2017–2018 NC Final Exams of Advanced Functions and Modeling and Precalculus

North Carolina Assessment Specifications

Purposes of the Assessments

 The NC Final Exams (NCFEs) for Advanced Functions and Modeling and Precalculus measure students' academic progress on the North Carolina Standard Course of Study, adopted by the North Carolina State Board of Education (SBE) in 2003.

 The NCFEs are considered standardized artifacts reflective of student growth for teachers and school growth for participants in the teacher evaluation process.

 SBE policy TEST-016 requires public schools to use the course-specific operational assessments as the only final exams for specific courses and to use the results from all course-specific operational assessments as a minimum of twenty percent (20%) of the student's final grade for each respective course.

Developing Assessments

 North Carolina educators are recruited and trained to write new items for the NCFEs. The diversity among the item writers and their knowledge of the content standards are 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. Teachers interested in training to become an item writer or reviewer for the North Carolina Testing Program can visit https://center.ncsu.edu/ncpd/course/view.php?id=128 .

 For an in-depth explanation of the test development process see SBE policy TEST-013.

Curriculum and Assessment Cycle

 2003: North Carolina SBE adoption of the Standard Course of Study.

 2012–2013: Operational administration of the Measures of Student Learning: Common Exams.

 2013–14: Redesign and subsequent first operational administration of the NCFEs.

 2014–15: Second operational administration of the NCFEs.

 2015–16: Third operational administration of the NCFEs.

 2016–17: Fourth operational administration of the NCFEs. 2017–18: Fifth operational administration of the NCFEs.

Prioritization of Standards

 Members of the North Carolina Department of Public Instruction's (NCDPI) Test Development section 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 percentage range of total score points that will appear on the NCFEs. The tables of test specification weights describe the percent of total score points.

Table 1. *Test Specification Weights for the **Advanced Functions and Modeling** NCFE—2003 Standard Course of Study*

	Percent of Total Score Points
Data Analysis and Probability	
1.01, 1.02	≈ 18%
1.03	≈ 30%
Algebra	
2.01, 2.04, 2.05	≈ 36%
2.02, 2.03	≈ 15%
Total	100%

Table 2. *Test Specification Weights for the **Precalculus** NCFE—2003 Standard Course of Study*

	Percent of Total Score Points
Numbers and Operations	
1.01, 1.03	≈ 7%
1.02	≈10%
Geometry and Measurement	
2.01, 2.05	≈ 23%
2.02, 2.04, 2.07, 2.08	≈ 53%
2.03, 2.06	≈ 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 NCFEs for Advanced Functions and Modeling and Precalculus consist of four-response-option multiple-choice items.

 Students must be provided a graphing calculator, a state-provided formula sheet, graph paper, and blank paper.

 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/.

 Released items, the necessary formula sheet, and graph paper are available at http://www.ncpublicschools.org/accountability/common-exams/released-items/highschoolitems. Released items may be used by school systems to help acquaint students with items. These materials must not be used for personal or financial gain.

 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.

Testing Structure and Test Administration Time
 The NCFE of Advanced Functions and Modeling contains 37 items. The NCFE of Precalculus contains 34 items. Included in the total item counts are embedded multiple-choice field test items that will not count toward or against a student's score. These items are indistinguishable from operational items and should not interfere with the student's test-taking experience.

NC Final Exam 2017-18	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 or against the student's 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 2017–2018 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 NCFEs are administered to students enrolled in fall and spring courses. A list of course codes that align with the 2016–17 NCFEs (i.e., *Course Codes that Align with the NC Final Exams*) is available at http://www.ncpublicschools.org/accountability/common-exams/.

 The NCFEs are administered through NCTest, the NCDPI's online assessment platform. Paper editions are also available.

 The NCFEs are only provided in English. Native language translation versions are not available.

Appendix A
Advanced Functions and Modeling NC Final Exam 2017–18
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 Table 1. 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.

Advanced Functions and Modeling Objective	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
1.02.c—Summarize and analyze univariate data to solve problems. c) Determine measures of central tendency and spread.	–
1.02.d—Summarize and analyze univariate data to solve problems. d) Recognize, define, and use the normal distribution curve.	1
1.02.e—Summarize and analyze univariate data to solve problems. e) Interpret graphical displays of univariate data.	–
1.02.f—Summarize and analyze univariate data to solve problems. f) Compare distributions of univariate data.	1
1.03.a—Use theoretical and experimental probability to model and solve problems. a) Use addition and multiplication principles.	3
1.03.b—Use theoretical and experimental probability to model and solve problems. b) Calculate and apply permutations and combinations.	2
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.	2
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.	2
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.	2
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
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.	2
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.	1
2.05.a—Use recursively-defined functions to model and solve problems. a) Find the sum of a finite sequence.	2
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.	–
2.05.d—Use recursively-defined functions to model and solve problems. d) Translate between recursive and explicit representations.	1

Appendix B
Precalculus NC Final Exam 2017–18
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 Table 1. 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.

Precalculus Objective	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.	2
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.	1
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.	1
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.	2
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.	1
2.05.b—Use polar equations to model and solve problems. b) Interpret the constants and coefficients in the context of the problem.	3
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.	1
2.07.b—Use recursively-defined functions to model and solve problems. b) Find the sum of an infinite sequence.	–
2.07.c—Use recursively-defined functions to model and solve problems. c) Determine whether a given series converges or diverges.	1
2.07.d—Use recursively-defined functions to model and solve problems. d) Translate between recursive and explicit representations.	2
2.08—Explore the limit of a function graphically, numerically, and algebraically.	4