New York State Testing Program

Educator Guide to the Regents Examination in Algebra II (Common Core)

May 2015

engage ny

Our Students. Their Moment.

THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of The University

Table of Contents

Regents Examination in
Algebra II (Common Core) Test Guide

Foreword

Beginning with the 2012-2013 school year, the New York State Education Department (NYSED) started redesigning its testing program to measure what students know and can do relative to the New York State P-12 Common Core Learning Standards (CCLS) for Mathematics. The CCLS for Mathematics make up a broad set of mathematics understandings for students, defined through the integration of the Standards for Mathematical Content and the Standards for Mathematical Practice. In June 2016, the Regents Examination in Algebra II (Common Core) measuring the CCLS will be administered for the first time.

The Regents Examination in Algebra II (Common Core) is designed to measure student mathematical understanding as defined by the CCLS. As such, there will be noticeable changes from the Regents Examination in Algebra 2/Trigonometry that measures the 2005 NYS Algebra 2/Trigonometry Standards.

The December 2014 memorandum, "Transition to Common Core Regents Examinations in English Language Arts and Mathematics" provides information on the phase-in schedule for all Mathematics Regents Examinations in Algebra I, Geometry (Common Core), and Algebra II. This memorandum can be found at:
http://www.p12.nysed.gov/assessment/commoncore/transitionccregents1113rev.pdf.

The CCLS define rigor around procedural fluency, conceptual understanding, and application to real-world problems. Many questions will require that students be fluent in earlier grade-level skills. Some questions will require students to show their procedural and conceptual proficiency on specific concepts in distinct ways. In addition, students will be asked to negotiate multistep questions that require knowledge and ability across more than one grade-level standard.

Students will be expected to understand math conceptually, use prerequisite skills with grade-level math facts, and solve math problems rooted in the real world, deciding for themselves which formulas and tools (e.g. graphing calculators or rulers) to use.

This guide details many of the changes involved with the newly designed Regents Examination in Algebra II (Common Core) that measures the CCLS for Mathematics. Although reading about each of the changes will help in understanding how to prepare students for the upcoming test, it is important to remember that research has consistently demonstrated that students perform best on local, regional, statewide, or national tests when they have a great teacher delivering high-quality instruction aligned to rigorous standards.[1] Rote test prep practices are incompatible with highly effective teaching and lead to lower student performance.[2]

---

[1] See, for example, http://ccsr.uchicago.edu/publications/authentic-intellectual-work-and-standardized-tests-conflict-or-coexistence.

[2] See, for example, http://metproject.org/downloads/MET_Gathering_Feedback_Research_Paper.pdf.

Common Core Regents Examinations in Mathematics

As part of the New York State Board of Regents Reform Agenda, the New York State Education Department (NYSED) has embarked on a comprehensive reform initiative to ensure that schools prepare students with the knowledge and skills they need to be college- and career-ready.

The New York State P-12 CCLS call for changes in what is expected from a teacher's instructional approach. In mathematics courses, the CCLS demand that teachers focus their instruction on fewer, more central standards (http://engageny.org/resource/math-content-emphases/), thereby providing time to build core understandings and connections between mathematical concepts and skills.

Instructional Shifts and how they will be reflected in the Mathematics Assessments

The CCLS for Mathematics will require changes in instruction. There are six instructional shifts required to ensure that curriculum materials and classroom instruction are truly aligned with the standards. Educators should focus instruction on the standards and six key shifts in mathematics http://www.engageny.org/resource/common-core-shifts. Each of the six shifts will be evident in the new assessments. The table below shows the ways that instructors can expect the mathematics assessments will differ from past assessments through the lens of the six shifts.

Common Core Shifts in Mathematics Assessments	
Shift 1: Focus	Priority standards, which are embedded in the major clusters, will be the focus of assessments. Other standards will be deemphasized.
Shift 2: Coherence	Assessments will reflect the progression of content and concepts as depicted in the standards across grade levels.
Shift 3: Fluency	At the high school level, assessments will require fluency in areas described by the PARCC Model Content Framework for Algebra II, including simple polynomial division, advanced factoring, and translating between explicit and recursive representations of sequences.
Shift 4: Deep Understanding	Standards will be assessed from multiple perspectives while not veering from the primary target of measurement for the standard.
Shift 5: Application Shift 6: Dual Intensity	Students will be expected to know grade-level mathematical content with fluency and to know which mathematical concepts to employ to solve real-world mathematics problems.

The New York State testing program has been redesigned to measure student learning aligned with the instructional shifts necessitated by the CCLS. This document provides specific details about the Regents Examination in Algebra II (Common Core) and the standards that it measures.

