MATH 48A: PRECALCULUS I

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	5
Hours:	5 lecture per week (60 total per quarter)
Prerequisite:	Intermediate Algebra or equivalent.
Corequisite:	For students who do not meet the prerequisite requirement, concurrent enrollment in MATH 248A or NCBS 448A is required.
Advisory:	Demonstrated proficiency in English by placement via multiple measures OR through an equivalent placement process OR completion of ESLL 125 & ESLL 249; UC credit for MATH 48A, 48B and 48C is limited to a maximum of 7.5 units for the combination or any portion of the series completed.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Area V: Communication & Analytical Thinking
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will model, solve, and interpret applications using linear, quadratic, absolute value, composite, piecewise-defined, power, and radical functions.
- Students will develop conceptual understanding of linear, quadratic, absolute value, composite, piecewise-defined, power, radical and inverse functions. They will demonstrate and communicate this understanding by graphing, analyzing, and transforming these functions and connecting their multiple representations.
- Students will demonstrate the ability to compute, interpret, and apply average rates of change of functions, including linear, quadratic, absolute value, composite, piecewise-defined, power, and radical functions.

Description

Introduction to functions and families of functions, including linear functions, quadratics, power and radical functions, absolute value functions, piece-wise defined functions, transformations of these functions, composition of these functions and their use in solving application problems.

Course Objectives

The student will be able to:

a. Examine the definition of a function and investigate the graph and algebraic representation of a function including linear, quadratic, piece-wise, absolute value, power and radical functions and their inverses.
b. Solve equations and inequalities, including linear, quadratic, absolute value, power and radical in the context of application problems.
c. Solve systems of equations and inequalities.
d. Understand and compute rates of change.
e. Explore and apply transformations to the graphs of relations and functions, including linear, quadratic, absolute value, power and radical functions.
f. Investigate quadratic functions.
g. Investigate power and radical functions and relationship between direct and inverse variation.
h. Apply linear, quadratic, absolute value, piece-wise, power and radical functions to model real world applications.
i. Use technology, such as graphing calculators and/or computer software to assist in solving problems involving any of the topics in (1) through (8) above.
j. Discuss mathematical problems and write solutions in accurate mathematical language and notation.
k. Interpret mathematical solutions.

Course Content

a. Examine the definition of a function and investigate the graph and algebraic representation of a function, including linear, quadratic, piece-wise, absolute value, power and radical functions and their inverses
    i. Define and evaluate functions, including linear, quadratic, piece-wise, absolute value, power and radical functions
        1. Determine a relation vs. a function
        2. Explain how a function is a process or a correspondence
        3. Write and interpret functions using function notation
    ii. Explore symbolic, numeric, graphical and verbal forms of a function
        1. Determine if a graph or table of data represents a function
        2. Be able to convert words representing function relationships into symbolic and graphical representations
        3. Translate functions given in equations, tables and graphs into words
        4. Create and use basic function formulas to model real-word situations
    iii. Determine and interpret the domain and range of a function, including linear, quadratic, piece-wise, absolute value, power and radical functions
        1. Be able to find the practical domain and range of a function when applied to a real-life situation
    iv. Determine and interpret the horizontal and vertical intercepts of a function
    v. Graph functions, including vertices and intercepts, on the rectangular coordinate system
    vi. Inverse functions
        1. Explain the relationship between a function and its inverse
        2. Understand and be able to determine one-to-one functions
        3. Explore the relationship between the graph of a function and its inverse
        4. Investigate the relationship between the domain and range of a function and its inverse

