ACT National Curriculum Survey® 2009

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ACT is an independent, not-for-profit organization that provides assessment, research, information, and program management services in the broad areas of education and workforce development. Each year we serve millions of people in high schools, colleges, professional organizations, businesses, and government agencies, nationally and internationally. Though designed to meet a wide array of needs, all ACT programs and services have one guiding purpose—helping people achieve education and workplace success.

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Overview

What Is the ACT National Curriculum Survey®?

The ACT National Curriculum Survey is a one-of-a-kind nationwide survey of educational practices and expectations conducted by ACT every 3 to 5 years. ACT surveys thousands of middle school/junior high school, secondary, and postsecondary* teachers in English/writing, reading (including English language arts and social studies teachers), mathematics, and science for the purpose of determining what skills and knowledge are currently being taught, and which are considered important for success at each grade level for college readiness.

ACT uses the survey results to guide the test development of ACT's EXPLORE® (8th and 9th grade), PLAN® (10th grade), and ACT® (11th and 12th grade) tests, which are the key components of ACT's Educational Planning and Assessment System (EPAS®) and the longitudinal assessments of ACT's College Readiness System. ACT conducts the ACT National Curriculum Survey to ensure its curriculum-based assessments are measuring the current knowledge and skills that instructors of entry-level college courses identify as important for success in each content area.

What is "college readiness"? In this report, the phrase is used to refer to the level of preparation a student needs to be ready to enroll and succeed without remediation in an entry-level, credit-bearing course at a two-year or four-year institution, trade school, or technical school.

Closing the gap between postsecondary expectations and high school practice has become a priority among national and state policymakers. With the passage of the American Recovery and Reinvestment Act of 2009 (ARRA), the Council of Chief State School Officers (CCSSO) and the National Governors Association's NGA Center for Best Practices joined to coordinate the Common Core State Standards Initiative, a state-led effort to develop and adopt a common set of state standards. These standards will be aligned with college and work expectations, include rigorous content and skills, and be internationally benchmarked (CCSSO, 2009). The evidence and research base for these standards will be drawn from the work of national educational leaders, including ACT.

Preliminary results of the Common Core State Standards Initiative are consistent with what ACT has long advocated (and long demonstrated in its own College Readiness Standards™): fewer

* Throughout this report, the term *postsecondary instructors* refers only to instructors of credit-bearing college courses; it does not include instructors of remedial college courses. When the latter are referenced in the report, they are termed "remedial teachers."

but deeper high school standards focusing on what is essential for college success. In states that adopt the Common Core State Standards, this will be a big change in direction: not only will curricula and instruction become more directed toward college and career readiness, but the assessments they choose also need to measure college and career readiness. ACT, through the ACT National Curriculum Survey and other research, will monitor these efforts closely and use these results to help inform and ensure that our assessments meet the needs of college and career readiness.

Because the ACT National Curriculum Survey collects a wealth of information about what entering college students should know and be able to do to be ready for credit-bearing college-level coursework, the results are being shared more broadly, recognizing that these data can help educational stakeholders make more informed educational decisions about college readiness standards and alignment of those standards with assessment and curriculum.

This first section is an overview that describes the 2009 survey and highlights key findings. This section is followed by the findings for each of four subject areas: English/writing, mathematics, reading, and science. The last section offers conclusions based on the results.

Survey Participants Included Middle School Teachers Through Postsecondary Instructors, and Remedial Teachers.

For the 2009 ACT National Curriculum Survey, surveys were sent to a nationally representative sample of middle school/junior high school, high school, and college teachers who teach courses in English/writing, reading (including English language arts and social studies), mathematics, and science (including biology, chemistry, physics, and Earth/space science) in public and private institutions all across the United States. College remedial teachers in English/writing, mathematics, and reading were also surveyed. These remedial teachers were included because they should be uniquely qualified to identify the critical skills and knowledge that high school graduates are typically missing and the set of knowledge and skills that, when emphasized, result in student readiness for success in postsecondary entry-level courses. The response rates by content area ranged from 9% to 20%, with an overall response rate of 14%. Appendix A provides complete details of the survey respondent information.

Table 1.1
ACT National Curriculum Surveys Sent in 2009

Grade level	Surveys sent	Surveys returned	Return %
Middle school/junior high	12,250	1,335	11
High school teachers	18,750	2,761	15
Postsecondary	17,279	2,831	16
Remedial	6,783	753	11
Total	55,062	7,680	14

All educators surveyed were asked to perform two primary tasks. First, the educators were asked to rate discrete *content knowledge and skills* with respect to how important each is to student success in the content area. (Specifically, secondary and remedial teachers were asked to rate the importance of each in a given class they teach; postsecondary instructors were asked to rate the importance of each as a prerequisite to success in a given class they teach.) These results allow for comparison of secondary school teachers' views of the importance of course outcomes to postsecondary instructors' expectations of what is needed for success in their courses.

Second, the educators were asked to rank *groups* of content and skills, known as *strands*, with respect to their relative importance to student readiness for college.

In addition, all educators except for postsecondary instructors were asked to indicate whether they teach that particular knowledge/skill as a standard part of their course, whether they teach it as a review, or whether they do not teach it at all. Educators were also asked to provide information about a variety of topics, including the number of years they have taught the course about which they responded, a description of their teacher certification, what texts and reading materials they use in their courses, the amount of instructional time they spend on reading strategies, their perceptions of overlap of college and workplace readiness demands, their perceptions of reduction of academic expectations for students who are not college bound, and their perceptions of student readiness in reading and in college-level work in their discipline. The educators also were asked for information about their state's assessments, graduation requirements, and standards. (For a detailed list of responses, see Appendix B).

Summary of Results

1. ACT's Educational Planning and Assessment System (EPAS) Tests Measure the Content and Skills Educators Identify as Important for College Readiness.

ACT conducts the National Curriculum Survey as part of its validation process every 3 to 5 years to make sure that ACT's EPAS test specifications are up to date and reflect the knowledge and skills currently needed for college readiness. The results of the ACT National Curriculum Survey affirm that the knowledge and skills currently being taught in United States classrooms and that are important for readiness and success in college are being adequately represented in ACT's EXPLORE, PLAN, and ACT tests. The knowledge and skills being measured by the tests and the relative emphasis accorded to each are consistent with those rated as important and necessary by secondary and postsecondary instructors.

Teachers rated the importance of skills and knowledge using a 5-point scale (0 = not important, 1 = low importance, and 4 = high importance). Survey results support the claim that the knowledge and skills measured by EPAS are considered important by postsecondary instructors: all science skills measured were rated above 2.5; all English/writing, mathematics, and reading skills were rated above 3.0. ACT uses importance rating results to guide decisions about the knowledge and skills to be measured on EPAS tests and in what proportions. When secondary teachers' and postsecondary instructors' ratings disagree, greater consideration is afforded to the postsecondary instructors' ratings to make sure that EPAS tests measure knowledge and skills critical to college readiness. If a particular skill or knowledge currently on the EPAS tests is rated as unimportant, or if an untested skill or knowledge is rated in the moderately important range or beyond, the ACT National Curriculum Survey results provide the validity evidence to make a corresponding change in our test specifications. Importance rating results are used to help guide evaluation of the overall emphases the knowledge and skills receive in each test. Appendix C gives statistical details about each knowledge and skill question asked. Appendix D provides details about EPAS test development, including EPAS test specifications. Sections 2 through 5 in this document include additional discussion about the validity evidence provided by ACT National Curriculum Survey 2009 results with respect to each content area of the EPAS tests.

Given the current interest in what are sometimes referred to as "21st century student outcomes"—a combination of specific skills, content knowledge, and expertise that some people believe students need to master in order to succeed in work and life in the 21st century—a special collection of items specifically asking about the importance of such skills was included on all of the surveys. Of those skills included, the ones rated most highly by postsecondary instructors across the content areas included reading, English and language arts, writing, communication skills, mathematics, science, and critical thinking and problem-solving skills. Appendix E provides details about all 26 skills in the collection and their relative ratings.

2. There Are Misalignments Between Postsecondary Instructors' Expectations and High School Teachers' Evaluations of Student Readiness.

Surveys asked postsecondary instructors and secondary teachers about how well their state standards and state graduation requirements identify and define what students need to know and to be able to do to be college ready in their content area. These educators were also asked how ready students are for college-level work in their content area. The results indicate that postsecondary and high school respondents have dramatically different perspectives.

- As Figure 1.1 shows, 71% of high school teachers reported that their state standards defined *well* or *very well* what students need to know to be college ready. Comparatively, only 28% of postsecondary instructors responded in that way.
- As shown in Figure 1.2, 71% of high school teachers felt that their state's graduation requirements prepare students for college *well* or *very well* compared to 20% of postsecondary instructors. Fifty-five percent of postsecondary instructors responded *poorly* or *very poorly*.
- Figure 1.3 shows that 91% of high school teachers reported that their students are prepared for college-level work in their content area. In contrast, only 26% of postsecondary instructors reported that their students arrive prepared. (Note: 2009 ACT data corroborate postsecondary instructors' report of students' readiness. *The ACT Profile Report* for the graduating class of 2009 shows that only 23% of 2009 high school graduates who took the ACT test are ready for college-level work in English, writing, reading, mathematics, and science [ACT, 2009a].)

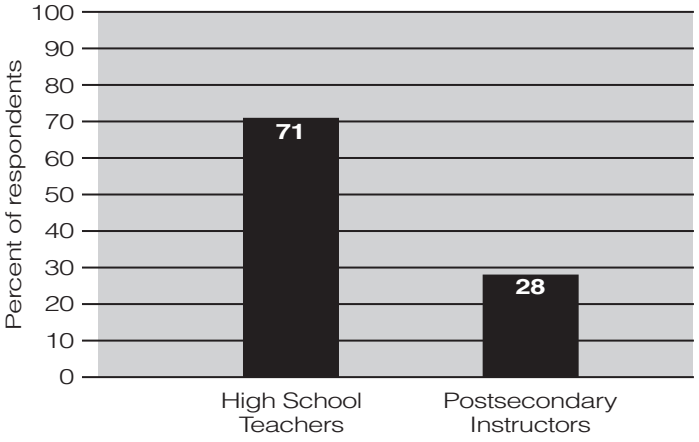

Figure 1.1: What Percentage of Educators Reported That Their State Standards Prepare Students Well or Very Well for College?

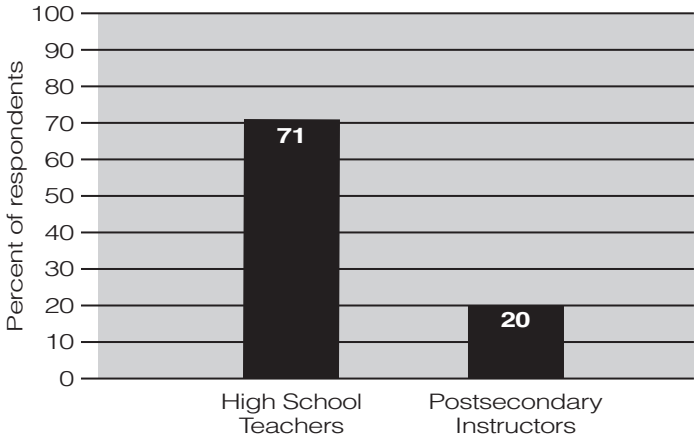

Figure 1.2: What Percentage of Educators Reported That Their State's Graduation Requirements Prepare Students Well or Very Well for College?

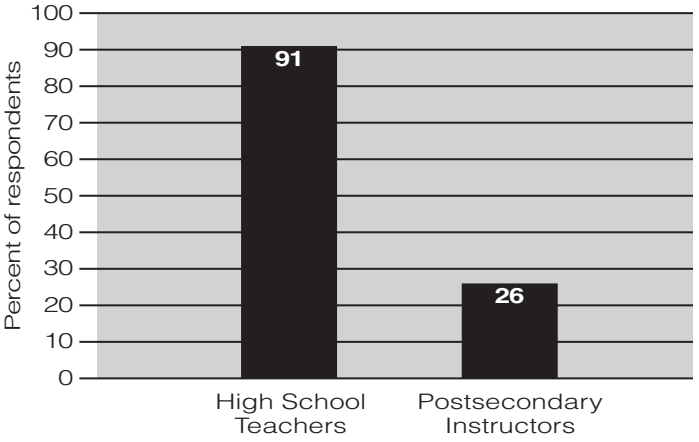

Figure 1.3: What Percentage of Educators Reported That Their Students Are Prepared for College-Level Work in Their Content Area?

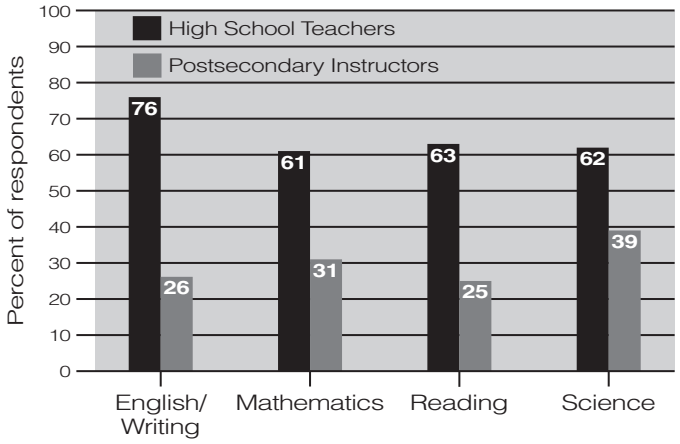

Figure 1.4: Percent of High School Teachers Versus Postsecondary Instructors Who Believe More Than Half of Their Students Are Ready to Do College-Level Reading

- Postsecondary instructors and high school teachers were also asked how many students are prepared to meet expectations for the required level of reading comprehension in their discipline. Again, the differences in perception are quite significant, as shown in Figure 1.4.

Across content areas, approximately two thirds of high school teachers reported that more than half of their students are ready to read at appropriate levels for college in the content area. Postsecondary instructors, however, clearly disagree, with only about one third reporting that most students are ready.

3. What Postsecondary Instructors Expect Entering College Students to Know Is More Targeted and Specific Than What High School Teachers View as Important.

Postsecondary instructors gave fewer skills the top rating of "high importance" than did middle school or high school teachers (see Figure 1.5). Postsecondary instructors also viewed more content and skills as being of low importance. This pattern was consistent across content areas, though it was most prevalent in science.

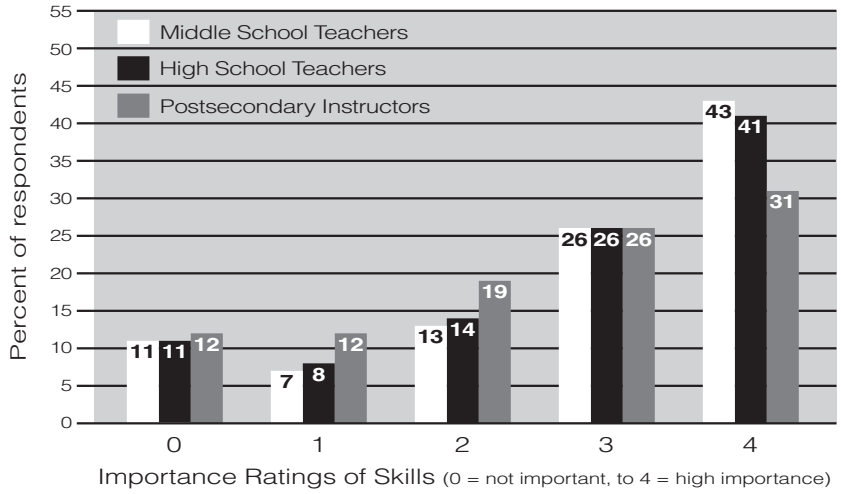

Figure 1.5: Distribution of Importance Ratings

This finding that postsecondary instructors target fewer skills as being of high importance is consistent with recent policy statements and findings raising concerns that some states require too many standards to be taught and measured, rather than focusing on the most important state standards for students to attain. The long lists of content topics and skills defy teachers' efforts to teach them in detail within the confines of a single school year (Finn, Petrilli, & Julian, 2006). It may be that the extensive demands of state standards force high school teachers to treat all content topics as important, sacrificing depth to breadth. Because the postsecondary survey results indicate that a more rigorous treatment of fundamental content knowledge and skills

needed for credit-bearing college courses would better prepare students for postsecondary school and work, states would likely benefit from examining their state standards and, where necessary, reducing them to focus only on the knowledge and skills that research shows are essential to college and career readiness and postsecondary success. States can also look to the results of the Common Core State Standards Initiative for help focusing their standards.

