COLLEGE OF THE DESERT

Course Outline of Record

1. Course Code: MATH-012
2.   a. Long Course Title: Pre-calculus
      b. Short Course Title: PRE-CALCULUS
3.   a. Catalog Course Description:

   This course is the second in a two semester sequence preparing students for Calculus. In this course, students will extend the concept of a function to polynomial, rational, exponential and logarithmic functions as well as studying analytic trigonometry. Topics include recognizing, graphing and solving equations and word problems involving polynomial, rational, exponential and logarithmic functions, trigonometric identities, inverse trigonometric functions, and solving trigonometric equations.

      b. Class Schedule Course Description:

   This course is the second in a two semester sequence preparing students for Calculus. Concepts to be studied include polynomial, rational, exponential and logarithmic functions and analytic trigonometry.

      c. Semester Cycle (*if applicable*): every semester
      d. Name of Approved Program(s):
         • LIBERAL ARTS with emphasis in Math and Science-H AA Degree and Transfer Preparation
4. Total Units: 5.00   Total Semester Hrs: 90.00
   Lecture Units: 5   Semester Lecture Hrs: 90.00
   Lab Units: 0   Semester Lab Hrs: 0
      Class Size Maximum: 35   Allow Audit: No
      Repeatability No Repeats Allowed
      Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
   Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)
   Prerequisite: MATH 005
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
      a. Stewart, J., Redlin, L., Watson, S. (2016). *Precalculus* (7th /e). Pacific Grove, CA Cengage. ISBN: 9781305071759
      College Level: Yes
      Flesch-Kincaid reading level: 12
7. Entrance Skills: *Before entering the course students must be able:*
   a. Apply facts about angles, parallel lines and triangles to deduce further results about a geometric figure.
         • MATH 005 - Apply facts about angles, parallel lines and triangles to deduce further results about a geometric figure.
   b. Prove when two triangles are congruent or similar.
         • MATH 005 - Prove when two triangles are congruent or similar.
   c. Justify the lengths of sides in an isosceles right triangle and in a 30 – 60 – 90 triangle.
         • MATH 005 - Justify the lengths of sides in an isosceles right triangle and in a 30 – 60 – 90 triangle.
   d. Deduce the lengths of sides in quadrilaterals such as trapezoids and rectangles using basic definitions, Pythagorean Theorem, perimeter and/or area.
         • MATH 005 - Deduce the lengths of sides in quadrilaterals such as trapezoids and rectangles using basic definitions, Pythagorean Theorem, perimeter and/or area.
   e. Calculate the measure of a central angle in a circle using the measure of the intercepted arc and calculate the areas of geometric figures involving circles.
         • MATH 005 - Calculate the measure of a central angle in a circle using the measure of the intercepted arc and calculate the areas of geometric figures involving circles.

f. Apply facts about plane geometric figures to deduce the surface area and volume of three dimensional geometric figures.
- MATH 005 - Apply facts about plane geometric figures to deduce the surface area and volume of three dimensional geometric figures.

g. Demonstrate an understanding of the concept of a function by identifying and describing a function graphically, numerically and algebraically.
- MATH 005 - Demonstrate an understanding of the concept of a function by identifying and describing a function graphically, numerically and algebraically.

h. Calculate the domain and range for a function expressed as a graph or an equation. From a graph, estimate the intervals where a function is increasing, decreasing and/or has a maximum or minimum value.
- MATH 005 - Calculate the domain and range for a function expressed as a graph or an equation. From a graph, estimate the intervals where a function is increasing, decreasing and/or has a maximum or minimum value.

i. Use and interpret function notation to find "inputs" and "outputs" from the graph, table and/or an equation describing a function
- MATH 005 - Use and interpret function notation to find "inputs" and "outputs" from the graph, table and/or an equation describing a function

j. From an equation, graph or table, calculate average rates of change by using a difference quotient or by using slopes of secant lines. Analyze average rates of change to determine the concavity of a graph.
- MATH 005 - From an equation, graph or table, calculate average rates of change by using a difference quotient or by using slopes of secant lines. Analyze average rates of change to determine the concavity of a graph.

k. Demonstrate an understanding of the six basic transformations of functions by graphing translated functions including the quadratic functions.
- MATH 005 - Demonstrate an understanding of the six basic transformations of functions by graphing translated functions including the quadratic functions.

l. Determine when a function has an inverse (one to one functions) and find the inverse function graphically or algebraically.
- MATH 005 - Determine when a function has an inverse (one to one functions) and find the inverse function graphically or algebraically.

m. Form new functions through addition, subtraction, multiplication, division and composition.
- MATH 005 - Form new functions through addition, subtraction, multiplication, division and composition.

n. Recognize classical and analytic definitions of the trigonometric functions.
- MATH 005 - Recognize classical and analytic definitions of the trigonometric functions.