5. Explain and use inverse function notation to solve real-world problems
6. Find the inverse of a function from a graph or equation
7. Interpret the practical meaning of an inverse function when applied to a real-life situation

vii. Algebra of functions
1. Combine functions
2. Compose functions

b. Solve equations and inequalities, including linear, quadratic, absolute value, power and radical in the context of application problems
i. Solve equations for a given variable
ii. Interpret solutions
iii. Solve inequalities algebraically and graphically

c. Solve systems of equations and inequalities
i. Solve systems of equations and inequalities algebraically and graphically
ii. Interpret solutions

d. Understand and compute rates of change
i. Calculate average rate of change from a table, graph and an equation
ii. Understand the implications of a function that has a constant rate of change
iii. Understand the implications of a function that has a variable rate of change
iv. Determine if a function is increasing and decreasing from a table or a graph
v. Determine the concavity of a function from a table or graph
vi. Interpret the meaning of an average rate of change in the context of a situation

e. Explore and apply transformations to the graphs of relations and functions, including linear, quadratic, absolute value, power and radical functions
i. Identify and graph the change in a function that results in a vertical or horizontal shift
ii. Identify and graph the change in a function that results in a horizontal or vertical reflection
iii. Identify and graph the change in a function that results in a vertical stretch or compression
iv. Identify and graph the change in a function that results in a horizontal stretch or compression
v. Be able to recognize the change in a graph of a function when a combination of transformations is applied
vi. Understand the impact a transformation has on the average rate of change of a function
vii. Understand the concept of symmetry of functions
viii. Be able to determine if a function is even, odd, or neither

f. Investigate quadratic functions
i. Recognize the relationship between a quadratic equation and its graph
ii. Construct and use quadratic models to predict results and interpret the findings in a real-world context
iii. Express quadratic functions in vertex, standard, and factored form
iv. Determine the vertex, horizontal and vertical intercepts of a quadratic function from its formula or graph
v. Identify relative maxima and minima as vertices
vi. Use the quadratic formula to solve real-world problems
vii. Investigate applications, such as:
1. Projectile motion
2. Free fall
3. Area
4. Quadratic economic models

g. Investigate power and radical functions and relationship between direct and inverse variation
i. Draw and recognize graphs of:
1. Power functions y = f(x) = a*x^b, where b is any real-number value
2. Root functions y=f(x)=x^(1/n), where n is an positive integer
ii. Investigate applications involving direct and inverse variation, such as:
1. Hooke's law
2. Intensity of illumination or radio waves
3. Length and period of a pendulum
4. Gravitational force
5. Distance, constant velocity, and time

h. Apply linear, quadratic, piece-wise, absolute value, power and radical functions to model real world applications
i. Create an appropriate model from a verbal description or graph
ii. Use chosen models to solve application problems
iii. Interpret solutions

i. Use technology, such as graphing calculators and/or computer software to assist in solving problems involving any of the topics in (1) through (8) above
i. Calculator/computer utilities for evaluating problems involving optimization
ii. Calculator/computer utilities for finding intersection points for graphs of two functions
iii. Calculator/computer utilities for finding zeros or roots of functions

j. Discuss mathematical problems and write solutions in accurate mathematical language and notation
i. Application problems from other disciplines
ii. Proper notation

k. Interpret mathematical solutions
i. Explain the significance of solutions to application problems

Lab Content

Not applicable.

Special Facilities and/or Equipment

1. Access to graphing technology, such as a graphing calculator or graphing software
2. When taught hybrid:
a. Internet access
b. Course management system
c. Specific software related to the course

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Homework
Quizzes

Exams
Proctored comprehensive final exam

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Discussion
Cooperative learning exercises

Representative Text(s) and Other Materials

Stewart, Redlin, and Watson. Precalculus: Mathematics for Calculus with Corequisite Support, 7th ed.. 2020.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

a. Homework problems covering subject matter from text and related material ranging from 30-60 problems per week. Students will need to employ critical thinking in order to complete assignments.
b. Reading and study of the textbook, related materials and notes.
c. Student projects covering subject matter from textbook and related materials. Projects will require students to discuss mathematical problems, write solutions in accurate mathematical language and notation and interpret mathematical solutions. Projects may require the use of a computer algebra system, such as Mathematica or MATLAB.
d. Worksheets: Problems and activities covering the subject matter. Such problems and activities will require students to think critically. Such worksheets may be completed inside and/or outside of class.

Discipline(s)

Mathematics