

**EXECUTIVE SUMMARY****Title:** Update: American Diploma Project Algebra II Exam**Type of Executive Summary:**

- Action       Action on First Reading       Discussion       Information

**Policy Implications:**

- Constitution \_\_\_\_\_  
 General Statute # \_\_\_\_\_  
 SBE Policy \_\_\_\_\_  
 SBE Policy Amendment  
 SBE Policy (New)  
 APA # \_\_\_\_\_  
 APA Amendment  
 APA (New)  
 Other \_\_\_\_\_

**Presenter(s):** Dr. Louis M. Fabrizio (Director, Accountability Services Division)**Description:**

The American Diploma Project (ADP) Algebra II End-of-Course Exam is an initiative of the ADP Network through Achieve, Inc., which includes 33 states that are dedicated to making sure every high school graduate is prepared for college or work. A total of twelve states participated in the spring 2008 administration.

The ADP Algebra II End-Of-Course Exam serves three main purposes:

- to improve curriculum and instruction,
- to help colleges determine if students are ready to do credit-bearing work, and
- to compare performance and progress among the participating states.

**Resources:**

State

**Input Process:**

N/A

**Stakeholders:**

Teachers, administrators, students, parents, college/university professors, community members and Department of Public Instruction staff

**Timeline For Action:**

This item is submitted for information.

**Recommendations:** Discuss Points to Consider.

Points to Consider: 1) What are the long term plans for ADP Algebra I and Algebra II Exam? 2) Should North Carolina have a representative sample for the fall 2008 and/or spring 2009 administration? 3) Should the online (first available in fall 2008) and/or paper/pencil version of the assessment be administered?

**Audiovisual equipment requested for the presentation:**

- Data Projector/Video (Videotape/DVD and/or Computer Data, Internet, Presentations-PowerPoint preferred)  
Specify: \_\_\_\_\_
- Audio Requirements (computer or other, except for PA system which is provided)  
Specify: \_\_\_\_\_
- Document Camera (for transparencies or paper documents – white paper preferred)  
\_\_\_\_\_

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Motion By: \_\_\_\_\_ Seconded By: \_\_\_\_\_  
Vote: Yes \_\_\_\_\_ No \_\_\_\_\_ Abstain \_\_\_\_\_  
Approved \_\_\_\_\_ Disapproved \_\_\_\_\_ Postponed \_\_\_\_\_ Revised \_\_\_\_\_  
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## NEWS STATEMENT

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### **Twelve States Administer Algebra II End-of-Course Exam to Measure College Preparedness**

#### ***Report Show States Working Jointly to Set the Bar Higher for High School Graduates and Improve College Readiness***

WASHINGTON – August 25, 2008 – Today, as students, schools, districts and states received results from the first administration of the American Diploma Project (ADP) Algebra II end-of-course exam, Achieve released its annual report on the first-of-its-kind multi-state exam. The exam was developed jointly by 14 states based on shared expectations of what students need to learn to be prepared for college mathematics courses. The test represents an ongoing policy shift in the states that includes more rigorous and common mathematics standards and exams and Algebra II as a required course.

The test was administered in the spring of 2008 to nearly 90,000 students in the following states: Arizona, Arkansas, Hawaii, Indiana, Kentucky, Minnesota, New Jersey, North Carolina, Ohio, Pennsylvania, Rhode Island and Washington. Maryland and Massachusetts are also members of the ADP Algebra II partnership and will administer the exam when an online version becomes available in 2009.

“The exam represents an important baseline from which states can now improve,” said Michael Cohen, president of Achieve. “The 14 states in the ADP Algebra II partnership should be applauded for voluntarily setting a high bar and for committing to report on their progress annually.”

That students did not do well on this exam the first time out is no surprise, continued Cohen. This exam sets a much higher bar than current high school exams. Currently too many students graduate from high school believing they are prepared for college level work, but soon find they are not. In fact, nearly one-quarter of first-year college students must take remedial courses in mathematics.

“This exam is a tool for improvement. It will give students, parents and teachers an honest assessment of whether students are ready for college mathematics,” Cohen said. “It will improve the consistency and rigor of Algebra II classes, and it will help states and schools ensure that students get the help they need to succeed while they are still in high school,” he concluded.

For a copy of the report and results, visit [www.achieve.org/2008Algebra2report](http://www.achieve.org/2008Algebra2report)

To learn more about Achieve, visit [www.achieve.org](http://www.achieve.org).

*Created by the nation's governors and business leaders, Achieve, is a bipartisan, non-profit organization that helps states raise academic standards, improve assessments and strengthen accountability to prepare all young people for postsecondary success. At the 2005 National Education Summit, Achieve launched the American Diploma Project (ADP) Network, a coalition that has grown to 33 states, educating nearly 80% of public school students in the United States. The ADP Network is committed to aligning high school expectations with the demands of college, careers and life.*



Report



**American Diploma Project**  
**Algebra II End-Of-Course**  
**Exam: 2008 Annual Report**

August 2008

## Introduction

States are increasingly focusing the mission of their elementary and secondary education systems on preparing all students for success in postsecondary education and 21st century careers. In 2005, Achieve and 13 states formed the American Diploma Project (ADP) Network for this purpose; today governors and business and education leaders in 33 states that collectively educate nearly 80 percent of U.S. public school students have made this commitment. In 2005, no state had aligned its academic standards at the secondary level with the knowledge and skills essential for postsecondary success; today 21 states have adopted college- and career-ready standards. Moreover, as states align their expectations with the real world demands students face, they are also increasingly reflecting the knowledge and skills that are common across states. As a recent Achieve report found<sup>1</sup>, nearly one-third of the states have a common—and rigorous—core of mathematics standards for the end of high school.