4. High School Teachers and College Instructors Agree That College Readiness Skills Overlap With Workforce Skills.

Evidence strongly supports the contention that the skills and knowledge needed for college readiness are the same as those needed to enter the workforce in a job paying a living wage (ACT, 2006). In the 2009 survey, postsecondary instructors and high school teachers across content areas were asked to what degree the knowledge and skills for college and career readiness overlap. Seventy-one percent of responding high school teachers and 78% of responding postsecondary instructors replied either "a great deal" or "completely." Only 1% of responding high school teachers or postsecondary instructors replied "not at all."

5. High School Teachers Report That Secondary Instructors Reduce Expectations for Students Who Are Not College Bound.

The following question was posed on high school teachers' surveys across the content areas: "To what degree do you believe secondary instructors reduce academic expectations for students they perceive are not college bound?" The results show that 42% of high school teachers replied either "a great deal" or "completely." Only 6% reported that there is no reduction of expectation. This result implies that high school students who indicate that they are not going on to college may not be held to the same standards as their college-going peers. Even more troubling is that this implication, if true, suggests that high school teachers may be reducing academic expectations for some students despite their strong belief (reported in the previous finding) that the skills needed for entry into the workforce are just as demanding as those needed for college.

Content Areas

The following sections discuss in detail the survey findings in the content areas of English/writing, mathematics, reading, and science, respectively.

2

English/Writing

The English/Writing ACT National Curriculum Survey

The English/Writing ACT National Curriculum Survey was sent to more than 10,000 educators in English and writing. The courses they taught are shown in Table 2.1. (See Appendix A, Tables A.1 and A.2 for further details.)

Table 2.1

Courses Taught by Participants in the English/Writing ACT National Curriculum Survey

Grade level	Courses
Middle school/junior high school	*English/Language Arts*
High school	*Writing/Composition*
Postsecondary	Entry-level courses *Composition* *Freshman English* *Survey of American Literature*
Remedial	*Developmental Writing*

All respondents were asked to perform two primary tasks. First, the educators were asked to rate discrete *content knowledge and skills* with respect to how important each is to student success in English and writing. (Specifically, secondary and remedial teachers were asked to rate the importance of each in a given class they teach; postsecondary instructors were asked to rate the importance of each as a prerequisite to success in a given class they teach.) These results allow for comparison of secondary school teachers' views of the importance of particular knowledge/skills in achieving desirable course outcomes to postsecondary instructors' expectations of what is needed as a prerequisite for success in their course.

Second, educators were asked to rank *groups* of content and skills, known as *strands*, with respect to their relative priority in contributing to student success in English and writing.

In addition, all educators except for postsecondary instructors were asked to indicate whether each skill or content is taught in their course. If it is not taught, the teacher was asked to indicate whether this was because the skill or content is taught prior to the current grade/course or for some other reason. (Further information about what knowledge and skills are being taught in middle school/junior high school and high school can be found in Appendix F.) Educators

were also asked to provide information about a variety of topics, including the number of years they have taught the course about which they responded, a description of their teacher certification, what texts and reading materials they use in their course, the amount of instructional time they spend on reading strategies, their perceptions of overlap of college and workplace readiness demands, their perceptions of reduction of academic expectations for students who are not college bound, and their perceptions of student readiness in reading and in college-level work in their discipline. The educators also were asked for information about their state's assessments, graduation requirements, and standards in English and writing. (For a detailed list of responses, see Appendix B.)

Results of Importance Ratings

Specific content and skills known to be in the English and writing domain were identified and described as individual survey items. Related content and skills items were grouped and organized into the categories referred to here as *strands*. Each content and skill item, as well as the strand as a whole, was rated by respondents using a 5-point importance scale where 0 = not important, 1 = low importance, and 4 = high importance. Individual survey item means are available in Appendix C. The focus of the discussion in this section, however, is on broader conceptual issues, and those are most accurately reflected by the strand-level means. The strand means are reported in Table 2.2 for middle school/junior high school (MS), high school (HS), postsecondary (PS), and remedial writing (REM) educators.

Table 2.2

English/Writing Mean Importance Ratings by Strand (0 = Not Important; 1 = Low Importance; 4 = High Importance)

Strand	MS	HS	PS	REM
Topic and Idea Development	3.70	3.76	3.50	3.79
Organization, Unity, and Coherence	3.69	3.65	3.44	3.72
Word Choice in Terms of Style, Tone, Clarity, and Economy	3.35	3.39	3.10	3.30
Sentence Structure and Formation	3.35	3.34	3.31	3.56
Conventions of Usage	3.30	3.09	3.32	3.40
Conventions of Punctuation	3.35	3.21	3.21	3.42

These strands closely represent content and skills areas in the EPAS English Tests. The relatively high values of these strand means indicate that educators across the grade levels consider the content and skills covered on the EPAS English Tests to be important.

Results of Rank Ordering Strands

Table 2.3
English/Writing Strand Rankings
(1 = Most Important; 6 = Least Important)

Strand	MS	HS	PS	REM
Topic and Idea Development	1	1	1	1
Organization, Unity, and Coherence	2	2	2	2
Word Choice in Terms of Style, Tone, Clarity, and Economy	4	4	5	6
Sentence Structure and Formation	3	3	3	3
Conventions of Usage	5	5	4	4
Conventions of Punctuation	6	6	6	5

In order to determine relative importance, the English/writing survey asked participants to rank order the six English/writing strands from most important (1st) through least important (6th). (For a detailed list of rankings, see Appendix G.) Results of rankings are provided in Table 2.3, again by educator level.

These results reveal that all groups rank the Topic and Idea Development and the Organization, Unity, and Coherence strands as most important, followed by Sentence Structure and Formation. Postsecondary and remedial writing instructors assign slightly greater importance to usage and punctuation strands than do secondary teachers.

Table 2.4 shows how often respondents placed each of the six strands at the top position when asked to rank them from 1 to 6. This display shows how often each strand is considered the most important, which gives information that examining mean rankings alone does not give. For example, if a large percentage of people consider a strand extremely important, but an equally large percentage disagree, averaging the rankings will place the strand somewhere in the middle. Examining what proportion of people place a strand in the top position, however, reveals what proportion consider the strand of great importance without the intensity of disagreement affecting the data.

Table 2.4
English/Writing Strand Ranked "1"
(Percentages)

Strand	MS	HS	PS	REM
Topic and Idea Development	59	63	55	57
Organization, Unity, and Coherence	23	24	18	14
Word Choice in Terms of Style, Tone, Clarity, and Economy	4	3	2	1
Sentence Structure and Formation	6	5	13	21
Conventions of Usage	4	2	8	6
Conventions of Punctuation	4	3	5	1

These results show that educators across grades rank Topic and Idea Development and Organization, Unity, and Coherence as the most important strands. Comparatively more postsecondary instructors and remedial writing teachers than secondary teachers ranked Sentence Structure and Formation or Conventions of Usage as most important, and though in neither group did either strand dislodge Topic and Idea Development as the choice of a majority of its members, Sentence Structure and Formation did get the second-most first-place votes among remedial writing teachers.

Areas of Agreement and Disagreement Between High School Teachers and Postsecondary Instructors

There is agreement across grade levels in the ranking of the top three strands: Topic and Idea Development; followed by Organization, Unity, and Coherence; and then by Sentence Structure and Formation. Survey results also reveal informative differences between the secondary and postsecondary judgments of what is most important for success in English and writing.

More postsecondary instructors (and remedial teachers) rank usage and sentence structure strands as most important than do high school teachers. The mean strand ratings show that high school teachers value the top two strands more highly than they do any of the rest of the strands, with a mean difference of 0.26 between second- and third-highest-rated strands. By comparison, there is only a 0.09 mean difference between postsecondary instructors' ratings of their second-highest-rated strand (Organization, Unity, and Coherence) and their third-highest-rated strand (Sentence Structure and Formation), which is only 0.01 higher than their fourth-rated-highest strand (Conventions of Usage). To some degree, then, it appears that high school teachers place a greater importance on what might broadly be called "content" issues (Topic and Idea Development; Organization, Unity, and Coherence), while postsecondary instructors see what might broadly be called "correctness" issues (Sentence Structure and Formation and Conventions of Usage) as being more closely equal in importance with the "content" strands.

This inference is further supported through additional analyses of the survey data. Seven of the 12 largest differences between high school teachers' and postsecondary instructors' ratings are found in the Conventions of Usage strand, with postsecondary instructors rating these seven approximately 40 to 70 spots higher than did high school instructors. Of these, "ensure straightforward subject-verb agreement," the 6th-highest-rated postsecondary skill, was rated only 46th by high school teachers.

High School Instructional Time Spent on Topics Versus Postsecondary Rating of Those Topics' Importance

Examination of responses to individual survey questions reveals discrepancies in terms of secondary instructional time spent on topics versus postsecondary rating of those topics' importance. Of all the skills rated by postsecondary instructors and high school teachers, the one with the largest difference in perceived importance was that of "writing to analyze literature," ranked 18th in importance by high school teachers, but only 87th by postsecondary instructors. In addition, this individual skill was the one reported as being the most commonly taught individual skill by high school teachers (endorsed by 85% of high school instructors as "taught in the course as part of standard course content"). Clearly there appears to be a difference of opinion about the criticality of writing to analyze literature.

The majority of "Not taught as standard course content" survey items are from the Conventions of Usage and Conventions of Punctuation strands.

High school response data indicate that some skills are not taught as part of standard course content. Analysis showed that the majority of these skills (60%, or 11 of 18) concerned usage and punctuation. While these responses do not necessarily mean that most students are not being taught these skills at all (since they may well be taught in prior grades), the skills appear to be receiving little if any instructional time in high schools. However, these skills are considered important for success at the postsecondary level; postsecondary instructors give 14 of the 18 a mean rating of greater than 3 on an importance scale of 0 to 4. The mean ratings of the other 4 skills ranged from 2.73 to 2.99.

Remedial Writing Teachers' Importance Ratings and Rankings More Closely Agree With Postsecondary Instructors' Ratings and Rankings.

A sample of teachers who teach remedial courses in writing at the postsecondary level participated in the 2009 English/writing survey. These teachers should be in a good position to identify the critical skills and knowledge that incoming students are typically missing, the acquisition of which results in student readiness for success in postsecondary writing.

Remedial teachers' responses more closely resemble postsecondary instructors' responses than high school teachers' responses. (See Appendix H for detailed results of remedial teachers' responses.) These two postsecondary groups appear to be more concerned with stressing the importance of attending to "correctness" issues involving usage and sentence structure, along with topic and idea development, than are high school respondents.

Discussion of Survey Results and EPAS English Tests

ACT National Curriculum Survey results support ACT's EPAS English Tests and ACT Writing Test as assessments of content and skills that are crucial for college readiness.

The EPAS English Tests measure student achievement and college and career readiness in punctuation, grammar and usage, sentence structure, writing strategy, organization, and style. Specific descriptions of the knowledge and skills currently measured by EPAS English Tests are listed in Appendix D. Importance ratings for specific content and skills provide empirical evidence that the knowledge and skills that EPAS English Tests measure are considered important for postsecondary success; similarly, content and skills rated by the majority of educators as not important are not present on EPAS English Tests or the ACT Writing Test (see Table C.1 in Appendix C for a complete listing of English/writing content and skills and their ratings). ACT staff will continue to use these survey results to continue to develop and refine the EPAS English Tests.

Discussion of Survey Results and the ACT Writing Test Specifications

Because postsecondary institutions have varying needs with respect to assessing students' writing for admissions and/or course placement purposes, ACT offers the ACT Writing Test as an optional standardized measure that postsecondary institutions may require, recommend, or not use. Making this test optional allows students to decide whether to take it in light of the requirements of the institutions they are considering attending; this ensures that students are not required to pay for and take a test that they do not need.

The ACT Writing Test is a 30-minute essay test. Students are given one writing prompt that defines an issue and describes two points of view on that issue. The student produces a direct writing sample that responds to the prompt; students may support one of the proffered positions or develop one of their own. The ACT Writing Test measures a student's ability to express judgments, maintain a focus, develop a position on a topic, organize ideas in a logical way, and use language clearly and effectively according to the rules of standard written English. (For the scoring rubric, see Appendix I.) These skills, along with writing to convey information and writing to argue or persuade readers (both central to the assessment) are all highly endorsed by postsecondary instructors as prerequisites for success in writing. (See Table C.1 in Appendix C for a listing of writing content and skills and their importance ratings under the heading "Evaluation of Writing.") ACT staff will continue to use these survey results to continue to develop and refine the ACT Writing Test.

3
Mathematics

The Mathematics ACT National Curriculum Survey

The Mathematics ACT National Curriculum Survey was sent to more than 13,000 mathematics educators. The courses they taught are shown in Table 3.1. (See Appendix A, Tables A.3 and A.4 for further details.)

Table 3.1

Courses Taught by Participants in the Mathematics ACT National Curriculum Survey

Grade level	Courses
Middle school/ junior high school	*Mathematics, Pre-Algebra, Algebra, Geometry*
High school	*Mathematics, Algebra, Geometry, Trigonometry, Pre-Calculus, Calculus, Probability and/or Statistics*
Postsecondary	Entry-level courses *College/Finite/Discreet Math* *Probability/Statistics* *Algebra* *Geometry/Precalculus* *Calculus*
Remedial	*Developmental Math/Remedial Math*

All respondents were asked to perform two primary tasks. First, the educators were asked to rate discrete *content knowledge and skills* with respect to how important each is to student success in mathematics. (Specifically, secondary and remedial teachers were asked to rate the importance of each in a given class they teach; postsecondary instructors were asked to rate the importance of each as a prerequisite to success in a given class they teach.) These results allow for comparison of secondary school teachers' views of the importance of particular knowledge/skills in achieving desirable course outcomes to postsecondary instructors' expectations of what is needed as a prerequisite for success in their course.

Second, educators were asked to rank *groups* of content and skills, known as *strands*, with respect to their relative priority in contributing to student success in mathematics.

In addition, all educators except for postsecondary instructors were asked to indicate whether each skill or content is taught in their course. If it is not taught, the teacher was asked to indicate whether this was because the skill or content is taught prior to the current grade/course or for some other reason. (Further information about what knowledge and skills are being taught in middle school/junior high school and high school can be found in Appendix F.) Educators were also asked to provide information about a variety of topics, including the number of years they have taught the course they responded about, a description of their teacher certification, what texts and reading materials they use in their course, the use of

calculators on tests, the amount of instructional time they spend on reading strategies, their perceptions of overlap of college and workplace readiness demands, their perceptions of reduction of academic expectations for students who are not college bound, and their perceptions of student readiness in reading and in college-level work in their discipline. The educators also were asked for information about their state's assessments, graduation requirements, and standards in mathematics. (For a detailed list of responses, see Appendix B.)

Results of Importance Ratings

Specific knowledge and skills known to be in the mathematics domain were identified and described as individual survey items. Related skills and knowledge items were grouped and organized into the categories referred to here as *strands*. Each knowledge and skill item, as well as the strand as a whole, was rated by respondents using a 5-point importance scale where 0 = not important, 1 = low importance, and 4 = high importance. Individual survey item means are available in Appendix C. The focus of the discussion in this section, however, is on broader conceptual issues, and those are most accurately reflected by the strand-level means. The strand means are reported in Table 3.2 for middle school/junior high school (MS), high school (HS), postsecondary (PS), and remedial math (REM) educators.

Table 3.2

Mathematics Mean Importance Ratings by Strand (0 = Not Important; 1 = Low Importance; 4 = High Importance)

Strand	MS	HS	PS	REM
Basic Operations and Applications	3.50	2.98	2.79	3.69
Probability, Statistics, and Data Analysis	2.97	1.70	1.44	1.84
Numbers: Concepts and Properties	3.32	2.88	2.96	3.25
Expressions, Equations, and Inequalities	3.43	3.12	3.02	3.14
Graphical Representations	3.16	3.23	2.99	2.85
Properties of Plane Figures	2.49	2.09	1.78	1.75
Measurement	3.08	2.24	2.00	2.36
Functions	1.85	2.67	2.43	1.74

These strands include the specific knowledge and skills that are measured by the EPAS Mathematics Tests. Some values appear to be relatively low (below 2.00), but the ratings—and the inclusion of these strands in the EPAS Mathematics Tests—can be accounted for by three main factors. First, some of the low-rated strands represent content and skills that are age inappropriate for some groups and consequently are not tested by all levels of EPAS. For example, content and skills from the Functions strand are rated 1.85 by middle school/junior high school teachers; therefore, these concepts are not tested on the EXPLORE test and only minimally on the PLAN test. Conversely, concepts in the Measurement strand, rated lowest as a group by postsecondary instructors, are tested more heavily on EXPLORE than on PLAN or the ACT.

