

2016–2017 NC Final Exams of Advanced Functions and Modeling and Precalculus North Carolina Assessment Specifications

Purpose of the Assessments

- NC Final Exams were developed to replace locally developed assessments, providing teachers and principals with a common measure for all students state-wide during a given testing window. NC Final Exam scores (along with any other relevant end-of-course or end-of-grade assessment scores) will be used in the Educational Value Added Assessment System (EVAAS) to produce student growth measures.
- North Carolina’s Final Exams for Advanced Functions and Modeling and Precalculus will measure students’ academic progress in the 2003 [North Carolina Standard Course of Study](#).
- NC State Board of Education policy [GCS-A-016](#) directs schools to use the results from all course-specific NC Final Exams as a minimum of 20% of the student’s final course grade.
- NC Final Exams will not be used for school and district accountability under the READY Accountability Model or for federal reporting purposes.

Developing Assessments

- North Carolina educators were recruited and trained to write new items for the NC Final Exams. The diversity among the item writers and their knowledge of the current standards was addressed during recruitment. Trained North Carolina educators also review items and suggest improvements, if necessary. The use of North Carolina educators to develop and review items strengthens the instructional validity of the items.
- For an in-depth explanation of the test development process see State Board policy [GCS-A-013](#) or reference the [Test Development Process: Item, Selection and Form Development](#) (Updated May 2016).

Curriculum and Assessment Cycle

- 2003: North Carolina State Board of Education adoption of the [Standard Course of Study](#).
- 2012–13: Operational administration of the Measures of Student Learning: Common Exams.
- 2013–14: Redesign and subsequent first operational administration of the NC Final Exams.
- 2014–15: Second operational administration of the NC Final Exams.
- 2015–16: Third operational administration of the NC Final Exams.
- 2016–17: Fourth operational administration of the NC Final Exams.

Prioritization of Standards

□ Members of the Test Development section of the North Carolina Department of Public Instruction (NCDPI) invited teachers to collaborate and develop recommendations for a prioritization of the standards indicating the relative importance of each standard, the anticipated instructional time, and the appropriateness of the standard for multiple-choice item format.

□ Tables 1 and 2 describe the range of total items that will appear on the NC Final Exams. The exams will consist of only multiple-choice items. Each item is worth one point.

*Table 1. Test Specification Weights for the **Advanced Functions and Modeling NC Final Exam***

2003 Standard Course of Study	Range of Total Items
Data Analysis and Probability	
1.01, 1.02	12% to 18%
1.03	27% to 32%
Algebra	
2.01, 2.04, 2.05	35% to 45%
2.02, 2.03	11% to 15%
Total	100%

*Table 2. Test Specification Weights for the **Precalculus NC Final Exam***

2003 Standard Course of Study	Percent of Total Score Points
Numbers and Operations	
1.01, 1.03	4% to 6%
1.02	8% to 12%
Geometry and Measurement	
2.01, 2.05	22% to 26%
2.02, 2.04, 2.07, 2.08	54% to 60%
2.03, 2.06	4% to 7%
Total	100%

Cognitive Rigor

The Advanced Functions and Modeling and Precalculus items were aligned to the content standards using Marzano's *Thinking Skill Levels*.

Types of Items and Supplemental Materials

□ The NC Final Exams for Advanced Functions and Modeling and Precalculus consist of four-response-option multiple-choice items.

□ A complete list of the supplemental test materials (i.e., *NC Final Exams Materials List*) may be reviewed at <http://www.ncpublicschools.org/accountability/common-exams/>. Students must be provided a graphing calculator and a state-provided formula sheet. Students taking math NC Final Exams must be provided with graph paper and blank paper.

□ Released items are available on the [NCDPI/Accountability Services](#) website. Released items may be used by school systems to help acquaint students with items. The released items may not reflect the breadth of the standards assessed and/or the range of item difficulty found on the NC Final Exam. These materials must not be used for personal or financial gain. The released items are also available to schools through NCTest, the NCDPI’s online assessment platform.

□ Schools must ensure every student participating in an online assessment for the North Carolina Testing Program completes the Online Assessment Tutorial for the associated assessment at least once at the school before test day. The tutorial provides students the opportunity to practice the mechanics of navigating through the testing platform, to become familiar with the tools, and to respond to the sample items. Refer to the [North Carolina Test Coordinators’ Policies and Procedures Handbook](#) (PDF pages 14, 42, 103) for additional information.