As standards have increased, so too have graduation requirements. When the network was formed in 2005, only two states required students to take a college- and career-ready course of study, including mathematics through Algebra II or its equivalent, in order to earn a high school diploma. Today, 20 states and the District of Columbia have adopted such high school graduation policies.

Even before states had raised their mathematics expectations, it became clear that a different kind of assessment was needed to reflect their changing expectations. To that end, fourteen states—Arkansas, Indiana, Kentucky, Maryland, Massachusetts, New Jersey, Ohio, Pennsylvania, Rhode Island, Arizona, Hawaii, Minnesota, North Carolina and Washington—joined together to develop and use a common end-of-course exam in Algebra II. This is the largest multi-state collaborative assessment effort ever undertaken. It is a dramatic departure from past testing practices in which states developed their own tests, based on their own standards and often at considerable expense. With increasingly common end of high school expectations among the states, collaborative efforts to develop assessments make good policy and economic sense.

In the spring of 2008, nearly ninety thousand students across twelve of the fourteen states in the partnership took the ADP Algebra II end-of-course exam for the first time. In subsequent years, the number of exam takers is expected to grow significantly.

At a time when many bemoan whether tests—and their scores—are an accurate reflection of what students need to know to succeed, these fourteen states have chosen voluntarily to raise the bar to ensure that their students graduate from high school prepared. The partnership states anticipated that this would be difficult work, but work that had to be done to ensure that students graduate from high school ready for the real world. The ADP Algebra II exam is designed to assess how well students master the content of a rigorous Algebra II course and to provide information on whether a student is prepared to enter and succeed in credit-bearing college-level mathematics courses.

This report, released as the scores from the first administration are reported to students, their teachers and their parents, provides an overview of the test as well as exam results from each of the participating states. Most states offered the test on a pilot basis this year, giving many educators a first look at the expectations of a rigorous Algebra II course assessment. States are in the process of developing policies for the use of the test

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<sup>1</sup> Achieve. (2008) *Out of Many, One: Toward Rigorous Common Core Standards from the Ground Up*, Washington, DC. <http://www.achieve.org/commoncore>

and how it will fit into their still-evolving high school assessment and accountability systems. And while most of the states in the partnership require, or plan to require, students to take Algebra II in order to graduate, these new requirements are being phased in over time and do not apply to most of the students who took the exam this year. Consequently, this year's participation rates in Algebra II courses and in the ADP end-of-course exam vary from state to state. Therefore, comparisons of state results are neither meaningful nor appropriate at this time.

In subsequent years, Achieve will issue annual reports comparing performance across the participating states. This will help states see how well they are doing and learn from their collective efforts to improve student achievement.

### The American Diploma Project Network

The states that have led this multistate effort are members of the American Diploma Project Network. In 2005, Achieve and 13 states created the ADP Network to help states close the significant gap between what students need to know for postsecondary success and what states require them to demonstrate in order to earn a high school diploma. The goal of the network is to ensure that students who graduate from high school are prepared for college, careers and citizenship. To that end, governors, chief state school officers, and postsecondary and business leaders in the network states have committed to work together to:

- Align high school standards with the demands of postsecondary education and the workplace;
- Require students to complete a college- and career-ready curriculum to earn a high school diploma;
- Build college- and career-ready tests into statewide high school assessment systems, and
- Hold high schools and postsecondary institutions accountable for student preparation and success.

The ADP Network has grown to include 33 states, educating nearly 80 percent of the public school children in the United States.

## States Launch the ADP Algebra II End-Of-Course Exam

State school chiefs in a core group of ADP Network states provided the leadership for the development of the ADP Algebra II end-of-course exam. They understood that an end-of-course exam would help provide much needed consistency in Algebra II classes statewide, particularly in anticipation of instituting requirements that all students take Algebra II or its equivalent. They also understood that Algebra II ought to focus on the same content across states, as well as within states. Collectively, they were prepared to ratchet up the content of Algebra II in their states to align with Achieve's ADP mathematics college- and career-ready benchmarks, as part of their broader efforts to increase the rigor of high school courses and align expectations with the skills needed for postsecondary success. In short, they chose to give up traditional state prerogatives to determine the content of their courses independently in favor of collaborating to increase their rigor. And they were eager to forgo the obligation of developing different state exams in favor of pooling their resources to develop one high quality exam.

*Why Algebra II?* Mastery of Algebra II (or an integrated course covering the same content) is important for high school graduates. It fosters problem solving, abstract reasoning and critical thinking skills<sup>2</sup> that are used long after the course ends. In addition, higher level mathematics courses such as Algebra II improve access to postsecondary education. Algebra II includes the advanced content that faculty at two- and four-year institutions say is critical for success in credit-bearing mathematics college coursework.<sup>3</sup> Students who study mathematics at least through Algebra II in high school are more than twice as likely as those who do not to earn a four-year degree and the level of mathematics a student reaches in high school is the most accurate predictor of whether that student will earn a Bachelor's degree.<sup>4</sup> In contrast, students who have not mastered Algebra II in high school are more likely to need remediation and, therefore, less likely to complete a college degree. Of students at two- and four-year colleges, just 42 percent of those who needed remediation in mathematics completed a degree;<sup>5</sup> in some states and institutions, the rates are even lower.