Second, the strand ratings are affected by the overall makeup of the sample, including the numbers of teachers and the courses that they teach. For example, a higher proportion of algebra instructors responded to the survey than did geometry instructors. Consequently, the Graphical Representations and Properties of Plane Figures strand, particularly important to geometry, has a low mean rating in the table yet is highly rated by geometry teachers (see Appendix G). The Probability, Statistics, and Data Analysis strand received relatively low ratings across grade levels and courses except for instructors who teach probability and statistics.

Third, the survey asks how important each content and skill is in terms of a specific course taught by respondents; therefore, mean ratings are more appropriately interpreted at the course level. For that reason, the ratings for Mathematics appear by course in Appendix C.

In conclusion, careful analyses of mean ratings, particularly when considered through a course lens, indicate that secondary teachers and postsecondary instructors consider the content and skills covered on their students' grade-appropriate EPAS Mathematics Test to be important.

Results of Rank Ordering Strands

In order to determine relative importance, the Mathematics survey asked participants to rank order the eight Mathematics strands from most important (1st) through least important (8th). (For a detailed list of rankings, see Appendix G.) Results of rankings are provided in Table 3.3, again by educator level.

Table 3.3

Mathematics Strand Rankings (1 = Most Important; 8 = Least Important) for All Mathematics Instructors

Strand	MS	HS	PS	REM
Basic Operations and Applications	2	5	1	1
Probability, Statistics, and Data Analysis	6	8	8	8
Numbers: Concepts and Properties	3	4	3	2
Expressions, Equations, and Inequalities	1	1	2	3
Graphical Representations	4	2	4	4
Properties of Plane Figures	7	6	7	7
Measurement	5	7	6	5
Functions	8	3	5	6

The degree of agreement in rankings varies. Postsecondary instructors' and remedial mathematics teachers' importance ratings are most closely in line with each other. The group most different from the others in terms of relative importance ratings is high school teachers. Some of these differences can be explained by the different courses represented by high school respondents. For example, high school teachers' higher ranking of the Graphical Representations and the Properties of Plane Figures strands can be explained at least in part by the greater proportion of geometry teachers in the high school sample. Other high school teacher

rankings seem to be reflective of high school teachers' tendency to rank advanced topics (e.g., Functions) as more important than mastery of fundamentals (e.g., the Basic Operations and Applications strand).

Table 3.4 shows how often respondents placed each of the eight strands at the top position when asked to rank them from 1 to 8. This display shows how often each strand is considered the most important, which gives information that examining mean rankings alone does not give. For example, if a large percentage of people consider a strand extremely important, but an equally large percentage disagree, averaging the rankings will place the strand somewhere in the middle. Examining what proportion of people place a strand in the top position, however, reveals what proportion consider the strand of great importance without the intensity of disagreement affecting the data.

Table 3.4

Mathematics Strand Ranked "1"
(Percentages for MS and Algebra Teachers Only)

Strand	MS	HS (Algebra-related courses only)	PS (College Algebra only)
Basic Operations and Applications	37	22	56
Probability, Statistics, and Data Analysis	2	1	0
Numbers: Concepts and Properties	16	6	13
Expressions, Equations, and Inequalities	38	39	20
Graphical Representations	3	4	3
Properties of Plane Figures	<1	<1	<1
Measurement	3	<1	0
Functions	1	26	8

Because of the specificity of math courses and the content and skills that are taught in those courses, the following section will deal specifically with the most commonly taken postsecondary mathematics course, namely College Algebra, and its prerequisite courses taught at the high school and middle school levels.

This table shows that postsecondary algebra instructors rate the importance of the fundamental content and skills in the Basic Operations and Applications strand more highly than do high school algebra teachers. A plurality of high school teachers ranked the Expressions, Equations, and Inequalities strand as most important. Of greatest interest here is the relatively high percentage of algebra teachers (26%) who ranked the Functions strand as "1"; in contrast, only 8% of postsecondary algebra instructors ranked that strand as most important as a prerequisite for success in College Algebra. This pattern continues across other mathematics topics as well, with high school teachers ranking strands that contain more advanced content topics and skills more highly than do postsecondary instructors of similar courses. Conversely, postsecondary instructors rank the strands containing fundamental knowledge and skills as "1" more often than do their high school counterparts.

Disagreement Between High School and Postsecondary Instructors About What Is Most Important in Mathematics

Across the mathematics courses, high school teachers tended to rate more advanced math topics more highly than did their postsecondary counterparts. To investigate this trend more rigorously, additional analyses were conducted.

Specifically, survey items were grouped by ACT content experts according to whether they describe skills and knowledge at, above, or below what ACT student performance data indicate is the level essential for college and career readiness, referred to hereafter as "benchmark level." (See ACT, 2005, *What Are ACT's College Readiness Benchmarks?* for further discussion and explanation of this grouping system and how it was derived.)

Both high school teachers and postsecondary instructors rated knowledge and skills **at** the benchmark level **higher** in importance than they rated the more advanced content and skills classified as above the benchmark level. However, postsecondary instructors' ratings for these two different groupings differed by an average of 0.50, whereas high school teachers' differed only by an average of 0.19. This suggests that high school teachers see many content topics and skills both at and above the benchmark level as similarly important, while college instructors focus more closely on the benchmark-level skills.

Even within courses, differences of importance persist in accordance with this pattern. Within the area of algebra, the rank-ordered list of content and skills that College Algebra teachers say are the most important as prerequisites for their course was compared to the rank-ordered list of what high school Algebra II teachers identify as most important. Of the top 10 skills rated of most importance by College Algebra teachers, 8 were ranked 26 or more spots lower by high school teachers (the actual range being from 26 to 81 places lower). See Tables 3.5 and 3.6 for the top 11 (due to ties for 9th place) postsecondary skills and the associated high school ratings followed by the top 10 rated high school content and topics and the associated postsecondary ratings.

Table 3.5

Rank-Ordered List of Mathematical Topics by Postsecondary Instructor Importance

Postsecondary rank	High School rank	Content and skills
1	27	Perform addition, subtraction, multiplication, and division on signed rational numbers
2	39	Solve routine first-degree equations
3	45	Add and subtract simple algebraic expressions
4	61	Locate points in the coordinate plane
5	47	Solve routine two- or three-step arithmetic problems
5	52	Evaluate algebraic expressions by substituting integers for unknown quantities
5	19	Solve linear equations and inequalities in one variable
8	65	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
9	16	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
9	3	Apply rules of exponents
9	90	Comprehend the concept of length on the number line

Table 3.6

Rank-Ordered List of Mathematical Topics by High School Teacher Importance

Postsecondary rank	High School rank	Content and skills
28	1	Solve quadratic equations
54	2	Evaluate quadratic functions based on function notation
9	3	Apply rules of exponents
20	4	Factor quadratics
45	5	Understand the concept of function
19	6	Add, subtract, and multiply polynomials
46	7	Evaluate linear functions based on function notation
12	8	Use mathematical symbols correctly
65	9	Find solutions to systems of linear equations
59	10	Find domain, range, and inverses of functions

Results reveal that the College Algebra instructors more highly value fundamental understanding of mathematical concepts as prerequisites for success for their courses. High school Algebra II teachers rated more advanced topics as most important.

Remedial Math Teachers' Responses Agree With Postsecondary Instructors': Fundamentals Are More Important Than Advanced Math Content Topics.

A sample of teachers who teach remedial courses in mathematics at the postsecondary level participated in the 2009 Mathematics survey. These teachers should be in a good position to identify the critical skills and knowledge that incoming students are typically missing, the acquisition of which results in student readiness for success in postsecondary mathematics.

Results reveal that remedial mathematics teachers' ratings were closer to postsecondary mathematics instructors' ratings than to high school mathematics teachers' ratings. (See Appendix H for detailed results of remedial teachers' responses.) Remedial teachers and postsecondary instructors considered rigorous understanding of fundamental mathematics more important than exposure to more esoteric mathematics content topics for success in their courses.

It should be pointed out here, though, that remedial mathematics teachers may very well be preparing their students to take either a credit-bearing mathematics course (such as College Algebra), or perhaps another remedial course that might be needed before the student would be prepared to enter a credit-bearing course. Therefore, the remedial mathematics teachers' ratings and rankings should be interpreted with great care.

Discussion of Survey Results and EPAS Mathematics Test Specifications

The EPAS Mathematics Tests measure student achievement and college readiness in Basic Operations and Applications; Probability, Statistics, and Data Analysis; Numbers: Concepts and Properties; Expressions, Equations, and Inequalities; Graphical Representations; Properties of Plane Figures; Measurement; and (for the ACT only) Functions. (For EPAS Mathematics Test specifications, see Appendix D.)

ACT National Curriculum Survey results support ACT's Mathematics Tests as assessments of important content and skills that are crucial for college readiness.

ACT National Curriculum Survey results provide solid validity evidence that EPAS Mathematics Tests measure important skills and knowledge at the appropriate levels that are necessary for success. Importance ratings for specific content and skills provide empirical evidence that the content and skills that EPAS Mathematics Tests measure are considered important for postsecondary success; similarly, content and skills rated by the majority of educators as not important are not present on EPAS Mathematics Tests (see Tables C.2a to C.2c in Appendix C for a complete listing of mathematics content and skills and their ratings).

The Probability and Statistics strand received the lowest importance ratings from aggregate groups of high school teachers and postsecondary instructors. ACT will continue to cover Probability and Statistics on EPAS Mathematics exams because postsecondary instructors teaching probability and statistics courses rate these content topics and skills as important, and analysis across math and science courses affirms that postsecondary instructors consider this group of knowledge and skills to be important for success in postsecondary mathematics. However, the majority of the EPAS Mathematics Tests is devoted to measuring other mathematical knowledge and skills.

ACT staff will continue to use these survey results to continue to develop and refine the EPAS Mathematics Tests.

Discussion of Survey Results and ACT Calculator Policy

ACT's calculator policy is well supported by the survey results from high school and postsecondary instructors (see Table B.11 in Appendix B). The vast majority of high school teachers, postsecondary instructors, and remedial mathematics teachers report that calculators are allowed to be used on their exams. EPAS Mathematics Tests are developed so that a student does not need to use a calculator on the exam in order to finish in the allotted time. However, approved calculators are allowed on EPAS Mathematics Tests and are recommended for use on the ACT.

Survey results for middle school/junior high school teachers indicated that 38% of the teachers allowed calculators on their tests, 33% did not allow calculators to be used on tests, and 30% reported allowing calculators only for parts of tests (see Table B.11 in Appendix B). In light of these findings, ACT will maintain the current policy of allowing calculators on all parts of the EXPLORE Mathematics Test because calculators are typically allowed on middle school/junior high school mathematics tests. However, if future Mathematics ACT National Curriculum Survey results show that calculators typically are prohibited from use on exams, the ACT calculator policy will be reconsidered at that time.

4

Reading

The Reading ACT National Curriculum Survey

The Reading ACT National Curriculum Survey was sent to more than 11,000 language arts and social studies educators. The courses they taught are shown in Table 4.1. (See Appendix A, Tables A.5 and A.6 for further details.)

Table 4.1

Courses Taught by Participants in the Reading ACT National Curriculum Survey

Grade level	Courses
Middle school/ junior high school	*Language Arts*
High school	*Language Arts* *History/Civics*
Postsecondary	Entry-level courses *Composition* *Freshman English* *Survey of American Literature*
Remedial	*Developmental Reading*

All respondents were asked to perform two primary tasks. First, the educators were asked to rate discrete *content knowledge and skills* with respect to how important each is to student success in reading. (Specifically, secondary and remedial teachers were asked to rate the importance of each in a given class they teach; postsecondary instructors were asked to rate the importance of each as a prerequisite to success in a given class they teach.) These results allow for comparison of secondary school teachers' views of the importance of particular content and skills in achieving desirable course outcomes to postsecondary instructors' expectations of what is needed as a prerequisite for success in their course.

Second, educators were asked to rank *groups* of content and skills, known as *strands*, with respect to their relative priority in contributing to importance for student success in reading.

In addition, all educators except for postsecondary instructors were asked to indicate whether each skill or content is taught in their course. If it is not taught, the teacher was to indicate whether this was because the skill or content is taught prior to the current grade/course, or for some other reason. (Further information about what knowledge and skills are being taught in middle school/junior high school and high school can be found in Appendix F.) Educators were also asked to provide information about a variety of topics,

including the number of years they have taught the course about which they responded, a description of their teacher certification, what texts and reading materials they use in their course, the amount of instructional time they spend on reading strategies, their perceptions of overlap of college and workplace readiness demands, their perceptions of reduction of academic expectations for students who are not college bound, and their perceptions of student readiness in reading and in college-level work in their discipline. The educators also were asked for information about their state's assessments, graduation requirements, and standards in reading. (For a detailed list of responses, see Appendix B.)

Results of Importance Ratings

Specific content and skills known to be in the reading domain were identified and described as individual survey items. Related skills and content items were grouped and organized into the categories referred to here as *strands*. Each content and skill item, as well as the strand as a whole, was rated by respondents using a 5-point importance scale where 0 = not important, 1 = low importance, and 4 = high importance. Individual survey item means are available in Appendix C. The focus of the discussion in this section, however, is on broader conceptual issues, and those are most accurately reflected by the strand-level means. The strand mean ratings are reported in Table 4.2 for middle school/junior high school (MS), high school (HS), postsecondary (PS), and remedial writing (REM) educators.

Table 4.2

Reading Mean Importance Ratings by Strand (0 = Not Important; 1 = Low Importance; 4 = High Importance)

Strand	MS	HS	PS	REM
Main Ideas and Author's Approach	3.82	3.64	3.72	3.90
Generalizations and Conclusions	3.58	3.50	3.37	3.80
Supporting Details	3.70	3.46	3.44	3.63
Relationships	3.60	3.44	3.32	3.82
Meanings of Words	3.76	3.57	3.41	3.71

These strands include the specific content and skills measured by the EPAS Reading Tests. Therefore, these results show that survey participants rate the knowledge and skills covered on the EPAS Reading Tests as important.

Results of Rank Ordering Strands

In order to determine relative importance, the Reading survey asked participants to rank the five Reading strands from most important (1st) through least important (5th). (For a detailed list of rankings, see Appendix G.) Results of rankings are provided in Table 4.3, again by educator level.

Table 4.3

Reading Strand Rankings
(1 = Most Important; 5 = Least Important)

Strand	MS	HS	PS	REM
Main Ideas and Author's Approach	1	1	1	1
Generalizations and Conclusions	4	2	3	4
Supporting Details	2	3	2	3
Relationships	5	5	4	5
Meanings of Words	3	4	5	2

These results show a high level of agreement between postsecondary instructors and high school teachers. High school teachers and post-secondary instructors emphasize Generalizations and Conclusions more than do the middle school/junior high school teachers or the remedial reading teachers. In contrast, middle school/junior high school teachers and remedial reading teachers rate the Meanings of Words strand higher (3rd and 2nd, respectively) than postsecondary instructors or high school teachers do (5th and 4th, respectively). This higher level of endorsement may reflect middle school/junior high school teachers and remedial reading teachers placing greater emphasis on "fix-up" strategies, such as using context to help determine meaning, with developing readers.

Table 4.4

Reading Strand Ranked "1"
(Percentages)

Strand	MS	HS	PS	REM
Main Ideas and Author's Approach	60	54	71	75
Generalizations and Conclusions	12	20	16	5
Supporting Details	6	4	4	0
Relationships	4	7	3	1
Meanings of Words	18	13	6	19

Table 4.4 shows how often respondents placed each of the five strands at the top position when asked to rank them from 1 to 5. This display shows how often each strand is considered the most important, which gives information that examining mean rankings alone does not give. For example, if a large percentage of people consider a strand extremely important, but an equally large percentage disagree, averaging the rankings will place the strand somewhere in the middle. Examining what proportion of people place a strand in the top position, however, reveals what proportion consider the strand of great importance without the intensity of disagreement affecting the data.

The vast majority of teachers from all levels rank Main Ideas and Author's Approach as the most important strand. The Generalizations and Conclusions strand also received "1" rankings from a substantial number of high school teachers and postsecondary instructors; a comparable number of middle school/junior high school teachers and remedial reading teachers endorsed the Meanings of Words strand with "1" ratings. All other educator groups surveyed gave more "1" rankings to Meanings of Words than did the postsecondary instructors. Again, this higher level of endorsement may reflect middle

school/junior high school teachers and remedial reading teachers placing greater emphasis on "fix-up" strategies with developing readers, such as using context to help determine meaning.

