

MA 109 (UK Course)

MA 109 College Algebra (3)

Course Description: Selected topics in algebra. Develops manipulative algebraic and mathematical reasoning required for further study in mathematics. Includes brief review of basic algebra, quadratic formula, systems of linear equations, introduction to functions and graphing. This course is not available for credit to persons who have received credit in any mathematics course of a higher number with the exceptions of MA 112, 123, 162, 201 and 202. Credit not available on the basis of special examination.

Prerequisites: Two years of high school algebra and a Math ACTE score of 21 or above or a Math SAT score of 510 or above; or MA 108R; or appropriate score on the math placement test.

Course Outline:

- I. Equations and Inequalities
 - A. Linear
 - 1. Solve linear inequalities.
 - 2. Review linear equations in two variables
 - a) graph, slope, equation of a line
 - b) parallel and perpendicular lines
 - B. Quadratic
 - 1. Solve quadratic equations
 - a) by factoring
 - b) by quadratic formula
 - c) by square root property
 - 2. Solve quadratic inequalities
 - C. Other
 - 1. Solve absolute value equations.
 - 2. Solve rational equations.
 - 3. Solve radical equations.
 - 4. Solve exponential equations
 - 5. Solve logarithmic equations
 - D. Applications
 - 1. Solve problems involving exponential growth and decay.
 - 2. Solve problems involving logarithmic functions.
 - E. Systems
 - 1. Solve systems of linear equations.
 - 2. Solve systems of non-linear equations.
- II. Functions (Linear, Absolute Value, Quadratic, Polynomial, Rational, Radical, Exponential, and Logarithmic)
 - A. Definition and characteristics of functions
 - 1. Identify a function from its graph, using the vertical line test.
 - 2. Understand function notation.
 - 3. Evaluate functions at given values or expressions.
 - 4. Determine the domain and range.
 - a) From the graph of a function
 - b) From its algebraic equation
 - 5. Determine the symmetry (y -axis, x -axis or origin) of a function or a relation from its graph.
 - 6. Find intervals where a function increases, decreases, or is constant from its graph.
 - 7. Find maximum and minimum function values from the graph of a function.

- B. Graphs of functions and relations
1. Know the basic graphs.
 $y = x$; $y = x^2$; $y = x^3$; $y = \sqrt{x}$; $y = \sqrt[3]{x}$; $y = |x|$; $y = \frac{1}{x}$; $y = \frac{1}{x^2}$; $y = \log_a x$; $y = a^x$
 2. Perform transformations on the basic graphs.
 - a) Vertical shifts
 - b) Horizontal shifts
 - c) Reflections
 - i) Across the y-axis
 - ii) Across the x-axis
 3. Graph piecewise-defined functions involving the basic graphs.
 4. Analyze the equation of a quadratic relation and sketch its graph.
 - a) Opens up/down
 - b) Vertex, using the vertex theorem
 - c) X- and y-intercepts
 - d) Axis of symmetry
 - e) Maximum or minimum function value
 5. Analyze the equation of a polynomial function and sketch its graph.
 - a) From factored form
 - i) X- and y-intercepts
 - ii) End behavior
 - iii) Multiplicity and root behavior
 - b) From standard form
 - i) Synthetic division
 - ii) Rational root theorem
 - iii) Real zeros
 6. Analyze the equation of a rational function and sketch its graph.
 - a) X- and y-intercepts
 - b) Horizontal and vertical asymptotes
 - c) Holes
 7. Analyze the equations of logarithmic and exponential functions and sketch their graphs.
 - a) X- or y-intercept
 - b) Horizontal or vertical asymptote
- C. Operations on functions
1. Recognize the notation indicating addition, subtraction, multiplication, division, and composition of functions.
 2. Find the function value of a sum, difference, product, quotient, and composition of functions.
 3. Find the sum, difference, product, quotient, and composition of functions algebraically.
 4. Find the domain of the sum, difference, product, quotient, and composition of functions.
 5. Find a decomposition of a function.
- D. Inverse functions
1. Determine if a function is one-to-one using the horizontal line test.
 2. Find the inverse of a one-to-one function algebraically.
 3. Sketch the graph of a function and its inverse on the same coordinate axes and recognize that the function and its inverse are symmetric across $y = x$.
 4. Find the domain and range of a function and its inverse.
 5. Verify that two functions are inverses using composition.