a C or better; or equivalent preparation.

Course Description
In-depth combined study of algebra, trigonometry, and other topics for calculus readiness. Lab required.

Textbook/Supplies
Onsite Courses: *Precalculus: Concepts Through Functions*, 5th Edition by Sullivan and Sullivan, Pearson, 2024.

Online Courses: Email your professor for textbook information.

Supplies: Graphing calculator required.

STUDENT LEARNING OUTCOMES (SLO)

Upon completion of this course the students should be able to do the following:

1. Demonstrate and apply knowledge of properties of functions. (Communication)
2. Recognize and apply algebraic and transcendental functions and solve related equations. (Empirical/Quantitative)
3. Apply graphing techniques to algebraic and transcendental functions. (Critical Thinking)
4. Compute the values of trigonometric functions for key angles in all quadrants of the unit circle measured in both degrees and radians. (Empirical/Quantitative)
5. Prove trigonometric identities. (Critical Thinking and Communication)
6. Solve right and oblique triangles. (Empirical/Quantitative)

REQUIRED CORE OBJECTIVES FOR MATHEMATICS

As per the Texas Higher Education Coordinating Board, mathematics students must develop and demonstrate the following three required core objectives:

- Critical Thinking Skills - creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.
- Communication Skills - effective development, interpretation and expression of ideas through written, oral and visual communication.
- Empirical and Quantitative Skills - manipulation and analysis of numerical data or observable facts resulting in informed conclusions.

METHOD OF EVALUATION

Course requirements

Attending class**,** completing homework assignments**,** completing labs, completing required exams, and knowledge of calculator use are all required.

Course format

Lecture, lab, and guided practice.

There will be a minimum of four written exams, a lab component grade, and a comprehensive final exam. Homework and/or quizzes may be used in place of one exam or in addition to exams. The weight of each of these components of evaluation will be specified in the individual instructor's addendum to this syllabus. All out-of-class course credit, including take-home exams, home assignments, service-learning, etc. may not exceed 25% of the total course grade; thus, at least 75% of a student's grade must consist of exams given in the class or testing center, and no student may retake any of these exams. Students are not not allowed a formula sheet or any notecards on exams.

COURSE POLICIES

College-wide policies are pre-loaded into the Concourse Syllabi and are not duplicated in the Expanded Generic Syllabi for each course.

Instructor specific policies should be added to the Concourse Syllabus.

COURSE CONTENT

Proofs and derivations will be assigned at the discretion of the instructor. The student will be responsible for knowing all definitions and statements of theorems for each section outlined in the following modules.

Module 1: Trigonometric Functions

The student will be able to:

1. Convert between decimal and degree, minute, second measures for angles. (SLO 4)
2. Find the length of an arc of a circle. (SLO 2)
3. Convert from degrees to radians and radian to degree measures. (SLO 4)
4. Find the area of a sector of a circle. (SLO 2)
5. Find the linear speed of an object traveling in circular motion. (SLO 2)
6. Find the values of trigonometric functions of acute angles. (SLO 4)
7. Use fundamental identities. (SLO 5)
8. Find the values of the remaining trigonometric functions, given the value of one of them. (SLO 2)
9. Use the Complementary Angle Theorem. (SLO 2)
10. Use a calculator to approximate the values of trigonometric functions of acute angles. (SLO 4)
11. Model and solve applied problems involving right triangles. (SLO 6)
12. Find the exact values of the trigonometric functions for any angle. (SLO 4)
13. Use coterminal angles to find the exact value of a trigonometric function. (SLO 4)
14. Determine the signs of the trigonometric function of an angle in a given quadrant. (SLO 4)
15. Find the reference angle of an angle. (SLO 4)
16. Use a reference angle to find the exact value of a trigonometric function. (SLO 4)
17. Find the exact values of the trigonometric functions of an angle, given information about the functions. (SLO 4)
18. Find the exact values of the trigonometric functions using the unit circle. (SLO 4)
19. Identify the domain and range of trigonometric functions. (SLO 3)
20. Use periodic properties to find the exact values of the trigonometric functions. (SLO 4)
21. Use Even-Odd properties to find the exact values of the trigonometric functions. (SLO 4 & 5)
22. Graph the sine function and functions of the form $y = A\sin(\omega x)$. (SLO 3)
23. Graph the cosine function and functions of the form $y = A\cos(\omega x)$. (SLO 3)
24. Determine the amplitude and period of sinusoidal functions. (SLO 3)
25. Graph sinusoidal functions using key points. (SLO 3)
26. Find an equation for a sinusoidal function from the graph. (SLO 3)
27. Graph the tangent, cotangent, secant, and cosecant functions. (SLO 3)
28. Graph functions of the form $y = A\tan(\omega x) + B$ and $y = A\cot(\omega x) + B$ (SLO 3)
29. Graph functions in the form $y = A\csc(\omega x) + B$ and $y = A\sec(\omega x) + B$ (SLO 3)
30. Graph sinusoidal functions of the form $y = A\sin(\omega x - \phi) + B$ (SLO 3)
31. Build sinusoidal models from data. (SLO 3)