o. Solve triangles using right triangle trigonometry, the law of sines and the law of cosines.
- MATH 005 - Solve triangles using right triangle trigonometry, the law of sines and the law of cosines.

p. Convert from radian to degree measure and vice-versa.
- MATH 005 - Convert from radian to degree measure and vice-versa.
- MATH 005 - Convert from radian to degree measure and vice-versa.

q. Graph the 6 trigonometric functions and demonstrate the ability to change parameters and predict corresponding graphic behavior.
- MATH 005 - Graph the 6 trigonometric functions and demonstrate the ability to change parameters and predict corresponding graphic behavior.

r. Use trigonometric functions to model periodic behavior.
- MATH 005 - Use trigonometric functions to model periodic behavior.

s. Recognize the basic features of the graphs of the conic sections (including parabolas, ellipses, circles and hyperbolas) and use those features to graph shifted conics.
- MATH 005 - Recognize the basic features of the graphs of the conic sections (including parabolas, ellipses, circles and hyperbolas) and use those features to graph shifted conics.

t. Analyze independently and set up application problems, thus applying problem solving technique to new situations. Demonstrate the ability to anticipate and check their proposed solutions.
- MATH 005 - Analyze independently and set up application problems, thus applying problem solving technique to new situations. Demonstrate the ability to anticipate and check their proposed solutions.

u. Communicate effectively with the instructor and mathematical community using proper terminology verbally as well as proper written notation.

8. Course Content and Scope:

Lecture:

> 1. POLYNOMIAL AND RATIONAL FUNCTIONS.
> Polynomial functions and their graphs. Dividing polynomials. Rational and irrational zeros of polynomials. Complex zeros and the Fundamental Theorem of Algebra. Rational functions. Modeling: Fitting polynomials to data.
> 2. EXPONENTIAL AND LOGARITHMIC FUNCTIONS.
> Exponential functions. Exponential growth and decay. Logarithmic functions. Graphs of exponential and logarithmic functions. Properties of logarithms. Exponential and logarithmic equations. Modeling with exponential and logarithmic functions. Fitting exponential and power curves to data.
> 3. ANALYTIC TRIGONOMETRY.
> Proofs of trigonometric identities. Addition and subtraction formulas. double-angle, half-angle, and sum-product identities. Inverse trigonometric functions. Solutions of trigonometric equations. Simplifying trigonometric expressions.
> 4. POLAR COORDINATES.
> Polar coordinates. Graphs of polar equations. Polar form of complex numbers; DeMoivre's theorem. Parametric equations.
>
> 5. SYSTEMS OF EQUATIONS AND INEQUALITIES.
> Systems of equations. Systems of linear equations in several variables. Best fit versus exact fit with matrices. Arithmetic of matrices.

Lab: *(if the "Lab Hours" is greater than zero this is required)*

9. Course Student Learning Outcomes:

1. Demonstrate improved mastery of fundamental skills and knowledge from arithmetic, algebra, and geometry introduced in prerequisite courses.
2. Demonstrate problem solving skills in application problems in the areas of algebra, geometry, and trigonometry, with an emphasis on the concept of function.
3. Create, analyze, and interpret graphs of algebraic and trigonometric functions, especially in relation to their real-world analogs.
4. Develop an appreciation for the use of deductive reasoning skills in mathematics, in the context of algebra and trigonometry.

10. Course Objectives: *Upon completion of this course, students will be able to:*

a. Analyze functions and graphs that are described either parametrically, using polar coordinates, or using rectangular coordinates. Demonstrate an understanding of the relationship between different coordinate systems.
b. Apply the properties of equality to solve equations in one variable involving polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric expressions which may involve parameters.
c. Apply the properties of the real numbers to solve inequalities in one variable involving polynomial, rational, root, exponential and trigonometric, and absolute value expressions.
d. Perform arithmetic with the complex numbers and use the complex numbers to completely solve a quadratic equation. Represent complex numbers in both rectangular and polar form and use DeMoivre's theorem to calculate powers and roots of complex numbers.
e. Analyze polynomial functions in one variable using methods such as end behavior analysis, the factor theorem, the remainder theorem, the theorem on rational zeros, Descartes' rule of signs, the intermediate value theorem, division algorithms, conjugate zeros and the fundamental theorem of algebra.
f. Analyze rational functions in one variable by analyzing the polynomials in the numerator and denominator and interpreting these to find domain, range, intercepts, and asymptotes and visualizing these through the construction of a graph.
g. Analyze exponential and logarithmic functions by finding an exponential expression based on essential characteristics such as the growth factor and in terms of domain, concavity, intercepts, asymptotes, transformations, and by visualizing these in the construction of a graph for the function.