Testing Structure and Test Administration Time

□ The NC Final Exam of Advanced Functions and Modeling contains 37 items. The NC Final Exam of Precalculus contains 34 items. Included in the total item counts are embedded multiple-choice field test items that will not count toward the students score but will be used for purposes of developing items for future test forms.

NC Final Exam 2016-17	Number of Operational Items	Number of Field Test Items*	Total Number of Items
Advanced Functions and Modeling	33 multiple-choice	4 multiple-choice	37
Precalculus	30 multiple-choice	4 multiple-choice	34

*Field test items will not count toward the students score but will be used for purposes of developing items for future test forms.

□ Students will be given 120 minutes to answer all items.

□ Appendices A–B show the number of operational items for each standard for the 2016–17 tests. Note that future coverage of standards could vary within the constraints of the content category weights in *Tables 1 and 2*.

Test Cycle and Delivery Mode

□ The NC Final Exams are administered to students enrolled in fall and spring courses. A list of course codes that align with the 2016–17 NC Final Exams (i.e., *Course Codes that Align with the NC Final Exams*) is available on the [NCDPI/Accountability Services](#) website.

□ The NC Final Exams are administered through NCTest, the NCDPI’s online assessment platform. Paper editions are available.

□ The NC Final Exams are only provided in English. Native language translation versions are not available.

Appendix A
Advanced Functions and Modeling NC Final Exam 2016–17
Number of Operational Items by Objective

The following table shows the number of operational items for each objective. Note that future coverage of objectives could vary within the constraints of the test specification weights in *Tables 1-2*. Some objectives not designated with tested items (i.e., “–”) may be a prerequisite objective, may be tested within the context of another objective or may be included as an embedded field test item.

<u>Advanced Functions and Modeling Objective</u>	Number of Operational Items per Objective
Competency Goal 1: The learner will analyze data and apply probability concepts to solve problems.	
1.01.a—Create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, and logarithmic functions of bivariate data to solve problems. a) Interpret the constants, coefficients, and bases in the context of the data.	1
1.01.b—Create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, and logarithmic functions of bivariate data to solve problems. b) Check models for goodness-of-fit; use the most appropriate model to draw conclusions and make predictions.	1
1.02.a—Summarize and analyze univariate data to solve problems. a) Apply and compare methods of data collection.	–
1.02.b—Summarize and analyze univariate data to solve problems. b) Apply statistical principles and methods in sample surveys.	–
1.02.c—Summarize and analyze univariate data to solve problems. c) Determine measures of central tendency and spread.	1
1.02.d—Summarize and analyze univariate data to solve problems. d) Recognize, define, and use the normal distribution curve.	2
1.02.e—Summarize and analyze univariate data to solve problems. e) Interpret graphical displays of univariate data.	1
1.02.f—Summarize and analyze univariate data to solve problems. f) Compare distributions of univariate data.	–
1.03.a—Use theoretical and experimental probability to model and solve problems. a) Use addition and multiplication principles.	1
1.03.b—Use theoretical and experimental probability to model and solve problems. b) Calculate and apply permutations and combinations.	3
1.03.c—Use theoretical and experimental probability to model and solve problems. c) Create and use simulations for probability models.	1