*Why an end-of-course exam?* End-of-course exams are attractive to states because they directly align to curriculum standards and the courses students need to take for graduation. End-of-course exams are also more sensitive to instruction than grade-level survey exams. Because they are taken right after a student has completed a course and can provide teachers with relevant information about students' understanding of the content, teachers can adjust instruction for subsequent classes accordingly. In addition, end-of-course tests serve as a way to ensure consistency and rigor in classrooms within and across states, so that all students are exposed to an equally rigorous curriculum. The ADP Algebra II end-of-course exam serves as both a means to ensure consistency of rigor as the number of students enrolled in the course grows, while simultaneously offering students a signal of readiness that can be valued and utilized by postsecondary institutions.

## Forming the ADP Algebra II Consortium

In May 2005, leaders from ADP states began to explore the possibility of working together, with support from Achieve, to develop a common end-of-course test in Algebra II. There were a number of reasons to work collaboratively: First, state leaders recognized that using a common end-of-course exam would help improve curriculum and instruction and ensure a consistent level of content and rigor in classes within and across their states—both of which were important to them for equity reasons. In addition, a common test—with commonly agreed to proficiency levels—would enable states to compare performance and progress with each other over time.

Since this test would be focused on rigorous Algebra II content, it would likely be more challenging than the other tests in their systems and early results would likely not be very strong. Joining forces would help them deliver the tough, but honest truth that student preparation needed to be improved. Finally, in pooling their energy and resources, there was the potential to create a high quality test faster and at a lower cost.

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<sup>2</sup> The National Center for Education Statistics, for example, highlights the advanced course sequences, including geometry, Algebra II and trigonometry, which yield the greatest gains in mathematical understanding. Bozick, Robert, Steven J. Ingels, and Jeffrey A. Owings (2008). *Mathematics Course-taking and Achievement at the End of High School: Evidence from the Education Longitudinal Study of 2002*. Statistical Analysis Report 2008-319. Washington, DC: National Center for Education Statistics.

<sup>3</sup> Achieve. (2004) *Ready or Not: Creating a High School Diploma That Works*. Washington, DC.

<sup>4</sup> Adelman, C. (2006, February). *The Toolbox Revisited: Paths to Degree Completion from High School through College*. Washington, DC: U.S. Department of Education.

<sup>5</sup> Adelman, C. (2004). *Principal Indicators of Student Academic Histories in Postsecondary Education, 1972–2000*. Washington, DC: U.S. Department of Education.

With these common purposes in mind, nine ADP states—Arkansas, Indiana, Kentucky, Maryland, Massachusetts, New Jersey, Ohio, Pennsylvania, and Rhode Island—launched a joint effort, with Ohio serving as the lead procurement state, to develop a high quality, rigorous end-of-course Algebra II exam. They reached consensus on the exam purposes, content, format and other characteristics; they issued an RFP; and in 2007 they selected Pearson as the development partner.<sup>6</sup> Since that time, five additional states—Arizona, Hawaii, Minnesota, North Carolina and Washington—have joined the partnership, bringing the total number of participating states to fourteen.<sup>7</sup>

## College-Ready Tests

A college-ready test measures the knowledge and skills students must have to enter and succeed in college-level courses, without the need for remediation. Current high school tests don't measure these skills; students often first encounter such tests when they enroll in postsecondary institutions and learn they must take a placement test to determine if they must take remedial courses rather than college-level courses.

A statewide college-ready test administered to all high school students will help prepare students academically for a successful transition from secondary to postsecondary education. Most states, however, cannot simply re-label existing tests as college-ready measures; they must look beyond their current tests that typically assess students at the 10th grade level or lower. States must have as a component of their high school assessment systems an instrument that measures the more advanced skills valued by postsecondary institutions. If states build more rigorous assessments into their high school testing systems, they can help schools determine whether students are on a path to be college-ready, a path that would enable them to enter and succeed in credit-bearing courses. College-ready measures will not just signal to schools, districts and states the readiness of their graduates but will also signal to students (and their parents) whether they are on track to meet their goals. In time, such measures will reduce the number of students who enter college needing remediation, thereby increasing the likelihood of postsecondary success.

Only nine states (see *Closing the Expectations Gap 2008* <http://www.achieve.org/files/50-state-2008-final02-25-08.pdf>) currently have in place assessments that are useful to postsecondary institutions for determining the readiness of incoming students for college-level coursework. Six of the nine have incorporated the ACT or SAT into their high school assessment system. Three have set college-ready cut scores on high school assessments given to all students, including California. In California, the Department of Education worked closely with the California State University (CSU) system to add additional questions to the state's 11th grade school accountability exam so that it could also measure whether students meet CSU college-ready standards in English and mathematics. Students who score well on that 11th grade test are exempt from the CSU-required mathematics and English placement tests. The 11th grade exam also serves to alert high school students in time to adjust their senior-year coursework if they need additional preparation for college. The CSU system has developed a variety of online and classroom-based resources to help high school seniors fill in the skill gaps identified by the test.

<sup>6</sup> Pearson developed the test items to meet the specifications agreed to by the states. However, Pearson shouldered all development costs and retains ownership of the test. States pay only for administration and scoring based on the number of tests ordered.

<sup>7</sup> Twelve states participated in the initial administration of the Algebra II exam. Maryland and Massachusetts will deliver the test online in 2009.