Module 2: Analytic Trigonometry

The student will be able to:

1. Define the inverse sine, cosine, and tangent functions. (SLO 2)
2. Find the value of an inverse sine, cosine, and tangent functions (SLO 2 & 4)
3. Solve equations involving inverse trigonometric functions. (SLO 2)
4. Define the inverse secant, cosecant, and cotangent functions. (SLO 2)

5. Find the value of inverse secant, cosecant, and cotangent functions. (SLO 2 & 4)
6. Find the exact value of composite functions involving the inverse trigonometric functions. (SLO 4)
7. Write a trigonometric expression as an algebraic expression. (SLO 2)
8. Solve equations involving a single trigonometric function. (SLO 2)
9. Solve trigonometric equations quadratic in form. (SLO 2)
10. Solve trigonometric equations using fundamental identities. (SLO 2 & 5)
11. Solve trigonometric equations using a graphing utility. (SLO 2 & 3)
12. Use algebra to simplify trigonometric expressions. (SLO 2)
13. Establish identities. (SLO 5)
14. Use Sum and Difference formulas to find exact values. (SLO 4 & 5)
15. Use Sum and Difference formulas to establish identities. (SLO 5)
16. Use Sum and Difference formulas involving inverse trigonometric functions (SLO 5).
17. Solve trigonometric equations linear in sine and cosine. (SLO 2 & 5)
18. Use Double-Angle formulas to find exact values. (SLO 4 & 5)
19. Use Double-Angle formulas to establish identities. (SLO 5)
20. Use Half-Angle formulas to find exact values. (SLO 4 & 5)
21. Express products as sums (optional) (SLO 5)
22. Express sums as products (optional) (SLO 5)

Module 3: Applications of Trigonometric Functions

The student will be able to:

1. Solve right triangles. (SLO 6)
2. Solve applied problems involving right triangles. (SLO 6)
3. Solve SAA, ASA, and SSA triangles. (SLO 6)
4. Solve applied problems involving SAA, ASA, and SSA triangles. (SLO 6)
5. Solve SAS and SSS triangles. (SLO 6)
6. Solve applied problems involving SAS and SSS triangles. (SLO 6)
7. Find the area of SAS and SSS triangles. (SLO 6)

Module 4: Algebra Topics to Prepare for Calculus

The student will be able to:

1. Solve a system of nonlinear equations using substitution. (SLO 1 & 2)
2. Solve a system of nonlinear equations using elimination. (SLO 1 & 2)
3. Solve polynomial inequalities. (SLO 1)
4. Solve rational inequalities. (SLO 1)
5. Find the difference quotient of a function including radical and rational functions. (SLO 1)
6. Find the composition of three functions including radical and rational functions. (SLO 1)
7. Find components of a composite function. (SLO 1)
8. Simplify radicals. (SLO 1)
9. Rationalize denominators and numerators. (SLO 1)
10. Simplify expressions with rational exponents. (SLO 1)

Module 5: Include at least ONE of the following four topics

Polar Coordinates and Vectors

The student will be able to:

1. Plot polar coordinates. (SLO 3)
2. Convert polar to and from rectangular coordinates. (SLO 3)
3. Transform equations between polar and rectangular. (SLO 3)
4. Identify and graph polar equations. (SLO 3)
5. Plot polar graphs. (SLO 3)
6. Graph vectors. (SLO 3)
7. Find a position vector. (SLO 3)
8. Find a unit vector. (SLO 3)
9. Find the dot product of two vectors. (SLO 3)
10. Find the angle between two vectors. (SLO 3)

Conics

The student will be able to:

1. Analyze parabolas with the vertex at the origin. (SLO 2 & 3)
2. Analyze parabolas with the vertex at (h,k). (SLO 2 & 3)
3. Solve applied problems using parabolas. (SLO 2)
4. Analyze ellipses with the center at the origin. (SLO 2 & 3)
5. Analyze ellipses with the center at (h,k). (SLO 2 & 3)
6. Analyze hyperbolas with the center at the origin. (SLO 2 & 3)
7. Analyze hyperbolas with the center at (h,k). (SLO 2 & 3)

Partial Fractions and the Binomial Expansion Theorem

The student will be able to:

1. Find the partial fraction decomposition of rational expressions for linear and quadratic factors (SLO 1)
2. Evaluate factorials and combinations. (SLO 1)
3. Use the Binomial Expansion Theorem (SLO 2)

Sequences and Series

The student will be able to:

1. List the terms of a general sequence. (SLO 1)
2. Use summation notation. (SLO 1)
3. Find the sum of a sequence. (SLO 1)
4. Determine if a sequence is arithmetic. (SLO 1)
5. Determine if a sequence is geometric. (SLO 1)
6. Find a formal for a geometric sequence. (SLO 1)
7. Find the sum of a geometric sequence. (SLO 1)
8. Determine whether a geometric sequence converges or diverges. (SLO 1)