Remedial Reading Teachers' Responses Align With Others and Give Particular Stress to Determining Meaning From Context.

A sample of teachers who teach remedial courses in reading at the postsecondary level participated in the 2009 Reading Survey. (See Appendix H for detailed results of remedial teachers' responses.) These teachers should be in a good position to identify the critical content and skills that incoming students are typically missing, the acquisition of which results in student readiness for success in postsecondary reading.

Remedial reading teachers' results reveal agreement with high school teachers and postsecondary instructors with respect to ranking the Main Ideas and Author's Approach strand as most important. Remedial reading teachers' responses differed from high school teachers' and postsecondary instructors' responses by ranking the content and skills in the Meanings of Words as being of relatively higher importance.

High School Teachers and Postsecondary Instructors Agree About Importance, Disagree About Student Reading Readiness.

High school teachers' and postsecondary instructors' importance ratings as well as ranking results show a high level of agreement about content and skills that are important for reading achievement. However, a startling disagreement exists in these two groups' perceptions about whether incoming first-year students meet expectations for reading comprehension in the disciplines.

High school teachers across all of the content areas (including English/writing, mathematics, reading, and science) were asked, "When they leave your course, how many students meet the required level of reading comprehension for students beginning entry-level college courses in your discipline?" Across content areas, about two thirds of high school teachers reported that more than half of their students were ready to read college-level material in their content area. (See Appendix B for data.)

Postsecondary instructors across content areas were asked, "How many students entering your course meet your expectations for the reading comprehension of incoming students in your discipline?" Across content areas, approximately one third of postsecondary instructors responded that most students arrive ready to read in their content area. (See Appendix B for data.)

Evidence Indicates Students Are Not Reading at Levels Sufficient for College and Career Readiness in Content Areas.

There are many indicators that students are not reaching adequate levels of reading achievement.

- As previously stated, postsecondary instructors across content areas report that the majority of students entering their courses do NOT meet expectations for reading comprehension of incoming students in the discipline (see Appendix B).
- Only slightly more than half (53%) of the members of the 2009 high school graduating class were ready for college-level and workplace training–level reading (ACT, 2009a). The figures are worse for African American/black students (29%) and Hispanic students (35%).
- In 2008–09, only 63% of eighth-grade students who took EXPLORE scored at a level that indicates they are on track for college and workplace readiness in reading (ACT, 2009b).

Yet evidence clearly supports that reading achievement is critical for student success.

- Low literacy levels often prevent students from mastering other subjects (Alliance for Excellent Education, 2002).
- Poor readers struggle to learn in text-heavy courses and are frequently blocked from taking academically more challenging courses (Au, 2000).
- More than 7,000 students drop out of high school every school day (Alliance for Excellent Education, 2009), and one of the most commonly cited reasons for the dropout rate is that students do not have the literacy skills to keep up with the curriculum (Kamil, 2003; Snow & Biancarosa, 2003).
- The level of academic achievement that students attain by eighth grade has a larger impact on their college and career readiness by the time they graduate from high school than anything that happens academically in high school (ACT, 2008). Students who do not meet reading-readiness indicators showing that they are on track for success by eighth grade do not benefit from high school instruction as much as students who do reach those indicators.

Little Instructional Time Is Devoted to Reading Strategies in Mathematics and Science Courses, Especially at the Postsecondary Level.

Reading achievement is a critical component for college and career readiness across content areas. The ACT National Curriculum Survey asked all respondents to report on how much time they spend teaching their students strategies on how to read the materials in their courses. High school English/writing, language arts, and social studies teachers most commonly reported spending "a moderate amount" of time. Both mathematics and science high school teachers most commonly reported that only "a little" time was devoted to reading in their content areas (see Table B.13 in Appendix B for all responses). Meanwhile, at the postsecondary level, **78% of mathematics instructors and 80% of science instructors reported spending no time, or only a little time, on teaching strategies for how to read materials for the course on which they reported (see Table B.13 in Appendix B for postsecondary responses).** If students are not ready to read content area materials at the college- and career-readiness level by the end of high school, they clearly should not count on receiving instruction about strategies in their postsecondary courses. This finding further emphasizes the importance of staying accurately informed about students' reading abilities across the content areas so that appropriate interventions and support can be provided to students in a timely manner.

Discussion of Survey Results and EPAS Reading Test Specifications

The EPAS Reading Tests measure student achievement and college readiness in referring to and reasoning from reading passages drawn from four content areas: Prose Fiction, Humanities, Social Sciences, and (for the ACT only) Natural Science. (For the EPAS Reading Test specifications, see Appendix D.) These content areas are equally represented in the EPAS Reading Tests since they include the content area reading that students typically encounter in their coursework. EPAS Reading Tests include passages of varying levels of complexity so that inferences can be made about students' abilities to comprehend different complexities of text.

ACT National Curriculum Survey results support ACT's Reading Tests as assessments of important and varied reading skills that are crucial for college readiness.

ACT National Curriculum Survey results provide solid validity evidence that the EPAS Reading Tests measure important skills and knowledge necessary for success and at the appropriate levels. Importance ratings for specific content and skills (see Table C.3 in Appendix C for a complete listing of reading content and skills and their ratings) provide empirical evidence that the referring and reasoning skills that EPAS Reading Tests measure are considered important for postsecondary success. Similarly, content and skills rated by the majority of educators as not important are not included on EPAS Reading Tests.

ACT staff will continue to use these survey results when making test development decisions about the specific knowledge and skills included on the EPAS Reading Tests.

5

Science

The Science ACT National Curriculum Survey

The Science ACT National Curriculum Survey was sent to more than 19,000 science educators. The courses they taught are shown in Table 5.1. (See Appendix A, Tables A.7 and A.8 for further details.)

All respondents were asked to perform two primary tasks. First, the educators were asked to rate discrete *content knowledge and skills* with respect to how important each is to student success in science. (Specifically, secondary and remedial teachers were asked to rate the importance of each in a given class they teach; postsecondary instructors were asked to rate the importance of each as a prerequisite to success in a given class they teach). These results allow for comparison of secondary school teachers' views of the importance of particular knowledge/skills in achieving desirable course outcomes to postsecondary instructors' expectations of what is needed as a prerequisite for success in their course. ACT sent biology, chemistry, physics, and Earth/space science surveys to biology, chemistry, physics, and Earth/space science teachers, respectively, so that educators were only giving feedback about courses that were within their own specialty.

Table 5.1

Courses Taught by Participants in the Science ACT National Curriculum Survey

Grade level and science content area	Courses
Middle school/ junior high school	*Science, Physical Science*
High school Biology	*Biology*
High school Chemistry	*Chemistry*
High school Earth Science	*Earth Science*
High school Physics	*Physics*
Postsecondary Biology	*Introduction to Biology/ Life Science*
Postsecondary Chemistry	*Introduction to Chemistry/ General Chemistry/etc.*
Postsecondary Earth/ Space Science	*Geology/Earth Sciences/etc.*
Postsecondary Physics	*Introduction to Astronomy, Introduction to Physics/ General Physics/etc.*

Second, educators were asked to rank *groups* of content and skills, known as *strands*, with respect to their relative priority in contributing to student success in science.

In addition, all educators except for postsecondary instructors were asked to indicate whether each skill or content is taught in their course. If it is not taught, the teacher was asked to indicate whether this was because the skill or content is taught prior to the current grade/course or for some other reason. Further information about what knowledge and skills are being taught in middle school/junior high school and high school can be found in Appendix F. Educators were also asked to provide information about a variety of topics,

including the number of years they have taught the course about which they responded, a description of their teacher certification, what texts and reading materials they use in their course, the amount of instructional time they spend on reading strategies, their perceptions of overlap of college and workplace readiness demands, their perceptions of reduction of academic expectations for students who are not college bound, and their perceptions of student readiness in reading and in college-level work in their discipline. The educators also were asked for information about their state's assessments, graduation requirements, and standards in science. (For a detailed list of responses, see Appendix B.)

Results of Importance Ratings

Specific content and skills known to be in the science domain were identified and described as individual survey items. Related content and skills items were grouped and organized into the categories referred to here as *strands*. Each content and skill item, as well as the strand as a whole, was rated by respondents using a 5-point importance scale where 0 = not important, 1 = low importance, and 4 = high importance. Individual survey item means are available in Appendix C. The focus of the discussion in this section, however, is on broader conceptual issues, and those are most accurately reflected by the strand-level means. The strand mean ratings are reported in Table 5.2 for middle school/junior high school (MS), high school (HS), and postsecondary (PS) educators. (Note: there were no remedial science teacher participants in the science survey.)

Table 5.2

Science Mean Importance Ratings by Strand (0 = Not Important; 1 = Low Importance; 4 = High Importance)

Strand	MS	HS	PS
Interpretation of Data	3.31	3.29	2.96
Scientific Investigation	3.53	3.19	2.50
Evaluation of Models, Inferences, and Experimental Results	2.82	2.82	2.54

These strands include the specific knowledge and skills measured on the EPAS Science Tests. Therefore, these results show that educators across grade levels rated the knowledge and skills covered on the EPAS Science Tests as important.

Results of Rank Ordering Strands

In order to determine relative importance, high school and postsecondary science participants ranked three strands in order of importance from most important (1st) to least important (3rd). (For a detailed list of strand data, see Appendix G.) Results of rankings are provided in Table 5.3 by middle school/junior high school (MS), high school (HS), and postsecondary (PS) responses.

Middle school teachers' strong endorsement of the Science Investigation strand aligns well with typical science curricular progression. At the middle school/junior high school level, teachers are working primarily with developing student understanding of how to pose scientific questions and how to conduct scientific investigations properly. Alternatively, high school teachers and postsecondary instructors ranked the Interpretation of Data strand as most important, which again aligns well with the laboratory experiences typically occurring at those levels, where less emphasis is placed on learning how to set up an investigation and more emphasis is placed on data collection and interpretation.

Table 5.3

Science Strand Rankings
(1 = Most Important; 3 = Least Important)

Strand	MS	HS	PS
Interpretation of Data	2	1	1
Scientific Investigation	1	2	2
Evaluation of Models, Inferences, and Experimental Results	3	3	3

Table 5.4 shows how often respondents placed each of the three strands at the top position when asked to rank them from 1 to 3. This display shows how often each strand is considered the most important, which gives information that examining mean rankings alone does not give. For example, if a large percentage of people consider a strand extremely important, but an equally large percentage disagree, averaging the rankings will place the strand somewhere in the middle. Examining what proportion of people place a strand in the top position, however, reveals what proportion consider the strand of great importance without the intensity of disagreement affecting the data.

Table 5.4

Science Strand Ranked "1"
(Percentages)

Strand	MS	HS	PS
Interpretation of Data	18	41	54
Scientific Investigation	72	45	25
Evaluation of Models, Inferences, and Experimental Results	10	14	20

With only three strands, these results are of limited help in identifying points of alignment or difference among secondary and postsecondary educators. The Scientific Investigation strand clearly received the most "1" rankings from middle school/junior high school teachers. As previously stated, this makes sense given the nature of science curriculum at that level. Postsecondary instructors most highly endorse the Interpretation of Data strand, whereas high school teachers appear to be split between Interpretation of Data and Science Investigation in a way that postsecondary instructors are not.

Postsecondary Instructors and Middle School/Junior High School Teachers Consistently Rate Science Content Much Lower in Importance Than Do Their High School Counterparts.

Close analysis of importance ratings shows an interesting pattern among middle school/junior high school teachers, high school teachers, and postsecondary science instructors. Of the top 21 survey items (there was a tie for 20th place) rated most highly by postsecondary science instructors, 10 were process skills, 10 were fundamental science content topics, and only 1 was an "advanced" science topic (understanding and applying the mole concept). For middle school/junior high school teachers, 19 of the top-rated survey items were process skills, and 1 was a fundamental science content topic. For high school instructors, all 20 of the skills were content topics, several of them advanced. In fact, of the top 50 highest-rated survey items for high school teachers, only 2 were process skills.

Both middle school/junior high school teachers and postsecondary science instructors rate process/inquiry skills as more important than advanced science content topics; high school teachers rate them in exactly the opposite order.

The results for middle school/junior high school teachers' responses make sense in light of the fact that science curricula at that level tend to focus on teaching fundamental science content while engaging students in introductory science inquiry experiences. Through this emphasis on science inquiry processes and skills, science students develop a more coherent understanding of how to collect and use data to support and refute inferences and also learn how science is different from other disciplines.

Postsecondary science instructors' rating of process skills as more important than advanced science content topics, and high school teachers' rating in the opposite way, are responses consistent with past ACT National Curriculum Survey results. These results indicate a substantive difference between high school science teachers' perceptions of what is most important and postsecondary science instructors' estimates of what content and skills incoming students already must have to succeed in science at the college/university level.

No Remedial Courses Identified for Science

We were not able to identify remedial science courses that students typically took to prepare them for postsecondary work, so no remedial course teachers' responses are available for comparison.

Discussion of Survey Results and EPAS Science Test Specifications

The EPAS Science Tests measure student achievement and college readiness in the skills needed for the natural sciences, including interpretation of data; scientific investigation; and evaluation of models, inferences, and experimental results. Some questions are posed about fundamental science content in life science (EXPLORE only), physical science (EXPLORE only), Earth/space science, and (PLAN and the ACT only) biology, chemistry, and physics. Some fundamental science content is measured on the EPAS Science Tests, but science inquiry and process skills receive the greatest emphasis. Knowledge and process skills such as how to accurately interpret data, how to make appropriate experimental design decisions, how to reach the appropriate conclusions when presented with results of experiments, and how to appropriately evaluate given models and scientific explanations, all cast in real-life contexts of the different science content areas, are extensively covered by EPAS Science Tests.

EPAS Science Tests emphasize application of science processes and inquiry skills and fundamental science knowledge in a variety of real-world science contexts.

ACT National Curriculum Survey results provide solid validity evidence that EPAS Science Tests measure important skills and knowledge at the appropriate levels that are necessary for success. Specific descriptions of the knowledge and skills currently measured by EPAS Science Tests are listed in Appendix D. Importance ratings provide empirical evidence that the content and skills that EPAS Science Tests measure are important for postsecondary success; similarly, content and skills rated by the majority of educators as not important are not included on EPAS Science Tests. (See Table C.4 in Appendix C for a complete listing of science content and skills and their ratings.)

ACT staff will continue to use these survey results when making test development decisions about the specific content and skills included on the EPAS Science Tests.

ACT National Curriculum Survey results support ACT's Science Tests as assessments of important science process and inquiry skills that are crucial for college readiness.

6

Conclusions

One major finding of the 2009 ACT National Curriculum Survey is that ACT's EPAS tests appropriately reflect college readiness expectations across the areas of English/writing, mathematics, reading, and science. More educators were sampled in 2009 than ever before, and this rich data set will continue to be used to inform and guide ACT's test development decisions.

The 2009 survey also yields interesting findings with respect to postsecondary instructors' and high school teachers' perceptions about college and workplace readiness. Survey results of postsecondary instructors and high school teachers across content areas reveal that a great deal of overlap exists in these educators' perception of the skills and knowledge needed for college readiness and those needed to enter the workforce in a job paying a living wage. Survey results from high school teachers also suggest, however, that secondary teachers lower expectations for students who are not college bound. This result is unfortunate, because it implies that students heading for the workforce and for college may be receiving different types and levels of instruction. Workforce-bound students may not be receiving instruction to the same standards as their college-going peers, even though the skills they need to master to be successful when they leave high school are fundamentally the same.

Another major finding is that postsecondary instructors indicate that neither their state's standards nor their state's graduation requirements align well with what students need to know and to be able to do to be college ready in their content area. By way of contrast, most high school teachers indicate that their instruction tends to cover these same state standards. States should seek empirical evidence that their standards and assessments are encouraging high school teachers to focus on teaching the knowledge and skills in each content area that are most critical for student readiness for postsecondary work in each content area.

The 2009 survey results delineate differences between high school teachers' and postsecondary instructors' perceptions of students' readiness for college and careers. High school teachers rate their students' readiness much higher then do their postsecondary counterparts with respect to preparedness for college-level work as well as with respect to how many students reach reading comprehension expectations. Given the high number of students enrolling in remedial courses, these differences in perception deserve greater scrutiny. More direct communication between postsecondary instructors and high school teachers within each discipline about expectations is also warranted.