## Test Content and Design

The Algebra II end-of-course exam was created to provide an honest assessment of how well students have mastered the advanced knowledge and skills that are necessary for success in credit-bearing college mathematics courses. By design, the test is challenging. To develop the test, the participating states engaged high school educators and college faculty in all stages of the development of the exam, from the writing of the content standards to reviewing the exam questions to determining how the student responses should be scored.<sup>8</sup>

**Common, rigorous standards:** The standards on which this exam is based were developed collaboratively by the partner states, based in large part on the ADP mathematics benchmarks. The Algebra II exam standards are robust, emphasizing advanced algebra, critical thinking and problem solving. The mathematics content assessed consists of five key strands. A description of each standard and its associated emphasis on the exam is listed in Table 1 below. In each strand, students are expected to model and solve problems in context and translate among multiple representations.

**TABLE 1: ALGEBRA II EXAM STANDARDS**

Standard	Topics Addressed	Percentage of Total Points
Operations on Numbers and Expressions	Operations with numbers and algebraic expressions, involving real and complex numbers.	15%
Equations and Inequalities	Linear and nonlinear equations and inequalities, and systems of linear equations and inequalities.	20%
Polynomial and Rational Functions	Quadratic functions and higher-order polynomial and simple rational functions.	30%
Exponential Functions	Exponential functions and basic logarithms and their relationship to exponents.	20%
Function Operations and Inverses	Combinations and inverses of functions.	15%

The emphasis a particular standard was given on the exam is related directly to the emphasis that topic should be given in an Algebra II classroom. Operations on Numbers and Expressions only comprises 15 percent of the exam because it is considered mostly introductory Algebra II material, some of which is covered in previous mathematics courses. Polynomials and Rational Functions is the main focus of most Algebra II curricula, and as such it is given the greatest emphasis on the exam. Function Operations and Inverses, only 15 percent of the

<sup>8</sup> The standards and sample items can be seen at <http://www.achieve.org/node/842>.

total points, is the most advanced content in the exam and may exceed what is covered in many typical Algebra II courses. Nevertheless, this content is important and the partner states determined that it should be included to drive curricular improvement to better prepare students for college mathematics.

**Item types:** The exam is a mix of multiple choice, short answer and extended response questions; at least one-third of the total points are from the short answer and extended response items. To measure advanced mathematics knowledge and skills, the exam includes a large number of open-response items that require students to show the steps they have taken and to justify their reasoning when solving a problem. These problem solving and reasoning skills are critical for credit-bearing coursework in college and are highly valued by postsecondary faculty.

**Calculator use:** In developing the content of the exam, the mathematics experts felt it was necessary for students to demonstrate fluency in mathematics both with and without the use of technology. As a result, the exam is structured into two sections, one that allows the use of a calculator, and one that does not. Although not required, the use of a graphing calculator is highly recommended on the calculator section.

**Room for growth:** The ADP Algebra II end-of-course exam content standards identify content for the core exam as well as content for seven optional modules. The modules were developed to further challenge students and to enable growth of the Algebra II end-of-course exam beyond the traditional Algebra II curriculum. The modules available are: Data and Statistics, Probability, Logarithmic Functions, Trigonometric Functions, Matrices, Conic Sections, and Sequences and Series. The modules have been field tested but were not administered during the spring 2008 test administration.

**Standard setting:** Setting standards on a mathematics exam—determining what it means to be proficient and the score necessary to achieve at that level—is typically a matter of the professional judgment of mathematics educators and mathematicians who review each item and its difficulty level and use that information to determine the mix of correct items that constitute basic, proficient or advanced performance of the test content. Standards for the ADP Algebra II exam will be set quite differently, although professional judgement remains an important part of the process. In this case, proficient must also mean prepared to succeed in a first-year credit-bearing college mathematics course in postsecondary institutions. Therefore, standard setting will rely heavily on data that show the relationship between scores on the Algebra II exam and performance in postsecondary education. High school mathematics teachers and postsecondary faculty alike will examine the predictive and concurrent validity of data during the standard setting process. Examples of data that will inform the standard setting process include establishing the relationship of the ADP Algebra II exam with commonly used admissions and placement tests. Studies will also be conducted at two- and four-year college campuses to establish the relationship between the ADP Algebra II exam and success in first-year credit-bearing college mathematics. The data will inform setting performance levels and cut scores and enable states to know that proficient truly means prepared. Standards are expected to be set in 2009.

## Administration and Funding of the Spring 2008 ADP Algebra II Exam

The development of the ADP Algebra II end-of-course exam is a critical piece of the broader agenda to prepare all students for success. Most of the states in the consortium are in the process of developing and adopting policies that will govern participation in the exam and address how the exam results will ultimately be used, and therefore treated this first test administration as an opportunity to pilot the test in a small number of school districts and schools.

States used a variety of approaches, both in terms of who decided which students would take the exam (the state or districts) and how the cost of the exam would be funded (See Table 2).

Two states (Arkansas and Hawaii) required all students who took an Algebra II course in the 2007-08 school year to take the exam in spring 2008. Arkansas is one of 20 states that requires all students, starting with the class of 2010, to complete Algebra II to graduate from high school. Hawaii does not currently require all students to take Algebra II, but includes the course as part of its recommended core curriculum and is working with both postsecondary institutions and employers to create incentives for students to complete that core.

Other states choose to pilot the exam, with only a subset of their students taking the exam, as they consider how to incorporate it into their broader assessment systems. Some states (Arizona, Kentucky, North Carolina, Ohio, Rhode Island, and New Jersey) made the exam available to all districts and provided funding for it, while one state invited only select schools to participate in the first administration (Pennsylvania), and still others (Minnesota and Washington) encouraged districts to use the exam at their own expense. Piloting the exam allows states to introduce the exam to mathematics educators and districts and to adjust curriculum accordingly.

