

Math 141 Challenge Exam Information
Mathematics Department
San Diego Miramar College

Do not attempt the Math 141 Challenge Exam unless you are confident that you can successfully answer questions regarding the following topics.

- Define and distinguish between higher order polynomial functions and non-polynomial functions and relations, and analyze the graphs of functions by determining their domains and ranges.
- Analyze properties of functions and their graphs, including symmetries, increasing and decreasing intervals and their end behavior asymptotes.
- Prove algebraically and justify graphically when a function is one-to-one.
- Graph a variety of algebraic, rational, exponential, logarithmic, and trigonometric functions, and where applicable, use rigid and non-rigid transformations, intercepts and asymptotes.
- Perform algebraic operations on various functions including composition of functions, and determine the domain of the resulting function.
- Calculate the inverse of a one-to-one function, determine the domain and range of the inverse and describe the relation between their graphs.
- Solve equations and application problems involving exponential and logarithmic functions.
- Simplify difference quotients involving a variety of functions including polynomial, rational, trigonometric, exponential, and logarithmic functions.
- Apply a variety of root finding theorems and tests in order to factor polynomials or solve polynomial equations whose degree is higher than quadratic.
- Simplify rational expressions and expressions involving radicals that arise from calculus operations, such as those from the product or quotient rules.
- Determine the partial fraction decomposition of rational functions.

- Define, evaluate, describe and graph all trigonometric and inverse trigonometric functions, and solve equations involving these functions.
- Derive and prove fundamental trigonometric identities including the sum, difference, double and half angle identities.
- Apply the laws of sines and cosines in solving oblique triangles and in application problems.
- Represent complex numbers in standard, trigonometric and exponential forms and perform arithmetic operations with each.
- Perform algebraic operations involving matrices.
- Apply matrices in solving linear systems of equations.
- Compute the determinant of a square matrix, and apply determinants to various applications.
- Apply vector algebra to problems involving vector quantities.
- Perform the vector operations of the dot product and the cross product, and formulate their geometric interpretations.
- Analyze, identify, and graph the four conic sections.
- Solve systems of non-linear equations and inequalities, including those involving conic sections.
- Define and analyze sequences and series, including arithmetic and geometric sequences and series, find the sum of finite and infinite geometric series.
- Apply the binomial theorem to expand powers of binomial expressions.
- Prove elementary mathematical statements using the principle of Mathematical Induction.