The survey also reveals differences between high school and postsecondary educators' importance ratings within content areas. In English/writing, postsecondary instructors rate proper usage and punctuation higher in importance than do high school teachers; conversely, high school teachers highly endorse some topics (e.g., writing to analyze literature) that postsecondary instructors do not rate highly in importance as prerequisite for success. In mathematics, high school teachers tend to rate advanced topics (e.g., functions) with greater importance than do their postsecondary counterparts; postsecondary mathematics instructors, by contrast, tend to endorse mastery of fundamental mathematic topics as being of higher importance for incoming students. High school teachers in English language arts and social studies report that their students leave their courses ready to do college-level reading in their content area; postsecondary instructors, on the other hand, report that most students arrive not ready. Finally, in science we see high school teachers highly endorsing advanced science topics (e.g., understanding and applying the mole concept) while not rating science process skills highly; postsecondary science instructors tend to respond in the exact opposite way.

ACT conducts the ACT National Curriculum Survey to monitor current educational practices, and to ascertain postsecondary expectations in order to build instruments that measure what content and skills educators have identified as important. ACT will actively use the survey results throughout EPAS test development. ACT offers these research results to the wider public so that they may also help inform educational stakeholders and policy decisions.

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Appendices

English/Writing Sample Breakdown for the 2009 ACT National Curriculum Survey

Tables A.1 and A.2 give the breakdown of English/writing participants in the 2009 ACT National Curriculum Survey. Table A.1 gives the number of survey instruments sent out to writing instructors, and Table A.2 gives the response rate.

Table A.1
English/Writing Surveys Sent

Sample	Courses	Sample size
Middle school/ junior high school	*English/Language Arts*	3,000
High school	*Writing/Composition*	2,350
Postsecondary	Entry-level courses *Composition* *Freshman English* *Survey of American Literature*	2,850
Remedial	*Developmental Writing*	2,500

Table A.2
English/Writing Survey Response Rate

Survey type	Number mailed	Number returned	Response rate
Middle school/ junior high school	3,000	315	11%
High school	2,350	351	15%
Postsecondary	2,850	385	14%
Remedial	2,500	225	9%
Total	10,700	1,276	12%

Mathematics Sample Breakdown for the 2009 ACT National Curriculum Survey

Tables A.3 and A.4 give the breakdown of math participants in the 2009 ACT National Curriculum Survey. Table A.3 gives the number of survey instruments sent out to math instructors, and Table A.4 gives the response rate.

Table A.3
Mathematics Surveys Sent

Sample	Courses	Sample size
Middle school/ junior high school	*Mathematics, Pre-Algebra, Algebra, Geometry*	4,000
High school	*Mathematics, Algebra, Geometry, Trigonometry, Precalculus, Calculus, Probability and/or Statistics*	4,500
Postsecondary	Entry-level courses *College/Finite/ Discrete Math* *Probability/Statistics* *Algebra* *Geometry/Precalculus* *Calculus*	3,000
Remedial	*Developmental Math/ Remedial Math*	2,033

Table A.4
Mathematics Survey Response Rate

Survey type	Number mailed	Number returned	Response rate
Middle school/ junior high school	4,000	386	10%
High school	4,500	618	14%
Postsecondary	3,000	598	20%
Remedial	2,033	223	11%
Total	13,533	1,825	13%

Reading Sample Breakdown for the 2009 ACT National Curriculum Survey

Tables A.5 and A.6 give the breakdown of reading participants in the 2009 ACT National Curriculum Survey. Table A.5 gives the number of survey instruments sent out to reading instructors, and Table A.6 gives the response rate.

Table A.5
Reading Surveys Sent

Sample	Courses	Sample size
Middle school/ junior high school	*Language Arts*	2,750
High school	*Language Arts* *History/Civics*	2,000 1,400
Postsecondary	Entry-level courses *Composition* *Freshman English* *Survey of American Literature*	3,337
Remedial	*Developmental Reading*	2,250

Table A.6
Reading Survey Response Rate

Survey type	Number mailed	Number returned	Response rate
Middle school/ junior high school	2,750	342	12%
High school	3,400	426	13%
Postsecondary	3,337	429	13%
Remedial	2,250	305	14%
Total	11,737	1,502	13%

Science Sample Breakdown for the 2009 ACT National Curriculum Survey

Tables A.7 and A.8 give the breakdown of science participants in the 2009 ACT National Curriculum Survey. Table A.7 gives the number of survey instruments sent out to science instructors, and Table A.8 gives the response rate.

Table A.7
Science Surveys Sent

Sample	Courses	Sample size
Middle school/ junior high school	*Science, Physical Science*	2,500
High school Biology	*Biology*	2,200
High school Chemistry	*Chemistry*	1,650
High school Earth Science	*Earth Science*	2,900
High school Physics	*Physics*	1,750
Postsecondary Biology	*Introduction to Biology/ Life Science*	2,200
Postsecondary Chemistry	*Introduction to Chemistry/ General Chemistry/etc.*	1,900
Postsecondary Earth/Space Science	*Geology/Earth Sciences/ etc.*	1,842
Postsecondary Physics	Entry-level courses *Introduction to Astronomy* *Introduction to Physics/ General Physics/etc.*	2,150

Table A.8
Science Survey Response Rate

Survey type	Number mailed	Number returned	Response rate
Middle school/ junior high school	2,500	292	12%
High school	8,500	1,366	16%
Postsecondary	8,092	1,419	18%
Total	19,092	3,077	16%

Items About Transitions From One Grade Level to the Next

Table B.1

How well do you think your high school state assessment measures college readiness expectations?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Very poorly	8	7	6	7
Poorly	34	26	34	30
Well	32	34	36	32
Very well	9	12	9	7
Don't know	12	16	12	17
Not applicable	5	5	3	7
Postsecondary Instructors				
Very poorly	9	8	10	9
Poorly	39	28	35	29
Well	12	16	12	14
Very well	2	2	2	0
Don't know	38	44	40	46
Not applicable	1	2	1	1

Table B.2

How well do you think your state graduation requirements prepare high school students for college?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Very poorly	2	2	2	2
Poorly	17	18	21	23
Well	57	55	54	54
Very well	18	19	17	14
Don't know	4	4	5	5
Not applicable	2	2	1	1
Postsecondary Instructors				
Very poorly	10	9	10	10
Poorly	49	41	46	45
Well	16	24	16	18
Very well	2	1	2	0
Don't know	23	23	26	25
Not applicable	1	1	0	1

Items About Transitions From One Grade Level to the Next

Table B.3

How well do you think your state content standards identify and define what students need to know and to be able to do to be college ready in your content area?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Very poorly	3	2	3	3
Poorly	16	16	18	23
Well	57	55	52	53
Very well	17	21	21	15
Don't know	5	5	5	4
Not applicable	2	2	1	1
Postsecondary Instructors				
Very poorly	8	6	8	7
Poorly	37	25	36	32
Well	18	31	18	23
Very well	6	6	4	4
Don't know	30	31	34	35
Not applicable	1	1	1	0

Table B.4

To what degree do you believe the skills and knowledge needed for college readiness overlap those needed to enter the workforce in a job paying a living wage?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Not at all	1	1	1	1
Slightly	18	33	18	25
A great deal	66	58	66	60
Completely	13	6	14	10
Don't know	3	2	2	4
Postsecondary Instructors				
Not at all	1	0	1	1
Slightly	14	22	15	16
A great deal	65	65	68	69
Completely	16	7	15	11
Don't know	3	7	2	3

Items About Student Ability

Table B.5

How many students entering your course meet your expectations for the reading comprehension of incoming students in your discipline?

Response	Writing %	Mathematics %	Reading %	Science %
Postsecondary Instructors				
None, or very few	6	8	5	3
Less than half	30	33	31	25
About half	38	28	39	34
More than half	21	20	21	29
All, or nearly all	5	12	4	9

Table B.6

When they leave your course, how many students meet the required level of reading comprehension for students beginning entry-level college courses in your discipline?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
None, or very few	1	3	2	4
Less than half	7	15	11	13
About half	16	21	24	21
More than half	31	34	33	32
All, or nearly all	45	27	30	30

Table B.7

After leaving your course, how well prepared are your students for high school-level work in your content area?

Response	Writing %	Mathematics %	Reading %	Science %
Middle School Teachers				
Very poorly	0	0	0	0
Poorly	3	7	3	3
Well	67	59	62	70
Very well	31	35	35	26

Items About Student Ability

Table B.8

After leaving your course, how well prepared are your students for college-level work in your content area?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Very poorly	0	1	0	0
Poorly	6	10	9	8
Well	54	60	63	66
Very well	40	29	28	26

Table B.9

How well prepared are incoming students for college-level work in your content area?

Response	Writing %	Mathematics %	Reading %	Science %
Postsecondary Instructors				
Very poorly	9	13	9	13
Poorly	68	61	63	61
Well	23	26	26	25
Very well	1	0	2	1

Items About Teachers and Classrooms

Table B.10

What kinds of materials do you require your students to read in your course?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Textbook	90	97	92	94
Books	95	3	78	13
Journal articles	63	3	56	34
Primary source materials	72	17	77	25
Charts and graphs	37	55	61	80
Internet material	87	25	85	70
Postsecondary Instructors				
Textbook	84	98	85	97
Books	50	2	59	8
Journal articles	69	4	55	20
Primary source materials	57	5	68	16
Charts and graphs	16	31	22	57
Internet material	70	22	62	55

Table B.11

Which ONE of the following best describes the use of calculators on exams in your course?

Response	Middle School %	High School %	Postsecondary %
Mathematics Teachers			
Usually allowed for all parts of exams	38	74	70
Allowed in some parts of exams, not in others	30	23	15
Rarely allowed for any part of exams	33	4	16

Table B.12

Which of the following best describes your teacher certification?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Alternative	6	3	3	5
Traditional pre-service	4	5	3	4
State	56	50	56	51
Designated a highly qualified teacher by the state	50	56	54	53
Uncertified	1	1	1	2
Other	5	3	6	5

Table B.13

How much time do you spend teaching your students strategies on how to read the materials in your course?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
None	1	8	2	13
A little	30	57	31	58
A moderate amount	46	30	47	25
A lot	22	4	20	4
Postsecondary Instructors				
None	2	26	4	23
A little	41	52	39	57
A moderate amount	43	18	41	17
A lot	15	3	16	2

Items About Teachers and Classrooms

Table B.14

Lab activity

Response	%
High School Biology Teachers	
Microscopy	94
Culturing of microorganisms	41
Sterile technique	31
Use of dichotomous keys	74
Gel electrophoresis	29
Restriction digest of DNA	15
Bacterial transformation	74
Genetic crosses	29
Dissection	15

Table B.15a

To what degree do you believe middle school/junior high instructors reduce academic expectations for students they perceive are not college bound?

Response	Writing %	Mathematics %	Reading %	Science %
Middle School Teachers				
Not at all	28	24	25	28
Slightly	39	44	37	36
A great deal	18	19	24	22
Completely	1	1	1	0
Don't know	15	13	12	14

Table B.15b

To what degree do you believe secondary instructors reduce academic expectations for students they perceive are not college bound?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
Not at all	6	7	7	6
Slightly	42	46	40	42
A great deal	36	39	42	41
Completely	2	1	2	1
Don't know	14	7	9	10

Table B.16

To what extent does your instruction match your state's content standards for your course?

Response	Writing %	Mathematics %	Reading %	Science %
High School Teachers				
No match	2	1	1	0
A minimal amount	1	1	2	2
A moderate amount	29	30	26	34
Complete coverage	33	44	40	34
Coverage and goes beyond	35	25	31	30

Table C.1
Statistical Details for English/Writing Topics and Skills

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						Composition Process and Purpose
3.27	0.09	3.29	0.08	3.16	0.09	Determine purpose and audience
3.57	0.08	3.25	0.10	3.00	0.10	Use prewriting, brainstorming, or other techniques of invention
3.32	0.09	2.96	0.11	2.59	0.11	Use mapping, clustering, outlining, or other organizational tools
2.87	0.12	3.36	0.09	2.96	0.10	Gather and synthesize resources
2.70	0.13	3.32	0.10	3.05	0.10	Evaluate source materials critically
3.63	0.07	3.53	0.07	3.07	0.09	Develop a cohesive first draft
3.70	0.06	3.64	0.07	3.47	0.08	Revise for content
3.66	0.07	3.59	0.07	3.44	0.07	Edit and proofread for usage and mechanics
2.93	0.13	3.59	0.09	3.12	0.10	Cite sources accurately
3.50	0.09	3.76	0.06	3.62	0.07	Avoid plagiarism
3.25	0.10	3.23	0.10	2.71	0.10	Develop one's own voice as a writer
1.89	0.15	1.62	0.15	1.07	0.11	Make use of and adapt elements of the writing process to create media productions
3.19	0.11	3.23	0.10	3.23	0.09	Write to explore ideas
3.34	0.09	2.85	0.12	2.16	0.12	Write to express one's feelings
3.25	0.10	2.41	0.14	1.74	0.13	Write to tell a story through fiction or nonfiction
3.25	0.12	3.55	0.09	2.25	0.14	Write to analyze literature
2.26	0.14	2.36	0.14	2.17	0.12	Write to analyze media
3.50	0.08	3.55	0.07	3.36	0.08	Write to convey information
3.48	0.10	3.56	0.08	3.35	0.09	Write to argue or persuade readers
2.80	0.14	2.17	0.15	2.06	0.12	Write to describe a process or how to do something
1.92	0.17	1.61	0.16	1.37	0.12	Write to produce work-related texts
2.79	0.14	3.24	0.12	2.62	0.13	Write to present research
3.69	0.07	3.77	0.05	3.44	0.08	**COMPOSITION PROCESS AND PURPOSE as an overall set of skills**
						Topic and Idea Development
3.61	0.09	3.83	0.05	3.61	0.07	Present a thesis that establishes focus on the topic
3.76	0.06	3.79	0.05	3.65	0.06	Maintain a focus on the general topic throughout a piece of writing
3.46	0.09	3.65	0.07	3.43	0.08	Narrow the focus to a specific issue within the general topic
3.24	0.10	3.38	0.09	3.13	0.08	Provide appropriate context or background information for readers
3.78	0.05	3.81	0.05	3.59	0.07	Develop ideas by using some specific reasons, details, and examples
3.44	0.11	3.59	0.08	3.23	0.09	Take and maintain a position on an issue
3.17	0.12	3.63	0.08	3.19	0.10	Support claims with multiple and appropriate sources of evidence
2.54	0.15	3.07	0.12	2.93	0.11	Differentiate between assertions and evidence
2.70	0.14	3.07	0.11	2.82	0.10	Fairly and accurately represent different points of view on an issue
2.48	0.15	3.02	0.12	2.77	0.11	Anticipate and respond to counterarguments to a position taken on an issue
2.94	0.13	3.10	0.12	3.04	0.09	Show some movement between general and specific ideas and examples
2.75	0.13	2.96	0.12	2.68	0.10	Identify the basic purpose or role of a phrase or sentence within a piece of writing
3.26	0.10	3.37	0.09	3.02	0.09	Determine the appropriateness of wording for audience and purpose
3.32	0.10	3.20	0.10	3.08	0.09	Delete a clause or sentence because it is obviously irrelevant to a piece of writing
3.30	0.09	3.23	0.10	3.13	0.09	Delete material that disturbs the development or flow of a piece of writing
3.39	0.10	3.48	0.09	3.26	0.09	Determine whether a piece of writing has accomplished its intended purpose
3.70	0.06	3.76	0.06	3.50	0.08	**TOPIC AND IDEA DEVELOPMENT as an overall set of skills**
						Organization, Unity, and Coherence
3.74	0.06	3.71	0.06	3.58	0.07	Provide an adequate organization with a logical grouping of ideas
3.79	0.05	3.75	0.06	3.50	0.07	Use discernible introductions and conclusions
3.57	0.07	3.54	0.07	3.30	0.08	Use appropriate transition words and phrases within a sentence or to connect sentences within a paragraph
3.53	0.08	3.54	0.07	3.30	0.08	Use effective transition sentences to connect paragraphs
3.15	0.11	.	.	.	.	Use conjunctive adverbs to show time relationships (e.g., then, this time)
2.98	0.13	3.02	0.11	2.89	0.09	Use conjunctive adverbs or phrases to express straightforward logical relationships
3.05	0.12	2.96	0.12	2.89	0.09	Select the most logical place to add a sentence in a paragraph
3.18	0.11	3.15	0.11	3.08	0.09	Determine the most logical place to add information to a piece of writing
3.69	0.06	3.65	0.06	3.44	0.08	**ORGANIZATION, UNITY, AND COHERENCE as an overall set of skills**
						Word Choice in Terms of Style, Tone, Clarity, and Economy
2.85	0.13	2.79	0.12	2.79	0.09	Revise expressions that deviate from the style of a piece of writing
3.48	0.08	.	.	.	.	Revise sentences to correct awkward and confusing arrangements of sentence elements
3.01	0.11	3.10	0.11	2.90	0.09	Maintain consistency of tone
3.50	0.08	3.46	0.08	3.22	0.08	Choose words and images that are specific, precise, and clear in terms of their context
3.57	0.07	3.54	0.07	3.31	0.07	Use appropriate vocabulary
3.18	0.09	3.22	0.10	3.12	0.08	Delete obviously synonymous and wordy material in a sentence
3.43	0.08	3.37	0.09	2.92	0.09	Use varied words and images
3.31	0.09	.	.	.	.	Revise vague nouns and pronouns
3.31	0.10	3.36	0.09	3.32	0.08	Avoid vague pronouns (i.e., pronouns without a clear antecedent)
2.94	0.11	2.92	0.11	2.90	0.09	Determine the clearest and most logical conjunction to link clauses
2.56	0.15	3.03	0.12	3.00	0.09	Use rhetorically effective subordination, coordination, and parallelism
3.35	0.08	3.39	0.08	3.10	0.08	**WORD CHOICE IN TERMS OF STYLE, TONE, CLARITY, AND ECONOMY as an overall set of skills**

