NC 227B: INTEGRATED MATH IIB

Citrus College Course Outline of Record

Heading	Value
Effective Term:	Fall 2022
Credits:	0
Total Contact Hours:	60
Lecture Hours :	60
Lab Hours:	0
Hours Arranged:	0
Outside of Class Hours:	120
Prerequisite:	Placement by high school counselor or math placement exam.
Transferable to CSU:	No
Transferable to UC:	No
Grading Method:	Non-Credit Course

Catalog Course Description

The focus of the Mathematics II course is on quadratic expressions, equations, and functions, comparing their characteristics and behavior to those of linear and exponential relationships from Mathematics I. This course includes standards from the conceptual categories of Number and Quantity, Algebra, Functions, Geometry, Statistics and Probability. Students will be focusing on five key elements: (1) extend the laws of exponents to rational exponents; (2) compare key characteristics of quadratic functions with those of linear and exponential functions; (3) create and solve equations and inequalities involving linear, exponential, and quadratic expressions; (4) extend work with probability; and (5) establish criteria for similarity of triangles based on dilations and proportional reasoning. 60 lecture hours.

Course Objectives

- Make sense of problems and persevere in solving them.
- Analyze givens, constraints, relationships, and goals.
- Make sense of quantities and their relationships in problem situations.
- Create a coherent representation of the problem at hand.
- Make conjectures and build a logical progression of statements to explore the truth of their conjectures.
- Compare the effectiveness of two plausible arguments.
- Distinguish correct logic or reasoning from that which is flawed using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. \\n
- Communicate precisely with others.
- Calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.

Major Course Content

1. Number and Quantity
    a. The Real Number System
2. Extend the properties of exponents to rational exponents.
    a. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define to be the cube root of 5 because we want to hold, so must equal 5.
    b. Rewrite expressions involving radicals and rational exponents using the properties of exponents
        i. Use properties of rational and irrational numbers.
3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
    a. The complex number system
        i. Perform arithmetic operations with complex numbers.
4. Know there is a complex number i such that = –1, and every complex number has the form a + bi with a and b real.
5. Use the relation = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
    a. Use complex numbers in polynomial identities and equations.
6. Solve quadratic equations with real coefficients that have complex solutions.
7. Extend polynomial identities to the complex numbers. For example, rewrite as (x + 2i) (x – 2i).
8. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
    a. Algebra
        i. See the structure of expressions
            1. Interpret the structure of expressions.
9. Interpret expressions that represent a quantity in terms of its context.
    a. Interpret parts of an expression, such as terms, factors, and coefficients.
    b. Interpret complicated expressions by viewing one or more of their parts as a single entity. [For example, interpret as the product of P and a factor not depending on P.]
10. Use the structure of an expression to identify ways to rewrite it. For example, see as , thus recognizing it as a difference of squares that can be factored as .
    a. Write expressions in equivalent forms to solve problems
11. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
    a. Factor a quadratic expression to reveal the zeros of the function it defines.
    b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
    c. Use the properties of exponents to transform expressions for exponential functions. For example, the expression 1.15t can be rewritten as to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
        i. Arithmetic with Polynomials and Rational expressions
            1. Perform arithmetic operations on polynomials
12. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials
    a. Create equations that describe numbers or relationships (linear, absolute value, exponential, and piecewise)
        i. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems.

Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

ii. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

iii. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

b. Reasoning with Equations and Inequalities

i. Solve equations and inequalities in one variable (quadratics)

13. Use the method of completing the square to transform any quadratic equation in x into an equation of the form that has the same solutions. Derive the quadratic formula from this form.
14. Solve quadratic equations by inspection (e.g., for), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.
15. Functions
    a. Interpret functions that arise in applications in terms of the context (Quadratic)
    b. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries.
    c. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
    d. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
    e. Analyze functions using different representations (linear, exponential, quadratic, absolute value, step, piecewise-defined)
    f. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
16. Graph linear and quadratic functions and show intercepts, maxima, and minima.
17. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
    a. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
18. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
19. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions and classify them as representing exponential growth or decay.
    a. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
    b. Build a function that models a relationship between two quantities (Quadratic and Exponential)
    c. Write a function that describes a relationship between two quantities.
20. Determine an explicit expression, a recursive process, or steps for calculation from a context.
21. Combine standard function types using arithmetic operations.
    a. Build new functions from existing functions (Quadratic and Absolute Value)
    b. Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
    c. Find inverse functions.
22. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =.
    a. Linear, Quadratic and Exponential Models
    b. Construct and compare linear and exponential models and solve problems
23. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
    a. Interpret expressions for functions in terms of the situation they model
    b. Apply quadratic functions to physical problems, such as the motion of an object under the force of gravity
    c. Trigonometric Functions
    d. Prove the Pythagorean identity
    e. Identify given an angle and a quadrant

Examples of Required Writing Assignments

When looking at inverse functions, students will be asked to write an explanation on: 1) How they get from the red graph (original) to the blue graph (inverse); 2) How is the line y = x (green) used to find the inverse? 3) Think back to Integrated 1 and describe in words what the vertical line test tells you about a graph.

Examples of Outside Assignments

There will be homework given on a daily basis along with some performance tasks that will need additional time outside of class.

Instruction Type(s)

Lecture, Online Education Lecture