Two other states in the partnership (Maryland and Massachusetts) did not participate in the spring 2008 administration and will test students for the first time in 2009 when the online version of the exam is introduced.

**TABLE 2: HOW STATES ADMINISTERED AND FUNDED THE SPRING 2008 ALGEBRA II EXAM**

State	Decision to Administer	Funding for Exam
AZ	District option	State expense
AR	State requires all Algebra II students to take exam	State expense
HI	State requires all Algebra II students to take exam	State expense
IN	State piloted three programs and assigned certain districts to this exam	State expense
KY	State invited all interested schools to participate, but not all those that responded were chosen to participate.	State expense
MD	No Testing in Spring 2008	Not applicable
MA	No Testing in Spring 2008	Not applicable
MN	District option	District expense
NJ	All districts invited to participate	State expense
NC	District option	State expense
OH	District option	State expense
PA	State selected schools to participate, including a required subset of Project 720 schools	State expense
RI	District option	State expense
WA	District option	District expense

## Interpreting the Spring 2008 Test Results

The ability to interpret the spring 2008 test results and make comparisons across states is limited for several reasons. First, performance standards or “cut scores” have not yet been established, so there is no clear basis for interpreting the results. For this first administration, scores are simply reported based on the percent of test questions answered correctly.

A second challenge in interpreting and comparing results is that the number of test takers varied significantly across the states (see Table 3). In some states, all students enrolled in an Algebra II course took the exam, while in others just a subset participated. In large part, this is due to varying state policies around test administration for the spring 2008 examination. **Because the factors for student selection were not controlled and the number of test takers varied significantly across the states for the first test administration, cross-state comparisons are not valid for the spring 2008 test administration.**

It is expected that as states continue to expand their use of the test, the number of test takers will increase and the results will yield more comparable data.

**TABLE 3: STUDENTS’ ENROLLMENT IN ALGEBRA II COURSES AND/OR PARTICIPATION IN ALGEBRA II EXAM BY STATE, 2007-08**

State	Number of Students Tested	Approximate Number of Students Taking Algebra II (or Equivalent)	Percent of Students Enrolled in Algebra II (or Equivalent) Taking Algebra II Exam	First Year Algebra II is Required for Graduation
Total	88,344			
AZ	1,091	No State Data Available	No State Data Available	2013
AR	22,101	23,949	92%	2010
HI	5,157	No State Data Available	No State Data Available	Not Required
IN	3,027	55,337	5%	2011
KY	2,019	80,400	3%	2012
MN	205	No State Data Available	No State Data Available	2015
NJ	9,813	43,000	23%	Not Required
NC	922	33,013	3%	2013
OH	33,611	128,576	26%	2014
PA	8,371	105,000	8%	Not Required
RI	1,853	7,000	26%	Not Required
WA	174	No State Data Available	No State Data Available	2013

**TABLE 4: AVERAGE NUMBER OF POINTS AND PERCENT CORRECT, BY QUESTION TYPE AND STATE**

State*	All Items (Total possible points = 76)		Multiple-Choice Items (Total possible points = 46)		Constructed Response Items (Total possible points = 30)	
	Average Number of Points Correct	Average Percent of Points Correct**	Average Number of Items Correct	Average Percent of Items Correct	Average Number of Points Correct	Average Percent of Points Correct
Total	20	26.9 %	17	37.8%	3	10.2%
AZ	19	25.0%	17	37.2%	2	6.4%
AR	20	26.6%	17	36.9%	3	10.8%
HI	19	25.5%	17	36.8%	2	8.2%
IN	20	25.8%	17	37.7%	2	7.6%
KY	16	20.8%	14	30.9%	2	5.4%
MN	16	21.7%	15	33.1%	1	4.2%
NJ	21	27.5%	18	38.5%	3	10.7%
NC	27	35.3%	22	48.3%	5	15.5%
OH	21	27.9%	18	39.0%	3	10.9%
PA	19	25.4%	17	36.3%	3	8.7%
RI	18	23.4%	16	34.0%	2	7.1%
WA	24	31.4%	19	42.0%	5	15.2%

\*Note: Maryland and Massachusetts are ADP partnership members but did not participate in the spring 2008 exam administration, as such they are not included in Table 3 or 4. Both states will administer the exam when the online version becomes available in 2009.

\*\*Differences in the "Average *Percent* of Points Correct" where states might appear to have the same "Average *Number* of Points Correct" can be attributed to rounding the number of points to the nearest whole number after calculating the percent of points.

**TABLE 5: AVERAGE NUMBER OF POINTS AND PERCENT CORRECT, BY CONTENT STANDARD**

	Content Standards				
	Operations on Numbers and Expressions	Equations and Inequalities	Polynomial and Rational Functions	Exponential Functions	Function Operations and Inverses
Total Number of Points Possible	11	16	22	15	12
Average Number of Points Correct	3	4	7	4	2
Average Percent of Correct Points	28.5%	25.0%	31.8%	27.6%	17.9%

Although scores cannot be used to compare one state's performance to another, the results of the first administration provide some interesting insight when taken in aggregate. Initial findings from the first administration of the Algebra II exam suggest the following:

**Student performance was low across all states and in all content strands:** As Table 4 demonstrates, average scores across the states ranged from 21 percent to 35 percent. This is not surprising given the rigorous nature of the exam's items and the exam's purpose: to measure mastery of advanced Algebra content, including the knowledge and skills necessary to be successful in a first-year credit-bearing college mathematics course. This is a significantly more rigorous test than most statewide high school exams, and states anticipated results would reflect that increased level of difficulty. In addition, this was the first year of administering the program. Often when new tests are given for the first time, results tend to be low, followed by growth over the next several years of the program as students and teachers become more familiar with the content, better understand what is expected of them and curriculum instruction improves to match the higher expectations. Finally, because there were no incentives or consequences associated with the exam, students may not have been motivated to put forth their best effort. Lack of motivation coupled with the level of challenge could both be factors that contributed to the low scores.

