

North Carolina School of Science and Mathematics

Mathematics Placement Guidelines

On Welcome Day, students will be given a mathematics placement test. This test determines the math course each NCSSM student will take during the first term at NCSSM. The placement test that you take will be determined by the math course you are currently taking and the course that normally follows that course at your high school.

- If you are currently enrolled in an Algebra I course or Geometry course and the course that normally follows it at your high school is Geometry or Algebra II, then you will take an Algebra II placement test.
- If you are currently enrolled in an Algebra II or Algebra III course and the course that normally follows it at your high school is Precalculus, Advanced Math, or IB level II mathematics, then you will take a Precalculus placement test.
- If you are currently enrolled in a Precalculus or Advanced Math course and the course that normally follows it at your high school is Calculus, then you will take a Calculus placement test.
- If you have completed AP Calculus, you will not take a placement test, but will complete forms about your math background and you will complete a diagnostic test to help us assess your math background during the placement time slot.
- If you are enrolled in Integrated Math II then you will take the Algebra II placement test.
- If you are enrolled in Integrated Math III then you will take the Precalculus placement test.
- If you are enrolled in Integrated Math IV then you will take the Calculus placement test. If you are enrolled in IB Mathematics HL or Further Mathematics SL, bring a copy of your course syllabus to Welcome Day so that you can take the appropriate placement test.
- If none of the above situations applies to you, then the appropriate placement test for you to take will be determined individually.

To do your best on the placement test you take, you should study your text and notes from the course in which you are currently enrolled or which you took most recently. This test is important to the mathematics work of each student who enrolls at NCSSM. Please take time to prepare for it. Your placement in mathematics at NCSSM will be based on your score on the appropriate placement test. On the following pages are lists of topics covered on the Precalculus placement test and the Calculus placement test.

BRING A CALCULATOR YOU ARE COMFORTABLE USING TO THE PLACEMENT TEST ON NCSSM'S WELCOME DAY. WE WILL NOT HAVE CALCULATORS TO LOAN.

This information is also on the NCSSM web page, www.ncssm.edu under the Mathematics Department.

Topics covered on the NCSSM Precalculus Placement Test (to place into Precalculus next year).

Bring your calculator to the mathematics placement test on NCSSM's Welcome Day.

- Function notation: Evaluating functions at different numeric values. Simplifying functions evaluated at different expressions, such as simplifying $f(2a + b)$ when $f(x)$ is given.
- Function domain: Determining the domain of a function from a graph or from an algebraic expression.
- Linear functions: Determining the equation for a line when given sufficient information, including slope and intercept, slope and a point on the line, two points on the line. Predicting y -values from given x -values and *vice-versa*. Approximating the equation of a line given a graph. Knowing the relationship between slopes of parallel or perpendicular lines.
- Quadratic functions: Identifying characteristics of quadratic functions (*e.g.*, vertex, x - and y -intercepts). Graphing quadratic functions. Rewriting quadratic expressions in different forms (factored form, “standard form”— $Ax^2 + Bx + C$, vertex form). Solving quadratic equations.
- Radical expressions: Simplifying radical expressions. Rationalizing the numerator or denominator of a fraction (possibly using conjugates).
- Rational expressions: Adding, subtracting, multiplying, and dividing fractions whose numerator and/or denominator may contain variables.
- Inequalities: Simplifying inequalities. Solving linear inequalities and writing solution sets using appropriate notation (*e.g.*, interval notation or set notation). Solving linear inequalities involving absolute value.
- Rational exponents: Multiplying, dividing, adding and subtracting expressions containing rational exponents. Writing rational exponents in radical form or *vice-versa*.
- Rules of exponents: Symbolic manipulation of exponential forms, such as x^{a+b} , $(x^r)^s$, $\frac{t^p}{t^q}$, *etc.*
- Solving equations: Solving a single linear equation. Solving systems of linear equations. Solving an equation for a single variable when the equation contains more than one variable. Solving equations containing quadratic expressions, rational expressions, or radical expressions.
- Problems in context: Translating “word problems” into appropriate algebraic problems. Interpreting graphs representing real quantities or real data. Creating graphs to represent the relationship between two real quantities.
- Using technology: Using a graphing calculator to produce graphs of functions, tables, and scatterplots of data.

During the placement test, you may use any calculator you have brought with you and with which you are comfortable. Bring your calculator to the math placement test.

This information is also on the NCSSM web page, www.ncssm.edu under the Mathematics Department.

Topics covered on the NCSSM Calculus Placement Test (to place into Calculus next year).

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Students taking the calculus placement test should be able to solve problems involving the topics in the list for the NCSSM Pre-Calculus Placement Test, and such problems may appear on the calculus placement test. Additional topics covered on the calculus placement test are:

- Functions: Determining domain *and* range of a function from an algebraic expression or a graph. Determining the inverse of a function, including its domain.
- Function composition: Simplifying $f \circ g(x)$ (i.e., $f(g(x))$) when $f(x)$ and $g(x)$ are given. Finding the domain of $f \circ g$. Recognizing when a function is a composition of other functions (e.g. $h(x) = \sqrt{\sin(3x)}$ can be written as $f(g(x))$ where $f(x) = \sqrt{x}$ and $g(x) = \sin(3x)$).
- Logarithms: Knowing rules of logarithms (any base, including the natural logarithm) and knowing how to use them appropriately. (e.g., $\ln(ab) = \ln a + \ln b$, $\log(x^y) = y \log x$, etc.) Solving equations involving logarithms. Simplifying logarithmic expressions. Graphing logarithmic functions.
- Exponential functions: Graphing exponential functions given sufficient information (e.g., two known points, one known point and a growth/decay rate). Solving equations involving exponential functions.
- Trigonometric functions: Determining characteristics of sine, cosine, and tangent functions, including domain, range, period, amplitude, and phase shift (horizontal shift). Creating graphs of trigonometric functions from equations and *vice-versa*. Solving equations involving trigonometric functions, giving all real solutions. Determining characteristics of the *inverse* functions of the trigonometric functions. Understanding right-triangle definitions of sine and cosine as well as unit circle definitions of sine and cosine.
- Function transformations: Recognizing vertical and horizontal translations (shifts) of functions and horizontal and vertical compressions/stretchings of functions. Given a graph of $f(x)$, producing a graph of $f(x+k)$, $f(x)+k$, $f(kx)$, $kf(x)$, or a combination of these, such as $a \cdot f(bx+c) + d$. Given a graph of a linear transformation of a function f , producing an expression for the graph in terms of $f(x)$.
- Function compositions: Given a graph of $f(x)$, producing a graph of the following functions:
 $\frac{1}{f(x)}$, $\sqrt{f(x)}$, $\log(f(x))$, $|f(x)|$, $f(|x|)$, $e^{f(x)}$.
- Systems of equations: Solving systems of equations of which one or more may be non-linear.
- Using technology: Using a graphing calculator to manipulate data lists; e.g., linearizing non-linear data by log-log or semi-log transformations, etc.

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