h. Demonstrate an understanding of a rich variety of trigonometric identities including the pythagorean identities, addition identities, the double angle identities, the half angle identities, sum to product and product to sum identities by proof and through the application of these identities to solve trigonometric equations and simplify trigonometric expressions.

i. Analyze trigonometric and inverse trigonometric functions in terms of their domain, range, asymptotes, and periodicity, and how these relate to chords, secants and arcs on the unit circle. Demonstrate an understanding of these circular functions by constructing graphs and solving equations.

j. Use Polya's problem solving strategies to solve problems, with an emphasis on the algebraic method with appropriate applications of polynomial, rational, root, exponential, logarithmic, trigonometric and inverse trigonometric expressions.

k. Communicate mathematics effectively using proper terminology in both verbal and written expressions.

l. Apply the properties of equality and the real numbers to solve systems of equations and inequalities. Represent a system of equations using matrix notation and demonstrate an understanding of the arithmetic of matrices.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
  a. Discussion
  b. Lecture
  c. Technology-based instruction
Other Methods:

collaborative quizzes

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
In Class Hours: 90.00
Outside Class Hours: 180.00
  a. Out-of-class Assignments

1. Read textbooks and supplementary assignments.
2. Complete daily assigned homework. Problems include problem solving, and exercises to improve skills and mathematical understanding.

  b. In-class Assignments

1. Attend classroom lectures and take notes.
2. Participate in classroom discussions to review, analyze, diagnose and evaluation various methods of solution used on their homework.
3.Complete examinations involving problems that apply studied principles to new situations.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
  • Written homework
   Homework notebook.
  • Product/project development evaluation
   Short projects
  • Mid-term and final evaluations
   In-class or proctored testing.
  • Student participation/contribution
   Discussion and collaboration.

14. Methods of Evaluating: Additional Assessment Information:

Chapter tests with in-class essay type exam questions, additional assignments as per the direction of the instructor and a comprehensive final exam with essay questions. Assignments and exams involve both performing computational problems and applying skills and ideas to new situations

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*

    IGETC Area 2: Mathematical Concepts and Quantitative Reasoning

       A: Mathematic

    CSU GE Area B: Physical and its Life Forms(mark all that apply)

       B4 - Mathematics/Quantitative Thinking

    PO-BS Critical Thinking

       Assess relevant information and come to thought-out conclusions and solutions.

    PO-BS Quantitative Reasoning

       Practice quantitative reasoning: when is quantitative reasoning appropriate and how can it be applied to simple-life problems.

    IO - Scientific Inquiry

       Analyze quantitative and qualitative information to make decisions, judgments, and pose questions.

    IO - Global Citizenship - Scientific & Technological Literacy

       Utilize quantitative expression in a variety of contexts. These would include units of measurement, visual representations, and scales and distributions.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year

17. Special Materials and/or Equipment Required of Students:

18. Materials Fees: ☐ Required Material?

Material or Item	**Cost Per Unit**	**Total Cost**

19. Provide Reasons for the Substantial Modifications or New Course:

    Fix some typos in course objectives. Clarify language as to the relation between this course and Math 5.

20.   a. Cross-Listed Course *(Enter Course Code)*: *N/A*

       b. Replacement Course *(Enter original Course Code)*: *N/A*

21. Grading Method *(choose one)*: Letter Grade Only

22. MIS Course Data Elements

       a. Course Control Number [CB00]: CCC000324989

       b. T.O.P. Code [CB03]: 170100.00 - Mathematics, General

       c. Credit Status [CB04]: D - Credit - Degree Applicable

       d. Course Transfer Status [CB05]: A = Transfer to UC, CSU

       e. Basic Skills Status [CB08]: 2N = Not basic skills course

       f. Vocational Status [CB09]: Not Occupational

       g. Course Classification [CB11]: Y - Credit Course

       h. Special Class Status [CB13]: N - Not Special

       i. Course CAN Code [CB14]: *N/A*

       j. Course Prior to College Level [CB21]: Y = Not Applicable

       k. Course Noncredit Category [CB22]: Y - Not Applicable

       l. Funding Agency Category [CB23]: Y = Not Applicable

       m. Program Status [CB24]: 1 = Program Applicable

    Name of Approved Program *(if program-applicable)*: *N/A*

    Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
    First Year: 0
    Third Year: 0

24. Resources - Faculty - Discipline and Other Qualifications:
    a. Sufficient Faculty Resources: No
    b. If No, list number of FTE needed to offer this course: *N/A*

25. Additional Equipment and/or Supplies Needed and Source of Funding.
    N/A

26. Additional Construction or Modification of Existing Classroom Space Needed. *(Explain:)*
    N/A

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES
    Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes

28. Originator   Daniel, P Kleinfelter   Origination Date 04/11/17