Table 5 shows the consortium-wide results by content standard. While performance was relatively low across all of the strands, Polynomial and Rational Functions had the highest result with an average score of 32 percent of possible points, while Function Operations and Inverses had the lowest average score at 18 percent correct. According to the content experts from the participating states, Polynomials and Rational Functions is the content most typically found in an Algebra II course in high school, so it is perhaps not surprising that students would perform best on this standard. The Function Operations and Inverses standard is the most advanced content and is not taught yet in all Algebra II courses. As teachers and students become more familiar with the standards and expectations, there likely will be an increase in performance across all of the content strands as well as in total scores.

**Constructed response items are a particular challenge for students:** Across the states, the average percentage of correct points for constructed response questions, in which students must formulate their own answer to the question rather than select among given answer choices, is three times lower than those for multiple choice items. Indeed, one-third of the total test takers either did not attempt any constructed response items—or received a zero on those that they did attempt. Since constructed response items comprise one-third of the total points on the exam, the poor performance on these items had a large impact on average total scores. All of the states that participated in the development of the test stressed the importance of these kinds of questions as they require students to demonstrate critical thinking and problem solving. Whether the poor response rate on these questions was due to the difficulty of the items, a lack of motivation—there were no student rewards or consequences attached to this exam administration—or perhaps a combination of the two, it points to an area that states will need to address as they consider how to strengthen curriculum and instruction. Students who responded and earned credit for constructed response items tended to do better across the entire test on average. For this set of students, who represent roughly the top quarter of students, the average percent correct was 13 points higher than for the whole set of test takers.

**Students who take Algebra II in earlier grades perform better:** Students who took Algebra II in 8th or 9th grade appear to have done better on the exam than those who took the course in 11th or 12th grade [See Table 6]. This is most likely because students who took the course in the earlier grades are the strongest and most advanced mathematics students, while those who took it toward the end of their high school career tend to struggle more in mathematics. If this interpretation is correct, it has important implications for states and local school districts as requirements for all students to take Algebra II are phased in. Struggling students will need the strongest teachers in order to succeed. States and districts must therefore ensure that the teachers assigned to classes with large numbers of older, struggling students have strong content knowledge and pedagogical skills to effectively deliver a rigorous course. This will require attention to both teacher assignment practices, and to providing ongoing, high quality professional development.

**TABLE 6: AVERAGE NUMBER OF POINTS AND PERCENT CORRECT, BY GRADE LEVEL**

Grade Level	Number of Students Tested	Average Number of Points Correct (Out of Possible 76)	Average Percent of Correct Items
Grade Eight	56	39	51.0%
Grade Nine	5,018	27	36.1%
Grade Ten	26,939	24	32.2%
Grade Eleven	41,934	18	23.9%
Grade Twelve	10,283	16	20.6%
Not Identified	4,114	20	26.4%

**States vary in their policies regarding course requirements and data collection:**

While eight of the participating consortium states require Algebra II for graduation, the six remaining states do not. In addition, only eight participating states had data systems in place state-wide that enabled them to provide the total number of students that were enrolled in an Algebra II course [See Table 3]. Statewide collection of course-taking enrollments and longitudinal data systems that track course-taking patterns and link to higher education institutions are vital to the development of research/data-driven decisions and will ultimately enhance the value of the Algebra II exam results.

**Next Steps for Policymakers**

There is much work ahead for the participating states in order to improve postsecondary preparation in mathematics. There are several key steps they each must take.

**Strengthen K-12 standards:** Though all of the participating states have or are in the process of adopting end of high school standards that reflect the demands of postsecondary education and 21st century careers, many still must articulate those standards into course descriptions for high school courses. The standards for the ADP Algebra II exam should provide the core of each state’s Algebra II course description, while leaving room for states to add additional content as needed, and to use the assessment modules as appropriate.

Of course, students need to be well prepared before they take Algebra II. States can help accomplish this by ensuring that their K-12 mathematics standards are clear, focused and provide a rigorous grade-by-grade

and course-by-course progression from kindergarten up to and through Algebra II, and that their summative assessments are well aligned with the standards.

**Provide supports to teachers and students:** Standards and tests alone cannot improve student achievement. As states raise standards for all students, they need to ensure that teachers and students have the tools and supports essential for success. For most states, this will require a substantial effort to prepare, recruit and retain talented individuals with strong mathematics content and pedagogical skills. States and districts will need to pay equal attention to ensuring that high poverty schools, which disproportionately are staffed with less experienced and less well prepared teachers, have experienced and capable staff with strong content and pedagogical expertise.

It will also require a substantial state effort in partnership with local districts, to provide current teachers with the high quality and engaging curriculum, instructional strategies and tools, formative assessments, and ongoing professional development needed for continuous improvement.