Note:
MS = Middle school/junior high school teachers
HS = High school teachers
PS = Postsecondary instructors (no remedial teachers)
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.1

Statistical Details for English/Writing Topics and Skills *(continued)*

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						Sentence Structure and Formation
2.48	0.15	3.05	0.12	3.15	0.08	Avoid faulty subordination, coordination, and parallelism
3.52	0.08	3.51	0.09	3.57	0.07	Use punctuation and conjunctions to avoid awkward sentence fragments and fused sentences (i.e., comma splices, run-on sentences)
3.42	0.09	.	.	.	.	Use punctuation and conjunctions to join clauses
2.78	0.13	3.09	0.11	3.07	0.09	Avoid dangling and misplaced modifiers
3.25	0.11	3.24	0.10	3.32	0.08	Decide on appropriate verb tense and voice by considering the meaning of an entire sentence
3.11	0.12	.	.	.	.	Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences
3.20	0.11	3.27	0.10	3.30	0.08	Decide on appropriate verb tense and voice in terms of a paragraph or a piece of writing
3.00	0.12	3.18	0.11	3.24	0.08	Avoid inappropriate shifts of mood, number, or person
2.85	0.13	2.97	0.12	3.09	0.09	Identify missing or incorrect relative pronouns
3.35	0.10	3.35	0.10	3.13	0.09	Use some varied kinds of sentence structures to vary pace and to support meaning
3.35	0.09	3.34	0.09	3.31	0.08	**SENTENCE STRUCTURE AND FORMATION as an overall set of skills**
						Conventions of Usage
2.90	0.12	2.68	0.13	3.22	0.09	Form simple and compound tenses of regular and irregular verbs
2.86	0.13	.	.	.	.	Form past and past participle of irregular and commonly used verbs
2.88	0.13	.	.	.	.	Form comparative and superlative adjectives
2.82	0.13	2.60	0.13	3.03	0.09	Form modifiers
2.82	0.13	2.55	0.13	2.99	0.10	Choose between using an adverb and using an adjective in a particular situation
3.39	0.10	3.20	0.11	3.58	0.07	Ensure straightforward subject-verb agreement
3.29	0.10	3.17	0.11	3.46	0.08	Ensure straightforward pronoun-antecedent agreement
2.91	0.13	3.00	0.12	3.14	0.09	Ensure subject-verb and pronoun-antecedent agreement in unusual or tricky situations (e.g., subject-verb order is inverted; subject is an indefinite pronoun)
3.28	0.10	3.04	0.12	3.41	0.08	Use the proper form of possessive pronouns
3.21	0.11	3.01	0.12	3.37	0.09	Use the appropriate case of a pronoun
2.78	0.14	2.70	0.14	3.28	0.08	Use the idioms of standard written English
2.86	0.12	2.62	0.13	3.15	0.09	Determine which preposition to use in simple contexts
2.51	0.15	2.57	0.13	2.94	0.09	Determine the appropriate preposition to use in situations involving sophisticated language or ideas
3.19	0.11	3.00	0.11	3.31	0.09	Use the appropriate word in frequently confused pairs of words (e.g., past and passed)
3.30	0.10	3.09	0.11	3.32	0.08	**CONVENTIONS OF USAGE as an overall set of skills**
						Conventions of Punctuation
3.06	0.12	3.01	0.11	3.09	0.09	Delete commas that disturb sentence flow (e.g., between modifier and modified element)
3.40	0.10	3.22	0.10	3.44	0.08	Provide appropriate punctuation in straightforward situations (e.g., items in a series)
3.25	0.11	3.15	0.11	3.28	0.08	Punctuate between clauses of compound sentences when the conjunction is omitted
3.05	0.13	3.06	0.11	3.15	0.09	Punctuate before a conjunctive adverb joining clauses of a compound sentence
2.94	0.13	3.04	0.11	3.04	0.09	Punctuate parenthetical elements with commas, parentheses, and dashes
3.01	0.13	3.06	0.10	3.09	0.09	Punctuate essential/nonessential elements, subordinate clauses, and restrictive/nonrestrictive appositives
3.31	0.11	3.11	0.10	3.37	0.08	Punctuate possessive nouns and pronouns
3.42	0.10	3.06	0.11	2.87	0.12	Punctuate dialogue
3.10	0.12	3.19	0.10	3.15	0.09	Use a semicolon to indicate a close relationship between two independent clauses
2.81	0.14	2.96	0.11	2.80	0.10	Use semicolons when items in a series have internal punctuation (e.g., when items have their own commas)
3.05	0.13	3.01	0.11	2.97	0.10	Use a colon to introduce a series of phrases (e.g., a list of examples)
2.60	0.15	2.83	0.12	2.73	0.11	Use a colon to introduce one or more sentences
3.35	0.10	3.21	0.10	3.21	0.08	**CONVENTIONS OF PUNCTUATION as an overall set of skills**
						Evaluation of Writing
3.53	0.08	3.57	0.06	3.52	0.07	Writing appropriately for purpose and audience
3.71	0.06	3.79	0.05	3.78	0.05	Writing unified and coherent text
3.57	0.07	3.67	0.06	3.68	0.06	Developing ideas using appropriate organizational strategy
3.68	0.06	3.83	0.04	3.77	0.05	Developing ideas using relevant examples and details
3.83	0.05	3.72	0.05	3.53	0.07	Using a clear beginning, middle, and ending
3.11	0.09	3.15	0.08	2.76	0.10	Using voice
3.23	0.08	3.30	0.07	3.11	0.07	Using precise word choice
2.94	0.09	3.20	0.08	3.05	0.08	Using appropriate tone
3.30	0.08	3.37	0.07	2.97	0.09	Using sentence variety
3.51	0.08	3.56	0.06	3.47	0.07	Using correct grammar, usage, and mechanics
3.74	0.06	3.80	0.04	3.67	0.06	**EVALUATION OF WRITING as an overall topic**

Note:
MS = Middle school/junior high school teachers
HS = High school teachers
PS = Postsecondary instructors (no remedial teachers)
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2a

Statistical Details for Mathematics Topics and Skills by Course
Middle School Reponses Only

7th Mean	7th +/–	8th Mean	8th +/–	P-Alg Mean	P-Alg +/–	Alg Mean	Alg +/–	Topics and Skills
								Process Skills
2.69	0.12	2.53	0.12	2.67	0.14	2.97	0.13	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
2.98	0.10	2.74	0.10	2.66	0.12	2.86	0.12	Estimate a reasonable result without using a calculator
2.60	0.11	2.29	0.12	2.18	0.14	1.97	0.14	Demonstrate concepts using manipulatives
2.95	0.10	2.76	0.11	2.67	0.12	2.63	0.13	Demonstrate concepts using pictorial representations
3.61	0.06	3.53	0.07	3.58	0.07	3.59	0.07	Solve problems posed in real-world settings and interpret the solutions
2.79	0.11	2.74	0.11	2.92	0.11	2.89	0.13	Recognize when essential information is missing
3.50	0.07	3.55	0.06	3.69	0.06	3.80	0.06	Plan and carry out a strategy for solving multistep problems
2.73	0.11	3.10	0.09	3.19	0.10	3.31	0.11	Recognize generalizations of mathematical ideas
3.38	0.08	3.53	0.06	3.29	0.09	3.45	0.09	Recognize and use patterns to solve problems
3.30	0.09	3.35	0.08	3.37	0.09	3.40	0.10	Apply mathematical ideas to new contexts
2.74	0.12	3.01	0.11	2.87	0.13	2.98	0.13	Formulate new patterns or structures
2.71	0.13	2.73	0.11	3.10	0.12	3.00	0.13	Solve several problems representing different aspects/components of one larger problem or scenario
1.94	0.14	2.15	0.14	2.09	0.16	2.33	0.14	Understand roles of definitions, proof, and counterexamples
3.40	0.09	3.41	0.08	3.49	0.08	3.62	0.08	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
1.53	0.15	2.18	0.15	2.03	0.18	2.72	0.15	Recall theorems and more complex formulas when needed to solve a problem
1.66	0.15	1.95	0.16	1.99	0.19	2.38	0.19	Apply theorems to solve a problem
0.55	0.10	0.82	0.12	0.69	0.11	1.13	0.17	Construct and/or critique proofs, either informal or formal
2.77	0.13	2.44	0.14	2.59	0.18	2.62	0.18	Perform basic operations with a calculator
1.10	0.14	1.15	0.14	1.22	0.15	2.18	0.19	Use the statistical capabilities of a calculator
1.03	0.14	1.51	0.15	1.12	0.16	2.69	0.19	Use the graphical capabilities of a calculator
0.97	0.14	1.29	0.14	1.29	0.18	2.16	0.20	Use the symbolic algebra capabilities of a calculator
0.81	0.12	0.86	0.12	0.91	0.14	0.98	0.14	Use spreadsheets
0.99	0.15	0.80	0.12	0.95	0.14	0.73	0.12	Use dynamic geometry
2.93	0.12	2.97	0.11	3.04	0.11	3.08	0.13	Solve routine problems quickly
2.11	0.13	2.23	0.14	2.28	0.15	2.68	0.16	Solve novel problems quickly
3.77	0.04	3.54	0.07	3.61	0.08	3.60	0.09	Use mathematical symbols correctly
2.58	0.11	2.39	0.14	2.65	0.14	2.62	0.16	Understand new material from reading a textbook
2.55	0.12	2.52	0.13	2.74	0.14	2.81	0.13	Work in a self-directed group
3.28	0.10	3.21	0.09	3.26	0.10	3.31	0.10	**PROCESS SKILLS as an overall topic**
								Basic Operations and Applications
3.70	0.06	3.74	0.05	3.67	0.08	3.42	0.10	Perform addition, subtraction, multiplication, and division on signed rational numbers
3.35	0.09	3.33	0.08	3.26	0.12	3.21	0.14	Perform one-step computations with whole numbers and decimals
3.81	0.04	3.65	0.07	3.72	0.07	3.44	0.10	Solve problems using ratios and proportions
3.61	0.07	3.53	0.09	3.48	0.11	3.16	0.12	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
2.98	0.12	2.72	0.11	2.97	0.12	2.52	0.14	Convert units of measure
3.38	0.10	3.26	0.10	3.30	0.11	3.02	0.14	Solve routine one-step arithmetic problems
3.35	0.09	3.40	0.10	3.47	0.10	3.33	0.12	Solve routine two- or three-step arithmetic problems
2.77	0.12	3.11	0.11	3.30	0.12	3.34	0.09	Solve nonroutine two- or three-step arithmetic problems
2.88	0.12	2.92	0.12	3.12	0.10	2.85	0.12	Solve multistep arithmetic problems that involve planning or converting units of measure
3.25	0.10	3.15	0.11	3.35	0.10	3.22	0.09	Solve word problems containing several rates, proportions, or percentages
3.48	0.09	3.47	0.09	3.60	0.08	3.41	0.09	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**
								Numbers: Concepts and Properties
2.88	0.13	2.41	0.15	2.49	0.15	2.23	0.17	Identify a digit's place
3.33	0.09	2.99	0.11	3.01	0.12	2.59	0.15	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
3.38	0.08	2.91	0.11	3.03	0.12	2.55	0.15	Order fractions
3.02	0.11	2.91	0.12	2.87	0.13	2.51	0.15	Recognize one-digit factors of a number
3.18	0.10	2.81	0.11	2.89	0.13	2.71	0.14	Find and use the least common multiple
3.43	0.08	3.24	0.09	3.23	0.10	2.81	0.13	Recognize equivalent fractions and fractions in lowest terms
3.18	0.09	3.48	0.07	3.23	0.09	3.19	0.10	Perform computations with squares and square roots of numbers
1.75	0.17	2.18	0.15	2.24	0.17	2.74	0.15	Perform computations with cubes and cube roots of numbers
2.83	0.14	3.16	0.12	3.11	0.13	3.52	0.09	Apply rules of exponents
0.58	0.12	0.89	0.13	0.85	0.15	1.86	0.18	Perform matrix addition and multiplication
2.75	0.13	2.64	0.14	2.48	0.15	2.51	0.15	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
0.98	0.14	1.29	0.15	1.21	0.16	2.37	0.18	Find union and intersection of sets
2.79	0.13	3.14	0.11	2.97	0.13	3.16	0.12	Apply properties of rational and irrational numbers
.	.	.	.	.	.	.	.	Exhibit knowledge of complex numbers
.	.	.	.	.	.	.	.	Apply properties of complex numbers
3.13	0.10	3.01	0.10	3.07	0.11	3.11	0.12	Apply number properties involving multiples and factors
2.57	0.14	3.04	0.10	2.99	0.11	2.83	0.13	Use scientific notation
.	.	.	.	.	.	.	.	Determine when an expression is undefined
.	.	.	.	.	.	.	.	Exhibit knowledge of logarithms and geometric sequences
3.49	0.07	3.24	0.08	3.32	0.07	3.10	0.10	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**

Note:
Only those courses with a sufficient number of respondants are included.
7th = 7th-grade mathematics
8th = 8th-grade mathematics
P-Alg = Pre-Algebra
Alg = Algebra
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2a

Statistical Details for Mathematics Topics and Skills by Course
Middle School Reponses Only *(continued)*