Regents Examination in Algebra II (Common Core)

All questions on the Regents Examination in Algebra II (Common Core) will measure the Common Core Algebra II standards as specified in the PARCC Model Content Framework for Algebra II, which can be found at http://www.parcconline.org/parcc-model-content-frameworks. The standards define what students should understand and be able to do at the high school level. The Model Content Framework describes which content is included and emphasized within the Algebra II (Common Core) course, specifically.

Conceptual Categories

Conceptual categories are the highest organizing level in the high school CCLS for Mathematics. These conceptual categories are divided into *domains, clusters, and standards*.

- *Domains* are larger groups of related *clusters* and *standards*. Standards from different domains may be closely related.

- *Clusters* are groups of related *standards*. Note that *standards* from different *clusters* may sometimes be closely related, because mathematics is a connected subject.

- *Standards* define what students should understand and be able to do. In some cases, standards are further articulated into lettered *components*.

Algebra II is associated with high school content standards within five conceptual categories: **Number & Quantity, Algebra, Functions, Geometry,** and **Statistics & Probability**. The conceptual category of **Modeling** is also included in Algebra II, but is best interpreted not as a collection of isolated topics but rather in relation to other standards.

Regents Examination in Algebra II (Common Core) Blueprint

New York State-certified teachers were involved in most stages of the test development process for the Regents Examination in Algebra II (Common Core). For example, teachers write and revise test questions and scoring rubrics.

The test blueprint for the Regents Examination in Algebra II (Common Core) demonstrates NYSED's commitment to ensuring that educators are able to focus their instruction on the most critical elements of the Algebra II (Common Core) course.

The chart on the following page shows the percent of test by credit, as well as the domains included in Algebra II for each conceptual category.

Conceptual Category	Percent of Test By Credit	Domains in Algebra II
Number & Quantity	5% - 12%	The Real Number System (N-RN) Quantities (N-Q) The Complex Number System (N-CN)
Algebra	35% - 44%	Seeing Structure in Expressions (A-SSE) Arithmetic with Polynomials and Rational Expressions (A-APR) Creating Equations (A-CED) Reasoning with Equations and Inequalities (A-REI) Expressing Geometric Properties with Equations (G-GPE)*
Functions	30% - 40%	Interpreting Functions (F-IF) Building Functions (F-BF) Linear, Quadratic, and Exponential Models (F-LE) Trigonometric Functions (F-TF)
Statistics & Probability	14% - 21%	Interpreting Categorical and Quantitative Data (S-ID) Making Inferences and Justifying Conclusions (S-IC) Conditional Probability and the Rules of Probability (S-CP)

*Although the organization of the CCLS places one standard from the **G-GPE** domain into the Geometry Conceptual Category, the content within this domain will be **assessed as part of the Algebra Conceptual Category** for the Regents Examination in Algebra II (Common Core).

Content Emphases

Within each domain, the Algebra II CCLS are divided into *Major Clusters*, *Supporting Clusters*, and *Additional Clusters*. The test will focus strongly where the standards focus. Major Clusters will be a majority (51–65%) of the test, while Supporting Clusters (14–28%) and Additional Clusters (19–33%) will together constitute less than half the possible points. Although clusters will be assessed more than once depending on the cluster emphases, the knowledge and skills necessary or the context will be distinctly different for each question. This will ensure that students have the opportunity to earn credit on every question regardless of how they performed on earlier questions—even those aligned to the same cluster.

The chart on the following page illustrates Algebra II (Common Core) at the cluster and standard level. It shows Major, Supporting, and Additional cluster emphases as well as standards that are shared by Algebra I and Algebra II. Assessment limits for shared standards are necessary to provide information on how a standard is assessed differently for each course. For more information about cluster emphases and assessment limits for shared standards please refer to the PARCC Model Content Frameworks and the New York State Common Core Algebra II Standards Clarifications.