Similarly, struggling students will need significant supports, including but not limited to, improved classroom instruction in order to meet the higher standards. As states begin to phase in Algebra II course-taking and examination requirements, they should target assistance to schools and districts to improve student success in Algebra I. This could include interventions and supports such as summer or other transitional programs prior to the first year of high school that help students develop academic and self-efficacy skills as well as a stronger foundation in algebra, or specialized double-period courses that intensify efforts to reinforce concepts and provide catch-up opportunities for students who enter high school behind. It should also involve special attention to improving the capacity of teachers to work with special needs students, including those with limited English proficiency and students in special education.<sup>9</sup>

These steps have always been an important component of standards-based reform, but in practice states and local districts have had far less success in designing and implementing the strategies and policies to carry them out than they have in adopting standards and assessments. Unless state and local leaders can build the partnerships and mobilize and sustain the political will and technical capacity necessary to do so, the payoff from higher standards and common assessments will be limited.

### **Make college and career readiness the focus of high school assessment and accountability systems:**

States will need to include the ADP Algebra II exam in a broader assessment and accountability system whose primary focus is on providing the information and incentives necessary to increase the number of students who graduate from high school prepared for success in postsecondary education and 21st century jobs. At present, most state assessment and accountability systems hold schools accountable for student performance on assessments that measure knowledge and skills typically learned in 9th or 10th grade, far less rigorous than the skills students need for postsecondary success. However, this is not just a matter of replacing current tests with more rigorous exams. Rather, states must develop a more robust set of indicators that yield information on student attainment, course participation and academic performance, and a data system that can follow students through the K-12 and postsecondary education systems.

<sup>9</sup> See The Charles A. Dana Center at the University of Texas at Austin, *Practices Worthy of Attention* <http://www.utdanacenter.org/pwoa/index.php>.

To help states tackle these assessment and accountability issues, Achieve and the Education Trust will release a set of recommendations to states in the fall of 2008.

### **Use the ADP Algebra II exam to determine if students can take credit-bearing**

**courses:** The ADP Algebra II exam measures the advanced mathematical knowledge and reasoning and problem solving skills needed for success in first-year credit-bearing mathematics courses. It measures content that is at least as rigorous, if not more rigorous, than placement exams postsecondary institutions use to determine if incoming students must take remedial rather than credit-bearing courses.<sup>10</sup> Today, students take these placement exams only after they have graduated from high school and enroll in college. On average, 22 percent of these first-year students find out then that they lack the skills to do college-level work in mathematics, and must pay for and take noncredit-bearing remedial courses.

To the extent that postsecondary systems use the information provided by this exam to let high school students know if they are ready to do college-level work, this exam will play a significant role in improving the transition from secondary to postsecondary education. It can open doors for students, but not close them. It will be a consequential test, though not a “high stakes” test in the conventional way. High school students who do not meet standards can use their remaining time in high school—potentially their junior and senior years—to fill in significant skill gaps before they arrive at college, rather than afterwards.

## **Conclusion**

The states participating in the ADP Algebra II end-of-course exam deserve credit for their efforts to build and administer an assessment that measures whether students are ready for credit-bearing college mathematics. This type of exam, and the level of rigor it entails, is unique. The states anticipated that results would show that much work was needed, yet remain committed to working together to affect results in and among their states and ensure that more students graduate from high school prepared for college. For all of the participating states, the ADP Algebra II end of course exam is just one first step in a broader strategy to ensure that all students have access to the curriculum and support they need to graduate from high school with a meaningful diploma that will prepare them for college, careers and life.

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<sup>10</sup> See *Aligned Expectations? A Closer Look at College Admissions and Placement Tests* for an analysis of what widely used college admissions and placement exams measure, <http://www.achieve.org/node/839>

## Acknowledgements

The ADP Algebra II end-of-course exam is the product of a unique partnership. It would not have been possible without the leadership shown by the 14 states that created and developed the exam. The vision and commitment of chief state school officers, governors, and higher education and business leaders in these states was critical.

Equally important are a larger number of people in each state, too numerous to list by name here, who translated leadership commitment into reality. State testing directors and other staff who participate in the ADP Algebra II Exam Coordination and Direction Team, as well as math content experts from each state, have been instrumental in the development of the test specifications and course description, the review of proposals, and oversight of test development, administration and reporting. In addition, many high school mathematics teachers and postsecondary faculty participated in reviewing test items during test development. Staff from the Ohio Department of Administrative Services and procurement officials in each state education agency cooperated in an extremely complex multi-state procurement. The commitment, wisdom, innovativeness and spirit of compromise demonstrated repeatedly by these state officials have been essential for the successful development of the ADP Algebra II exam.

As the test developer, Pearson has also been a vital partner in this project. We would like to thank the Pearson team members who have worked so hard to develop this exam, many of whom also provided support in the drafting of this report.

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Finally, Achieve would like to thank the Bill & Melinda Gates Foundation for providing generous funding for this report and the broader work of the American Diploma Project. This project was an ambitious undertaking, and Achieve would like to thank the states and individuals that made it possible.

Michael Cohen  
*President*  
Achieve

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## ABOUT ACHIEVE

Created by the nation's governors and business leaders, Achieve is a bipartisan, non-profit organization that helps states raise academic standards, improve assessments and strengthen accountability to prepare all young people for postsecondary education, careers and citizenship. Achieve has helped more than half the states benchmark their academic standards, tests and accountability systems against the best examples in the United States and around the world. Achieve also serves as a significant national voice for quality in standards-based education reform and regularly convenes governors, CEOs and other influential leaders at National Education Summits to sustain support for higher standards and achievement for all of America's schoolchildren.