7th Mean	7th +/–	8th Mean	8th +/–	P-Alg Mean	P-Alg +/–	Alg Mean	Alg +/–	Topics and Skills
								Expressions, Equations, and Inequalities
3.51	0.08	3.63	0.06	3.76	0.05	3.57	0.10	Evaluate algebraic expressions by substituting integers for unknown quantities
3.43	0.08	3.45	0.09	3.49	0.09	3.47	0.11	Exhibit knowledge of basic expressions
3.39	0.11	3.55	0.09	3.79	0.05	3.73	0.07	Add and subtract simple algebraic expressions
2.95	0.14	3.47	0.09	3.71	0.07	3.75	0.06	Combine like terms
3.24	0.13	3.59	0.08	3.76	0.06	3.63	0.07	Solve routine first-degree equations
2.87	0.15	3.61	0.08	3.52	0.12	3.76	0.07	Solve linear equations and inequalities in one variable
3.63	0.06	3.62	0.07	3.75	0.07	3.59	0.09	Substitute whole numbers for unknown quantities
3.35	0.10	3.49	0.09	3.49	0.10	3.62	0.08	Perform word-to-symbol translations
3.35	0.09	3.42	0.09	3.58	0.09	3.68	0.06	Write expressions, equations, or inequalities for common settings
3.58	0.08	3.66	0.06	3.78	0.06	3.62	0.08	Solve one-step equations having integer or decimal values
0.60	0.12	1.90	0.18	1.91	0.20	3.67	0.10	Multiply two binomials
1.73	0.17	2.03	0.17	2.51	0.19	3.60	0.10	Solve absolute value equations and inequalities
0.65	0.13	1.94	0.18	2.07	0.20	3.69	0.10	Add, subtract, and multiply polynomials
0.24	0.07	1.29	0.17	0.73	0.16	3.66	0.10	Factor quadratics
0.27	0.08	1.15	0.17	0.64	0.14	3.66	0.10	Solve quadratic equations
0.51	0.12	1.39	0.17	1.28	0.19	3.35	0.13	Apply properties of exponential functions
.	.	.	.	.	.	.	.	Solve quadratic inequalities
.	.	.	.	.	.	.	.	Use the discriminant
.	.	.	.	.	.	.	.	Determine solutions of polynomial and rational equations
.	.	.	.	.	.	.	.	Implement remainder and factor theorems for polynomials
.	.	.	.	.	.	.	.	Apply properties of logarithmic and exponential functions
0.87	0.14	2.14	0.18	1.86	0.20	3.69	0.09	Find solutions to systems of linear equations
0.31	0.08	0.77	0.13	0.58	0.15	2.66	0.19	Solve problems using equations of parabolas and circles
.	.	.	.	.	.	.	.	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
.	.	.	.	.	.	.	.	Solve problems using parametric equations
0.62	0.13	1.38	0.17	1.00	0.18	3.33	0.12	Transform functions algebraically
.	.	.	.	.	.	.	.	Find the limit of an expression
3.07	0.12	3.57	0.07	3.55	0.09	3.82	0.05	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**
								Graphical Representations
3.11	0.11	2.85	0.13	2.92	0.14	3.03	0.13	Comprehend the concept of length on the number line
3.41	0.08	3.26	0.10	3.42	0.09	3.24	0.12	Locate points on the number line and in the first quandrant
.	.	.	.	.	.	.	.	Locate points on the number line
3.67	0.06	3.43	0.08	3.56	0.08	3.52	0.09	Locate points in the coordinate plane
2.08	0.16	3.29	0.12	3.08	0.15	3.75	0.06	Exhibit knowledge of slope
1.73	0.16	3.24	0.13	3.00	0.16	3.83	0.05	Find the slope of a line
2.48	0.16	3.09	0.13	3.36	0.11	3.73	0.06	Identify graphs on a number line
2.11	0.17	3.12	0.14	2.94	0.17	3.75	0.06	Match linear graphs with their equations
2.31	0.18	2.59	0.16	2.46	0.19	3.56	0.09	Use properties of parallel and perpendicular lines
0.97	0.15	2.05	0.17	2.14	0.21	3.69	0.07	Solve systems of equations and inequalities graphically
0.43	0.10	0.92	0.15	0.58	0.14	2.53	0.19	Recognize special characteristics of parabolas and circles
.	.	.	.	.	.	.	.	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
2.55	0.16	2.99	0.13	2.53	0.19	3.57	0.08	Interpret and use information from graphs in the coordinate plane
1.55	0.17	2.46	0.17	1.96	0.18	3.44	0.08	Identify characteristics of graphs based on a set of conditions or on a general equation
.	.	.	.	.	.	.	.	Understand the properties of graphs of rational functions (e.g., asymptotes)
1.02	0.14	1.42	0.17	1.70	0.19	2.76	0.18	Find midpoints
1.57	0.17	1.79	0.18	1.86	0.19	2.97	0.17	Use the distance formula
.	.	.	.	.	.	.	.	Work with discontinuous graphs and piecewise-defined functions
2.77	0.12	3.24	0.10	3.09	0.13	3.69	0.06	**GRAPHICAL REPRESENTATIONS as an overall topic**
								Properties of Plane Figures
2.74	0.16	2.68	0.15	2.94	0.15	2.05	0.17	Find the measure of an angle using properties of parallel lines
2.87	0.14	2.71	0.14	2.94	0.15	2.22	0.16	Exhibit some knowledge of angles associated with parallel lines
3.22	0.11	3.08	0.12	3.23	0.11	2.27	0.16	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
2.29	0.17	3.62	0.07	3.12	0.16	3.09	0.14	Use the Pythagorean theorem
2.85	0.14	2.46	0.14	2.63	0.17	1.93	0.18	Apply properties of lines, segments, and rays
2.73	0.15	2.24	0.16	2.46	0.17	1.77	0.18	Apply properties of special quadrilaterals
2.46	0.17	2.32	0.16	2.22	0.17	1.80	0.18	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
1.12	0.16	1.13	0.16	1.11	0.17	1.41	0.18	Use relationships among angles, arcs, and distances in a circle
0.54	0.12	0.63	0.12	0.56	0.13	1.38	0.17	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
0.59	0.13	0.83	0.14	1.00	0.17	1.38	0.17	Prove results by mathematical induction
2.69	0.12	2.66	0.12	2.51	0.16	1.95	0.16	**PROPERTIES OF PLANE FIGURES as an overall topic**

Note:
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8th = 8th-grade mathematics
P-Alg = Pre-Algebra
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+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2a

Statistical Details for Mathematics Topics and Skills by Course
Middle School Reponses Only *(continued)*

7th Mean	7th +/–	8th Mean	8th +/–	P-Alg Mean	P-Alg +/–	Alg Mean	Alg +/–	Topics and Skills
								Measurement
3.52	0.07	3.29	0.10	3.34	0.11	2.61	0.15	Compute the area and perimeter of triangles and rectangles
2.52	0.15	2.28	0.16	2.24	0.17	1.88	0.18	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
2.76	0.14	2.82	0.14	2.96	0.14	2.44	0.16	Compute the perimeter of composite geometric figures with unknown side lengths
.	.	.	.	.	.	.	.	Compute the area and perimeter of polygons
3.44	0.09	3.11	0.11	3.39	0.11	2.24	0.17	Compute the area and circumference of circles after identifying necessary information
3.38	0.10	3.10	0.12	3.20	0.13	2.39	0.15	Compute the area and perimeter of polygons with known side lengths
2.82	0.14	2.93	0.13	3.20	0.13	2.10	0.17	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
2.02	0.17	2.50	0.15	2.71	0.16	2.13	0.18	Compute the area and volume of composite geometric figures
3.37	0.10	3.14	0.12	3.27	0.14	2.38	0.16	Use geometric formulas
3.24	0.11	2.76	0.12	2.83	0.14	1.98	0.17	Understand how to read measurement tools (e.g., rulers and protractors)
2.90	0.13	2.79	0.13	2.69	0.15	2.20	0.17	Use scale factors to determine the magnitude of a size change
3.49	0.07	3.11	0.10	3.22	0.10	2.27	0.14	**MEASUREMENT as an overall topic**
								Probability, Statitics, and Data Analysis
3.67	0.06	3.27	0.10	3.31	0.09	2.95	0.13	Read and interpret graphs, charts, and other data representations
3.11	0.12	3.12	0.11	2.91	0.13	2.69	0.15	Manipulate data from tables and graphs
3.45	0.08	3.14	0.11	3.15	0.11	2.81	0.14	Perform computations on data from tables and graphs
3.38	0.09	2.91	0.13	3.07	0.11	2.57	0.14	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
0.75	0.12	1.19	0.16	1.05	0.17	1.58	0.17	Exhibit knowledge of correlation, variance, and standard deviation of data
3.60	0.07	2.97	0.13	3.31	0.09	2.48	0.14	Find the median and mode
3.29	0.11	3.00	0.14	3.22	0.11	2.54	0.14	Determine the probability of a simple event
2.15	0.16	2.33	0.16	2.52	0.17	2.03	0.16	Use the relationship between the probability of an event and the probability of its complement
2.09	0.16	2.46	0.16	2.46	0.16	2.08	0.17	Determine the probability of mutually exclusive, dependent, and independent events
2.29	0.15	2.40	0.15	2.46	0.17	2.08	0.15	Exhibit knowledge of counting techniques
.	.	.	.	.	.	.	.	Exhibit knowledge of combinations, permutations, and the binomial theorem
3.62	0.06	3.10	0.12	3.35	0.10	2.39	0.13	Calculate the average of a list of numbers
2.63	0.14	2.59	0.15	2.85	0.14	2.34	0.14	Calculate a missing data value, given the average and all the missing data values but one
3.43	0.09	2.84	0.13	3.17	0.11	2.40	0.13	Calculate the average, given the number of data values and the sum of the data values
2.34	0.16	2.24	0.16	2.41	0.16	2.07	0.16	Calculate the average, given the frequency counts of all the data values
0.76	0.13	1.02	0.15	1.15	0.16	1.66	0.18	Calculate or use a weighted average
3.29	0.08	2.99	0.12	3.04	0.09	2.47	0.13	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
								Functions
2.37	0.17	2.65	0.14	2.42	0.17	3.25	0.14	Understand the concept of function
1.42	0.16	1.97	0.16	1.91	0.19	3.05	0.16	Use function notation
1.38	0.17	2.10	0.17	2.18	0.17	3.20	0.14	Find the domain and range of functions
.	.	.	.	.	.	.	.	Find domain, range, and inverses of functions
1.87	0.17	2.64	0.16	2.28	0.19	3.47	0.12	Evaluate linear functions based on function notation
0.27	0.07	1.36	0.17	0.72	0.16	3.21	0.16	Evaluate quadratic functions based on function notation
0.24	0.07	0.78	0.14	0.56	0.14	2.67	0.19	Evaluate polynomial functions based on function notation
0.20	0.06	0.49	0.12	0.37	0.11	1.81	0.20	Evaluate composite functions based on function notation
0.33	0.08	0.75	0.13	0.93	0.17	1.28	0.19	Apply basic trigonometric ratios to solve right-triangle problems
0.20	0.05	0.60	0.12	0.66	0.15	1.24	0.19	Use trigonometric concepts and basic identities to solve problems
.	.	.	.	.	.	.	.	Use the law of sines and law of cosines
.	.	.	.	.	.	.	.	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
.	.	.	.	.	.	.	.	Use radian measure
0.15	0.04	0.31	0.09	0.17	0.06	0.81	0.16	Exhibit knowledge of vectors in a plane
1.12	0.14	1.83	0.14	1.65	0.17	2.98	0.14	**FUNCTIONS as an overall topic**

Note:
Only those courses with a sufficient number of respondants are included.
7th = 7th-grade mathematics
8th = 8th-grade mathematics
P-Alg = Pre-Algebra
Alg = Algebra
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2b

Statistical Details for Mathematics Topics and Skills by Course
High School Reponses Only

Alg 1 Mean	Alg 1 +/–	Alg 2 Mean	Alg 2 +/–	Geo Mean	Geo +/–	P-Cal Mean	P-Cal +/–	Topics and Skills
								Process Skills
2.68	0.12	2.61	0.09	2.43	0.10	2.69	0.13	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
2.59	0.11	2.38	0.08	2.58	0.09	2.68	0.11	Estimate a reasonable result without using a calculator
1.62	0.12	1.17	0.09	2.35	0.10	1.33	0.13	Demonstrate concepts using manipulatives
2.47	0.10	2.47	0.08	3.47	0.07	2.96	0.12	Demonstrate concepts using pictorial representations
3.50	0.07	3.33	0.06	3.32	0.06	3.64	0.07	Solve problems posed in real-world settings and interpret the solutions
2.77	0.10	2.57	0.08	3.00	0.07	2.75	0.13	Recognize when essential information is missing
3.66	0.05	3.57	0.05	3.49	0.06	3.66	0.07	Plan and carry out a strategy for solving multistep problems
3.00	0.09	3.11	0.07	3.11	0.07	3.27	0.10	Recognize generalizations of mathematical ideas
3.23	0.08	3.18	0.06	3.37	0.06	3.21	0.10	Recognize and use patterns to solve problems
3.16	0.10	3.29	0.06	3.34	0.06	3.39	0.10	Apply mathematical ideas to new contexts
2.60	0.12	2.62	0.08	2.94	0.09	2.73	0.13	Formulate new patterns or structures
2.95	0.10	2.94	0.08	3.01	0.08	3.25	0.10	Solve several problems representing different aspects/components of one larger problem or scenario
1.97	0.14	2.20	0.09	3.58	0.06	2.75	0.11	Understand roles of definitions, proof, and counterexamples
3.62	0.06	3.46	0.06	3.59	0.05	3.48	0.09	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
2.11	0.16	2.92	0.07	3.59	0.06	3.24	0.09	Recall theorems and more complex formulas when needed to solve a problem
1.92	0.16	2.56	0.09	3.78	0.04	3.36	0.09	Apply theorems to solve a problem
0.66	0.11	1.04	0.08	3.06	0.09	1.94	0.14	Construct and/or critique proofs, either informal or formal
2.95	0.12	2.96	0.09	2.68	0.10	2.88	0.13	Perform basic operations with a calculator
1.31	0.15	2.36	0.11	1.07	0.10	2.15	0.15	Use the statistical capabilities of a calculator
2.14	0.17	3.37	0.07	1.44	0.11	3.61	0.08	Use the graphical capabilities of a calculator
1.69	0.16	1.91	0.12	1.32	0.12	2.04	0.16	Use the symbolic algebra capabilities of a calculator
0.59	0.09	0.53	0.07	0.61	0.08	0.85	0.12	Use spreadsheets
0.52	0.11	0.66	0.08	1.79	0.14	1.25	0.15	Use dynamic geometry
2.90	0.10	3.01	0.07	2.84	0.09	2.89	0.10	Solve routine problems quickly
2.21	0.13	2.32	0.09	2.39	0.10	2.54	0.11	Solve novel problems quickly
3.60	0.06	3.60	0.05	3.61	0.05	3.45	0.09	Use mathematical symbols correctly
2.59	0.10	2.50	0.08	2.65	0.09	2.63	0.12	Understand new material from reading a textbook
2.58	0.11	2.33	0.09	2.46	0.10	2.52	0.13	Work in a self-directed group
3.13	0.09	3.12	0.06	3.10	0.08	3.20	0.10	**PROCESS SKILLS as an overall topic**
								Basic Operations and Applications
3.59	0.07	3.33	0.07	2.83	0.10	3.05	0.13	Perform addition, subtraction, multiplication, and division on signed rational numbers
.	.	.	.	.	.	.	.	Perform one-step computations with whole numbers and decimals
3.56	0.06	3.08	0.07	3.56	0.05	2.96	0.12	Solve problems using ratios and proportions
3.29	0.09	2.66	0.08	1.83	0.11	2.44	0.15	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
2.54	0.14	2.13	0.09	2.51	0.10	2.68	0.13	Convert units of measure
3.32	0.10	2.84	0.09	2.78	0.09	2.43	0.14	Solve routine one-step arithmetic problems
3.51	0.07	3.13	0.08	3.03	0.08	2.83	0.13	Solve routine two- or three-step arithmetic problems
3.32	0.09	3.07	0.08	2.88	0.08	3.00	0.12	Solve nonroutine two- or three-step arithmetic problems
2.84	0.12	2.52	0.10	2.72	0.09	2.78	0.12	Solve multistep arithmetic problems that involve planning or converting units of measure
3.30	0.09	2.63	0.09	2.59	0.10	2.67	0.13	Solve word problems containing several rates, proportions, or percentages
3.48	0.07	3.04	0.08	2.92	0.08	2.77	0.12	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**
								Numbers: Concepts and Properties
.	.	.	.	.	.	.	.	Identify a digit's place
3.19	0.09	2.88	0.09	2.48	0.10	2.54	0.14	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
2.62	0.11	2.15	0.10	1.80	0.11	1.92	0.15	Order fractions
.	.	.	.	.	.	.	.	Recognize one-digit factors of a number
2.71	0.11	2.61	0.09	1.74	0.11	2.25	0.14	Find and use the least common multiple
.	.	.	.	.	.	.	.	Recognize equivalent fractions and fractions in lowest terms
3.20	0.08	3.38	0.06	3.30	0.06	2.96	0.11	Perform computations with squares and square roots of numbers
1.94	0.14	3.24	0.06	1.97	0.12	2.96	0.11	Perform computations with cubes and cube roots of numbers
3.44	0.08	3.73	0.04	2.00	0.10	3.45	0.08	Apply rules of exponents
1.21	0.14	2.43	0.11	0.73	0.10	2.43	0.15	Perform matrix addition and multiplication
1.74	0.14	2.50	0.10	1.49	0.12	2.87	0.13	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
1.41	0.13	1.86	0.10	1.47	0.11	2.07	0.15	Find union and intersection of sets
2.66	0.12	3.29	0.06	2.08	0.11	3.08	0.10	Apply properties of rational and irrational numbers
0.82	0.14	3.32	0.07	0.59	0.09	3.29	0.11	Exhibit knowledge of complex numbers
0.84	0.14	3.30	0.07	0.57	0.09	3.32	0.10	Apply properties of complex numbers
2.88	0.12	3.15	0.07	1.93	0.11	2.93	0.12	Apply number properties involving multiples and factors
2.60	0.12	2.19	0.09	1.33	0.11	2.04	0.15	Use scientific notation
2.66	0.12	3.21	0.07	1.74	0.11	3.25	0.10	Determine when an expression is undefined
0.49	0.10	2.97	0.09	0.93	0.11	3.52	0.07	Exhibit knowledge of logarithms and geometric sequences
3.04	0.09	3.45	0.05	2.09	0.09	3.19	0.09	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**