1.03.d—Use theoretical and experimental probability to model and solve problems. d) Find expected values and determine fairness.	3
1.03.e—Use theoretical and experimental probability to model and solve problems. e) Identify and use discrete random variables to solve problems.	2
1.03.f—Use theoretical and experimental probability to model and solve problems. f) Apply the Binomial Theorem.	–
Competency Goal 2: The learner will use functions to solve problems.	
2.01.a—Use logarithmic (common, natural) functions to model and solve problems; justify results. a) Solve using tables, graphs, and algebraic properties.	3
2.01.b—Use logarithmic (common, natural) functions to model and solve problems; justify results. b) Interpret the constants, coefficients, and bases in the context of the problem.	3
2.02.a—Use piecewise-defined functions to model and solve problems; justify results. a) Solve using tables, graphs, and algebraic properties.	2
2.02.b—Use piecewise-defined functions to model and solve problems; justify results. b) Interpret the constants, coefficients, and bases in the context of the problem.	1
2.03.a—Use power functions to model and solve problems; justify results. a) Solve using tables, graphs, and algebraic properties.	2
2.03.b—Use power functions to model and solve problems; justify results. b) Interpret the constants, coefficients, and bases in the context of the problem.	–
2.04.a—Use trigonometric (sine, cosine) functions to model and solve problems; justify results. a) Solve using tables, graphs, and algebraic properties.	–
2.04.b—Use trigonometric (sine, cosine) functions to model and solve problems; justify results. b) Create and identify transformations with respect to period, amplitude, and vertical and horizontal shifts.	3
2.04.c—Use trigonometric (sine, cosine) functions to model and solve problems; justify results. c) Develop and use the law of sines and the law of cosines.	–
2.05.a—Use recursively-defined functions to model and solve problems. a) Find the sum of a finite sequence.	1
2.05.b—Use recursively-defined functions to model and solve problems. b) Find the sum of an infinite sequence.	1
2.05.c—Use recursively-defined functions to model and solve problems. c) Determine whether a given series converges or diverges.	1
2.05.d—Use recursively-defined functions to model and solve problems. d) Translate between recursive and explicit representations.	–

Appendix B
Precalculus NC Final Exam 2016–17
Number of Operational Items by Objective

The following table shows the number of operational items for each objective. Note that future coverage of objectives could vary within the constraints of the test specification weights in *Tables 1-2*. Some objectives not designated with tested items (i.e., “–”) may be a prerequisite objective, may be tested within the context of another objective or may be included as an embedded field test item.

<u>Precalculus Objective</u>	Number of Operational Items per Objective
Competency Goal 1: The learner will describe geometric figures in the coordinate plane algebraically.	
1.01— Transform relations in two dimensions; describe the results algebraically and geometrically.	1
1.02.a—Use the quadratic relations (parabola, circle, ellipse, hyperbola) to model and solve problems; justify results. a) Solve using tables, graphs, and algebraic properties.	1
1.02.b—Use the quadratic relations (parabola, circle, ellipse, hyperbola) to model and solve problems; justify results. b) Interpret the constants and coefficients in the context of the problem.	2
1.03— Operate with vectors in two dimensions to model and solve problems.	1
Competency Goal 2: The learner will use relations and functions to solve problems.	
2.01.a—Use functions (polynomial, power, rational, exponential, logarithmic, logistic, piecewise-defined, and greatest integer) to model and solve problems; justify results. a) Solve using graphs and algebraic properties.	2
2.01.b—Use functions (polynomial, power, rational, exponential, logarithmic, logistic, piecewise-defined, and greatest integer) to model and solve problems; justify results. b) Interpret the constants, coefficients, and bases in the context of the problem.	1
2.02.a—Use trigonometric and inverse trigonometric functions to model and solve problems; justify results. a) Solve using graphs and algebraic properties.	–
2.02.b—Use trigonometric and inverse trigonometric functions to model and solve problems; justify results. b) Create and identify transformations with respect to period, amplitude, and vertical and horizontal shifts.	1
2.02.c—Use trigonometric and inverse trigonometric functions to model and solve problems; justify results. c) Develop and use the law of sines and the law of cosines.	3
2.03.a—For sets of data, create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, logistic, and logarithmic functions. a) Interpret the constants, coefficients, and bases in the context of the data.	–

2.03.b—For sets of data, create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, logistic, and logarithmic functions. b) Check models for goodness-of-fit; use the most appropriate model to draw conclusions or make predictions.	1
2.04— Use the composition and inverse of functions to model and solve problems.	4
2.05.a—Use polar equations to model and solve problems. a) Solve using graphs and algebraic properties.	3
2.05.b—Use polar equations to model and solve problems. b) Interpret the constants and coefficients in the context of the problem.	1
2.06—Use parametric equations to model and solve problems.	1
2.07.a—Use recursively-defined functions to model and solve problems. a) Find the sum of a finite sequence.	–
2.07.b—Use recursively-defined functions to model and solve problems. b) Find the sum of an infinite sequence.	1
2.07.c—Use recursively-defined functions to model and solve problems. c) Determine whether a given series converges or diverges.	2
2.07.d—Use recursively-defined functions to model and solve problems. d) Translate between recursive and explicit representations.	1
2.08—Explore the limit of a function graphically, numerically, and algebraically.	4