In 2005, Achieve co-sponsored the National Education Summit on High Schools. Forty-five governors attended the Summit along with corporate CEOs and K-12 and postsecondary leaders. The Summit was successful in making the case to the governors and business and education leaders that our schools are not adequately preparing students for college and 21st-century jobs

and that aggressive action will be needed to address the preparation gap. As a result of the Summit, 33 states have since joined with Achieve to form the American Diploma Project Network—a coalition of states committed to aligning high school standards, assessments, graduation requirements and accountability systems with the demands of college and the workplace.

For more information, visit Achieve's website at [www.achieve.org](http://www.achieve.org).

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## EDUCATION WEEK

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### New Algebra 2 Test Suggests States Face High Hurdles

By Sean Cavanagh

Students across the country struggled with advanced algebra on a first-of-its-kind test in that subject, according to a report to be released this week by **Achieve**, the nonprofit Washington organization that helped coordinate the exam.

A dozen states had students take part in the test, the product of an unusual collaboration among states seeking to establish a common standard for judging teenagers' ability in challenging math, as well as their preparation for college.

Achieve is part of the **American Diploma Project Network**, an effort among two-thirds of the nation's states to align standards, tests, and graduation requirements. Achieve officials in 2005 began working with states to devise a test in advanced algebra, or Algebra 2. Nearly 90,000 students took part in the first test, which was given as an end-of-course exam this spring.

The Algebra 2 test is designed to be a demanding exam, the authors of the report say. Most state high school math exams, by contrast, gauge students on 9th or 10th grade math, not the skills they need to prosper in college classes, the report states.

Achieve was set to release the results of the algebra test Aug. 25. Not surprisingly, given the test's relative difficulty, scores from the 12 participating states were low. North Carolina's students earned the highest average of percentage points correct, 35 percent. Kentucky's students had the lowest, at 21 percent.

Achieve officials, however, cautioned against reading too much into individual states' results, which they said could be affected by several factors. They noted that the number of students taking the test varied enormously by state, from nearly 34,000 in Ohio to only a few hundred in Minnesota. They also pointed out that students in various grades took the Algebra 2 exam, depending on the math requirements of

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#### **Advanced Algebra: Success Varies by Grade**

The following table shows the performance of students on a recent Algebra 2 end-of-course test, as documented in a report released by **Achieve Inc.** Performance varied by grade—probably because students who took the course earlier in school tend to be stronger math students, the report explains.

their states.

"We were not surprised" by the low scores, said Michael Cohen, the president of Achieve, which seeks to raise academic standards and prepare students for college and the workforce. "We knew that a rigorous algebra test, pegged at a college-readiness level, was not something a lot of students would do well on." Even so, he added "it's a big reminder of how much further we have to go."

ALL TEST		Enlarge
Average Number of Points Correct (Out of Possible 76)	Average Percent of Correct Items	
39	51.0%	
27	36.1	

SOURCE: Achieve Inc., American Diploma Project Algebra 2 End-of-Course Exam, 2008 Annual Report

### Advanced Content

Algebra 2, and high school courses with the same math content, are widely seen as vital to students' success in college. Advanced algebra requires abstract reasoning and critical-thinking skills. Achieve's research has shown that college faculty members regard advanced-algebra content as critical for students to survive in college math.

The goal of the Achieve exam and the report is not to emphasize state-by-state comparisons of test scores, Mr. Cohen said, but to encourage states to set agreed-upon standards for what students should know in Algebra 2. In addition, the project can demonstrate the feasibility of states working together to craft common tests, and urge them to develop tests that measure college readiness rather than a less rigorous standard, he said.

Many states have increased their math-coursetaking requirements in recent years. California, for instance, recently mandated that students be tested in introductory algebra, or Algebra 1, in 8th grade three years from now. ("**Experts Question Calif.'s Algebra Edict**," July 30, 2008.)

One state that participated in the Achieve test, Arkansas, requires students to complete Algebra 2 to graduate from high school, unless their families opt out. Arkansas had 22,000 students take the Achieve test, one of the largest populations of test-takers of any participating state.

Arkansas' students, on average, got only 27 percent of the questions correct—which put the state's performance in about the middle of the pack—but the state's commissioner, T. Kenneth James, said he did not find those results especially startling. Arkansas has made progress on state math tests at earlier grade levels, he said, and he expects it to make strides in Algebra 2 in the future, as the state commits more resources to teaching and to classroom improvement at the high school level.

Mr. James also said he expects more states eventually will join in Achieve's Algebra 2 project, despite the initial low scores. Most state officials find the idea of having their students take part in a challenging exam, used across several states, appealing, he said.

"We've talking about a common standard," he said. "What we expect students to demonstrate after completing Algebra 2 should not be that hard to come up with."

The report shows that the largest group of Algebra 2 test-takers had taken that class in 11th grade. But those who took Algebra 2 earlier in school produced higher average scores—a result that was not surprising, because teenagers who enrolled in more-rigorous math classes earlier were more likely to have stronger math skills, the authors concluded.

The Achieve report also shows that students struggled far more on the algebra constructed-response questions, or those which asked them to formulate their own answers, than they did on multiple-choice items.

That weakness did not surprise Hank Kepner, the president of the National Council of Teachers of Mathematics, a 100,000-member organization based in Reston, Va., who worked with Achieve in designing the test. He saw it as evidence that students were struggling with more complex problem-solving, an important skill in college math.

Those complex questions allow teachers to understand “the thinking the student put into the problem,” Mr. Kepner said, and “where a student made a misstep.”

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