Conceptual Category	Domain	Cluster		Cluster Emphasis	Standard	Shared with Algebra I
Number & Quantity 5% - 12%	The Real Number System	**Extend the properties of exponents to rational exponents.**	**N-RN.A**	**Major**	N-RN.1	
					N-RN.2	
	Quantities	Reason quantitatively and use units to solve problems.	N-Q.A	Supporting	N-Q.2	x
	The Complex Number System	Perform arithmetic operations with complex numbers.	N-CN.A	Additional	N-CN.1	
					N-CN.2	
		Use complex numbers in polynomial identities and equations.	N-CN.C		N-CN.7	
Algebra 35% - 44%	Seeing Structure in Expressions	**Interpret the structure of expressions.**	**A-SSE.A**	**Major**	A-SSE.2	x
		Write expressions in equivalent forms to solve problems.	**A-SSE.B**		A-SSE.3	x (c)
					A-SSE.4	
	Arithmetic with Polynomials and Rational Expressions	**Understand the relationship between zeros and factors of polynomials.**	**A-APR.B**		A-APR.2	
					A-APR.3	x
		Use polynomial identities to solve problems.	A-APR.C	Additional	A-APR.4	
		Rewrite rational expressions.	A-APR.D	Supporting	A-APR.6	
	Creating Equations	Create equations that describe numbers or relationships.	A-CED.A	Supporting	A-CED.1	x
	Reasoning with Equations and Inequalities	**Understand solving equations as a process of reasoning and explain the reasoning.**	**A-REI.A**	**Major**	A-REI.1	x
					A-REI.2	
		Solve equations and inequalities in one variable.	A-REI.B	Supporting	A-REI.4	x (b)
		Solve systems of equations.	A-REI.C	Additional	A-REI.6	x
					A-REI.7	
		Represent and solve equations and inequalities graphically.	**A-REI.D**	**Major**	A-REI.11	x
	Expressing Geometric Properties with Equations*	Translate between the geometric description and the equation for a conic section.	G-GPE.A*	Additional	G-GPE.2*	
Functions 30% - 40%	Interpreting Functions	Understand the concept of a function and use function notation.	F-IF.A	Supporting	F-IF.3	x
		Interpret functions that arise in application in terms of the context.	**F-IF.B**	**Major**	F-IF.4	x
					F-IF.6	x
		Analyze functions using different representations.	F-IF.C	Supporting	F-IF.7 (c,e)	
					F-IF.8 (b)	
					F-IF.9	x
	Building Functions	**Build a function that models a relationship between two quantities.**	**F-BF.A**	**Major**	F-BF.1 (a)	x
					F-BF.1 (b)	
					F-BF.2	
		Build new functions from existing functions.	F-BF.B	Additional	F-BF.3	x
					F-BF.4 (a)	
	Linear, Quadratic and Exponential Models	Construct and compare linear, quadratic, and exponential models and solve problems.	F-LE.A	Supporting	F-LE.2	x
					F-LE.4	
		Interpret expressions for functions in terms of the situation they model.	F-LE.B	Additional	F-LE.5	x
	Trigonometric Functions	Extend the domain of trigonometric functions using the unit circle.	F-TF.A	Additional	F-TF.1	
					F-TF.2	
		Model periodic phenomena with trigonometric functions.	F-TF.B		F-TF.5	
		Prove and apply trigonometric identities.	F-TF.C		F-TF.8	
Statistics & Probability 14% - 21%	Interpreting Categorical and Quantitative Data	Summarize, represent and interpret data on a single count or measurement variable.	S-ID.A	Additional	S-ID.4	
		Summarize, represent and interpret data on two categorical and quantitative variables.	S-ID.B	Supporting	S-ID.6 (a)	x
	Making Inferences and Justifying Conclusions	Understand and evaluate random processes underlying statistical experiments.	S-IC.A	Supporting	S-IC.1	
					S-IC.2	
		Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	**S-IC.B**	**Major**	S-IC.(3-6)	
	Conditional Probability and the Rules of Probability	Understand independence and conditional probability and use them to interpret data.	S-CP.A	Additional	S-CP.(1-5)	
		Use the rules of probability to compute probabilities of compound events in a uniform probability model.	S-CP.B	Additional	S-CP.(6,7)	

*G-GPE.A will be assessed as part of the Algebra Conceptual Category.

Testing Session and Time

The Regents Examination in Algebra II (Common Core) will consist of **one booklet** that is administered during the designated time determined by NYSED. Students are permitted three hours to complete the Regents Examination in Algebra II (Common Core). While it is likely that most students will complete the test in less than three hours, students may not leave the testing location prior to the Uniform Admission Deadline. This design provides ample time for students who work at different paces.

The test must be administered under standard conditions and the directions must be followed carefully. The same test administration procedures must be used with all students so that valid inferences can be drawn from the test results. Students with disabilities must be provided testing accommodations as stated in their Individualized Education Programs (IEPs) or Section 504 Accommodation Plans (504 Plans). For additional information, go to: http://www.p12.nysed.gov/assessment/sam/secondary/.

NYSED devotes great attention to the security and integrity of the Regents Exams. School administrators and teachers involved in the administration of State examinations are responsible for understanding and adhering to the instructions set forth in the *Directions for Administering Regents Examinations*. These resources will be posted prior to each Regents Examination at: http://www.p12.nysed.gov/assessment/hsgen/.

Question Formats

The Regents Examination in Algebra II (Common Core) contains four parts: one with multiple-choice questions and three with constructed-response questions. For multiple-choice questions, students select the correct response from four answer choices. For constructed-response questions, students are required to clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, proofs, etc. In some cases, they may be required to provide written explanations or justifications to demonstrate conceptual understanding.

Multiple-Choice Questions

Multiple-choice questions will primarily be used to assess procedural fluency and conceptual understanding. Multiple-choice questions measure the Standards for Mathematical Content and may incorporate Standards for Mathematical Practice and real-world applications. Some multiple-choice questions require students to complete multiple steps. Likewise, questions may measure more than one cluster, drawing on the simultaneous application of multiple skills and concepts. Within answer choices, distractors[3] will all be based on plausible missteps.

Constructed-Response Questions

Constructed-response questions will require students to show a deep understanding of mathematical procedures, concepts, and applications. The Regents Examination in Algebra II (Common Core) contains 2-, 4-, and 6-credit constructed-response questions.

---

[3] A distractor is an incorrect response that may appear to be a plausible correct response to a student who has not mastered the skill or concept being tested.

2-credit constructed-response questions require students to complete a task and show their work. Like multiple-choice questions, 2-credit constructed-response questions may involve multiple steps, the application of multiple mathematics skills, and real-world applications. These questions may ask students to explain or justify their solutions and/or show their process of problem solving.

4-credit and 6-credit constructed-response questions require students to show their work in completing more extensive problems that may involve multiple tasks and concepts. Students will be asked to make sense of mathematical and real-world problems in order to demonstrate procedural and conceptual understanding. For 6-credit constructed-response questions, students will analyze, interpret, and/or create mathematical models of real-world situations to solve multi-step problems that connect multiple major clusters or a major cluster to supporting or additional content.

Regents Examination in Algebra II (Common Core) Design

Test Component	Number of Questions	Credits per Question	Total Credits in Section
Part I	24	2	48
Part II	8	2	16
Part III	4	4	16
Part IV	1	6	6
Total	37	-	86

Regents Examination in Mathematics Scoring Policies

The Regents Examination in Algebra II (Common Core) scoring policies will follow the same guidelines as previous mathematics Regents Examinations. For more information see the *Information Booklet for Scoring the Regents Examinations in Mathematics* at: http://www.p12.nysed.gov/assessment/hsgen/home.html.

Additional Assessment Resources

Additional information and resources for Common Core Regents Examinations in Mathematics are available at: http://www.engageny.org/resource/regents-exams-mathematics.

Mathematics Tools for the Regents Examination in Algebra II (Common Core)

Calculators

Each student must have the exclusive use of a Graphing Calculator for the full duration of the Regents Examination in Algebra II (Common Core). No student may use a calculator that is capable of symbol manipulation or that can communicate with other calculators through infrared sensors, nor may a student use operating manuals, instruction or formula cards, or other information concerning the operation of calculators during the test. For more information regarding calculators see Directions for Administering Regents Examinations, at http://www.p12.nysed.gov/assessment/hsgen/home.html.

Straightedges (rulers)

A straightedge (ruler) must be available to all students taking the Regents Examination in Algebra II (Common Core).

Note: Schools are responsible for supplying calculators and rulers for use with the Regents Examination in Algebra II (Common Core). NYSED does not provide them.

Values of Pi and e

Students should use the π and e symbols and their corresponding values (i.e. pi key on the calculator) when applicable on the Regents Examination in Algebra II. Unless otherwise specified, use of the approximate values of π, such as 3.1416, 3.14 or $\frac{22}{7}$, and e, such as 2.718 is unacceptable.

Why Mathematics Tools?

These provisions are necessary for students to meet the Standards for Mathematical Practice in the New York State P-12 Common Core Learning Standards for Mathematics. For example:

Use appropriate tools strategically

Mathematically proficient students consider the available tools when solving a mathematical problem. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

Attend to precision

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, expressing numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school, they have learned to examine claims and make explicit use of definitions.

Reference Sheet

A detachable reference sheet will be included at the end of the Regents Examination in Algebra II (Common Core) booklet.

Common Core High School Math Reference Sheet
(Algebra I, Geometry, Algebra II)

CONVERSIONS

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilograms	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallon
		1 liter = 1000 cubic centimeters

FORMULAS

Triangle	$A = \dfrac{1}{2}bh$	Pythagorean Theorem	$a^2 + b^2 = c^2$
Parallelogram	$A = bh$	Quadratic Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Circle	$A = \pi r^2$	Arithmetic Sequence	$a_n = a_1 + (n-1)d$
Circle	$C = \pi d$ or $C = 2\pi r$	Geometric Sequence	$a_n = a_1 r^{n-1}$
General Prisms	$V = Bh$	Geometric Series	$S_n = \dfrac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Cylinder	$V = \pi r^2 h$	Radians	$1 \text{ radian} = \dfrac{180}{\pi} \text{ degrees}$
Sphere	$V = \dfrac{4}{3}\pi r^3$	Degrees	$1 \text{ degree} = \dfrac{\pi}{180} \text{ radians}$
Cone	$V = \dfrac{1}{3}\pi r^2 h$	Exponential Growth/Decay	$A = A_0 e^{k(t - t_o)} + B_0$
Pyramid	$V = \dfrac{1}{3}Bh$		