Note:
Only those courses with a sufficient number of respondants are included.
Alg 1 = Algebra 1
Alg 2 = Algebra 2
Geo = Geometry
P-Cal = Pre-Calculus
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2b

Statistical Details for Mathematics Topics and Skills by Course
High School Reponses Only *(continued)*

Alg 1 Mean	Alg 1 +/–	Alg 2 Mean	Alg 2 +/–	Geo Mean	Geo +/–	P-Cal Mean	P-Cal +/–	Topics and Skills
								Expressions, Equations, and Inequalities
3.63	0.06	3.05	0.08	2.70	0.10	2.51	0.13	Evaluate algebraic expressions by substituting integers for unknown quantities
.	.	.	.	.	.	.	.	Exhibit knowledge of basic expressions
3.79	0.04	3.15	0.07	2.79	0.09	2.61	0.14	Add and subtract simple algebraic expressions
.	.	.	.	.	.	.	.	Combine like terms
3.75	0.05	3.23	0.07	3.02	0.08	2.73	0.13	Solve routine first-degree equations
3.81	0.04	3.39	0.06	2.86	0.09	2.85	0.13	Solve linear equations and inequalities in one variable
.	.	.	.	.	.	.	.	Substitute whole numbers for unknown quantities
3.68	0.06	3.28	0.07	2.98	0.10	3.01	0.11	Perform word-to-symbol translations
3.69	0.06	3.30	0.06	2.59	0.11	3.02	0.12	Write expressions, equations, or inequalities for common settings
.	.	.	.	.	.	.	.	Solve one-step equations having integer or decimal values
3.47	0.09	3.53	0.05	1.97	0.10	3.12	0.10	Multiply two binomials
2.96	0.12	3.26	0.07	1.25	0.11	2.86	0.12	Solve absolute value equations and inequalities
3.50	0.09	3.64	0.04	1.82	0.11	3.20	0.10	Add, subtract, and multiply polynomials
3.14	0.14	3.72	0.04	1.76	0.11	3.35	0.09	Factor quadratics
3.02	0.14	3.84	0.03	1.87	0.12	3.49	0.08	Solve quadratic equations
.	.	.	.	.	.	.	.	Apply properties of exponential functions
1.53	0.17	2.97	0.10	0.78	0.10	3.07	0.12	Solve quadratic inequalities
1.69	0.16	2.98	0.08	0.60	0.09	2.79	0.12	Use the discriminant
2.04	0.17	3.56	0.06	1.04	0.11	3.51	0.09	Determine solutions of polynomial and rational equations
0.73	0.13	2.75	0.10	0.46	0.08	3.31	0.11	Implement remainder and factor theorems for polynomials
0.72	0.12	3.17	0.09	0.48	0.09	3.73	0.05	Apply properties of logarithmic and exponential functions
3.45	0.09	3.59	0.05	1.80	0.12	3.27	0.11	Find solutions to systems of linear equations
.	.	.	.	.	.	.	.	Solve problems using equations of parabolas and circles
0.81	0.13	2.60	0.11	1.24	0.12	3.29	0.11	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
0.39	0.09	1.09	0.11	0.45	0.08	2.38	0.17	Solve problems using parametric equations
1.83	0.17	2.98	0.09	1.21	0.12	3.48	0.08	Transform functions algebraically
0.39	0.10	1.05	0.11	0.44	0.08	2.63	0.16	Find the limit of an expression
3.51	0.08	3.68	0.04	2.12	0.10	3.45	0.08	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**
								Graphical Representations
2.87	0.13	2.33	0.10	3.02	0.09	2.12	0.16	Comprehend the concept of length on the number line
.	.	.	.	.	.	.	.	Locate points on the number line and in the first quandrant
3.12	0.11	2.46	0.10	2.72	0.11	2.19	0.16	Locate points on the number line
3.56	0.07	2.94	0.08	3.26	0.07	2.77	0.13	Locate points in the coordinate plane
3.76	0.06	3.37	0.06	3.32	0.08	3.04	0.10	Exhibit knowledge of slope
3.82	0.05	3.38	0.06	3.29	0.07	3.02	0.11	Find the slope of a line
3.44	0.08	2.89	0.09	2.40	0.12	2.39	0.15	Identify graphs on a number line
3.73	0.06	3.25	0.07	2.36	0.12	2.74	0.13	Match linear graphs with their equations
3.17	0.12	3.21	0.07	3.71	0.05	2.83	0.12	Use properties of parallel and perpendicular lines
3.28	0.10	3.38	0.06	1.67	0.12	2.94	0.12	Solve systems of equations and inequalities graphically
.	.	.	.	.	.	.	.	Recognize special characteristics of parabolas and circles
0.90	0.13	2.67	0.11	1.33	0.13	3.29	0.11	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
3.34	0.09	3.35	0.06	2.50	0.11	3.37	0.10	Interpret and use information from graphs in the coordinate plane
2.73	0.14	3.34	0.06	1.86	0.13	3.43	0.09	Identify characteristics of graphs based on a set of conditions or on a general equation
0.76	0.14	3.01	0.09	0.76	0.10	3.67	0.07	Understand the properties of graphs of rational functions (e.g., asymptotes)
2.33	0.16	2.61	0.09	3.51	0.06	2.59	0.12	Find midpoints
2.52	0.15	2.79	0.09	3.56	0.06	2.82	0.12	Use the distance formula
0.59	0.12	2.33	0.11	0.59	0.09	3.19	0.10	Work with discontinuous graphs and piecewise-defined functions
3.48	0.07	3.42	0.05	2.96	0.08	3.29	0.09	**GRAPHICAL REPRESENTATIONS as an overall topic**
								Properties of Plane Figures
0.59	0.13	1.12	0.10	3.95	0.02	1.85	0.16	Find the measure of an angle using properties of parallel lines
.	.	.	.	.	.	.	.	Exhibit some knowledge of angles associated with parallel lines
1.06	0.14	1.56	0.10	3.95	0.02	2.67	0.13	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
2.56	0.14	2.49	0.10	3.99	0.01	3.24	0.10	Use the Pythagorean theorem
0.76	0.13	1.24	0.09	3.95	0.02	1.71	0.14	Apply properties of lines, segments, and rays
0.71	0.13	1.20	0.09	3.94	0.02	1.81	0.15	Apply properties of special quadrilaterals
0.71	0.13	1.78	0.11	3.96	0.02	3.31	0.10	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
0.41	0.11	1.22	0.10	3.82	0.04	2.71	0.15	Use relationships among angles, arcs, and distances in a circle
0.44	0.10	0.88	0.09	3.52	0.08	1.42	0.15	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
0.49	0.11	0.80	0.09	2.80	0.13	1.60	0.16	Prove results by mathematical induction
0.82	0.12	1.38	0.09	3.93	0.02	2.44	0.13	**PROPERTIES OF PLANE FIGURES as an overall topic**

Note:
Only those courses with a sufficient number of respondants are included.
Alg 1 = Algebra 1
Alg 2 = Algebra 2
Geo = Geometry
P-Cal = Pre-Calculus
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2b

Statistical Details for Mathematics Topics and Skills by Course
High School Reponses Only *(continued)*

Alg 1 Mean	Alg 1 +/–	Alg 2 Mean	Alg 2 +/–	Geo Mean	Geo +/–	P-Cal Mean	P-Cal +/–	Topics and Skills
								Measurement
2.33	0.13	1.81	0.09	3.81	0.04	2.08	0.14	Compute the area and perimeter of triangles and rectangles
.	.	.	.	.	.	.	.	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
1.85	0.15	1.35	0.10	3.61	0.07	1.75	0.14	Compute the perimeter of composite geometric figures with unknown side lengths
.	.	.	.	.	.	.	.	Compute the area and perimeter of polygons
1.68	0.15	1.64	0.10	3.83	0.04	2.11	0.13	Compute the area and circumference of circles after identifying necessary information
1.79	0.15	1.47	0.10	3.81	0.04	1.83	0.14	Compute the area and perimeter of polygons with known side lengths
1.47	0.15	1.46	0.10	3.74	0.05	1.94	0.16	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
1.28	0.15	1.28	0.10	3.56	0.08	1.65	0.15	Compute the area and volume of composite geometric figures
1.74	0.16	1.82	0.09	3.89	0.03	2.23	0.14	Use geometric formulas
1.60	0.15	1.29	0.10	3.50	0.07	1.70	0.15	Understand how to read measurement tools (e.g., rulers and protractors)
1.65	0.16	1.43	0.10	3.52	0.07	1.71	0.14	Use scale factors to determine the magnitude of a size change
1.79	0.14	1.54	0.09	3.80	0.04	1.89	0.13	**MEASUREMENT as an overall topic**
								Probability, Statitics, and Data Analysis
3.08	0.11	2.54	0.09	1.52	0.11	2.33	0.17	Read and interpret graphs, charts, and other data representations
2.56	0.14	2.33	0.09	1.10	0.11	2.19	0.16	Manipulate data from tables and graphs
2.89	0.12	2.46	0.09	1.28	0.10	2.27	0.17	Perform computations on data from tables and graphs
2.45	0.14	2.10	0.10	0.97	0.10	1.79	0.17	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
0.98	0.15	1.66	0.11	0.43	0.07	1.57	0.17	Exhibit knowledge of correlation, variance, and standard deviation of data
2.67	0.13	1.98	0.10	0.90	0.10	1.53	0.15	Find the median and mode
2.58	0.14	2.04	0.11	1.34	0.11	1.80	0.15	Determine the probability of a simple event
.	.	.	.	.	.	.	.	Use the relationship between the probability of an event and the probability of its complement
1.69	0.16	1.87	0.11	0.79	0.10	1.77	0.16	Determine the probability of mutually exclusive, dependent, and independent events
1.58	0.15	1.83	0.11	0.74	0.10	1.88	0.17	Exhibit knowledge of counting techniques
1.06	0.15	1.91	0.11	0.51	0.08	2.25	0.17	Exhibit knowledge of combinations, permutations, and the binomial theorem
2.67	0.13	2.09	0.10	1.28	0.11	1.70	0.16	Calculate the average of a list of numbers
2.23	0.15	1.80	0.10	0.81	0.09	1.34	0.15	Calculate a missing data value, given the average and all the missing data values but one
.	.	.	.	.	.	.	.	Calculate the average, given the number of data values and the sum of the data values
1.65	0.16	1.58	0.10	0.62	0.09	1.29	0.15	Calculate the average, given the frequency counts of all the data values
1.28	0.16	1.25	0.10	0.54	0.08	1.20	0.15	Calculate or use a weighted average
2.25	0.14	2.01	0.10	0.87	0.09	1.78	0.16	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
								Functions
3.30	0.10	3.67	0.05	1.22	0.11	3.70	0.07	Understand the concept of function
.	.	.	.	.	.	.	.	Use function notation
.	.	.	.	.	.	.	.	Find the domain and range of functions
2.78	0.13	3.58	0.05	0.81	0.10	3.80	0.05	Find domain, range, and inverses of functions
3.30	0.12	3.63	0.05	1.38	0.13	3.55	0.09	Evaluate linear functions based on function notation
2.45	0.17	3.74	0.04	1.04	0.12	3.68	0.07	Evaluate quadratic functions based on function notation
1.52	0.17	3.56	0.06	0.65	0.10	3.72	0.06	Evaluate polynomial functions based on function notation
0.62	0.12	3.22	0.08	0.42	0.07	3.66	0.07	Evaluate composite functions based on function notation
0.88	0.14	2.08	0.12	3.61	0.07	3.79	0.07	Apply basic trigonometric ratios to solve right-triangle problems
0.61	0.12	1.86	0.13	2.91	0.13	3.79	0.06	Use trigonometric concepts and basic identities to solve problems
0.42	0.10	1.70	0.13	1.89	0.14	3.73	0.07	Use the law of sines and law of cosines
0.26	0.08	1.24	0.12	0.49	0.08	3.78	0.07	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
0.24	0.08	1.46	0.12	0.52	0.09	3.76	0.06	Use radian measure
0.17	0.06	0.66	0.09	1.24	0.12	3.00	0.16	Exhibit knowledge of vectors in a plane
2.07	0.15	3.27	0.08	1.48	0.11	3.80	0.06	**FUNCTIONS as an overall topic**

Note:
Only those courses with a sufficient number of respondants are included.
Alg 1 = Algebra 1
Alg 2 = Algebra 2
Geo = Geometry
P-Cal = Pre-Calculus
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2c

Statistical Details for Mathematics Topics and Skills by Course
Postsecondary Reponses Only

Prob Mean	Prob +/–	Alg Mean	Alg +/–	P-Cal Mean	P-Cal +/–	Calc Mean	Calc +/–	Topics and Skills
								Process Skills
3.06	0.12	2.92	0.09	2.97	0.13	2.91	0.09	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
2.81	0.11	2.87	0.07	2.85	0.11	2.84	0.07	Estimate a reasonable result without using a calculator
1.54	0.16	1.34	0.10	1.51	0.16	1.48	0.10	Demonstrate concepts using manipulatives
2.71	0.14	2.28	0.09	2.50	0.13	2.76	0.08	Demonstrate concepts using pictorial representations
3.41	0.11	3.10	0.07	3.08	0.10	3.23	0.06	Solve problems posed in real-world settings and interpret the solutions
3.13	0.10	2.73	0.08	3.00	0.11	2.89	0.08	Recognize when essential information is missing
3.40	0.09	3.34	0.06	3.40	0.09	3.54	0.05	Plan and carry out a strategy for solving multistep problems
2.75	0.11	2.84	0.08	3.07	0.10	3.02	0.07	Recognize generalizations of mathematical ideas
2.78	0.12	2.99	0.07	3.23	0.09	3.07	0.07	Recognize and use patterns to solve problems
3.15	0.10	3.01	0.06	3.19	0.09	3.11	0.06	Apply mathematical ideas to new contexts
2.17	0.13	2.24	0.08	2.38	0.11	2.38	0.08	Formulate new patterns or structures
2.65	0.13	2.51	0.08	2.78	0.12	2.67	0.07	Solve several problems representing different aspects/components of one larger problem or scenario
2.38	0.14	2.11	0.09	2.56	0.12	2.91	0.08	Understand roles of definitions, proof, and counterexamples
3.13	0.12	3.56	0.05	3.56	0.09	3.62	0.04	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
2.03	0.14	2.36	0.08	2.56	0.12	3.07	0.06	Recall theorems and more complex formulas when needed to solve a problem
2.29	0.15	2.41	0.09	2.88	0.12	3.15	0.07	Apply theorems to solve a problem
0.97	0.12	1.04	0.08	1.41	0.13	1.79	0.08	Construct and/or critique proofs, either informal or formal
3.74	0.07	3.29	0.08	3.30	0.13	2.67	0.10	Perform basic operations with a calculator
2.63	0.17	1.12	0.09	1.12	0.13	0.70	0.07	Use the statistical capabilities of a calculator
2.00	0.17	2.23	0.11	2.62	0.15	2.29	0.12	Use the graphical capabilities of a calculator
1.01	0.16	1.26	0.11	1.23	0.14	0.96	0.09	Use the symbolic algebra capabilities of a calculator
1.56	0.16	0.72	0.08	0.71	0.11	0.59	0.07	Use spreadsheets
0.38	0.08	0.60	0.07	0.82	0.12	0.71	0.08	Use dynamic geometry
2.71	0.15	3.10	0.07	3.13	0.10	3.05	0.08	Solve routine problems quickly
1.71	0.14	1.91	0.08	1.99	0.13	1.94	0.07	Solve novel problems quickly
3.26	0.10	3.54	0.06	3.47	0.09	3.62	0.04	Use mathematical symbols correctly
2.86	0.11	2.47	0.07	2.59	0.10	2.66	0.07	Understand new material from reading a textbook
2.17	0.16	2.08	0.10	2.04	0.14	1.92	0.09	Work in a self-directed group
3.07	0.07	2.99	0.06	3.15	0.08	3.09	0.06	**PROCESS SKILLS as an overall topic**
								Basic Operations and Applications
3.33	0.14	3.89	0.03	3.92	0.04	3.86	0.03	Perform addition, subtraction, multiplication, and division on signed rational numbers
.	.	.	.	.	.	.	.	Perform one-step computations with whole numbers and decimals
3.15	0.13	3.36	0.06	3.41	0.10	3.36	0.07	Solve problems using ratios and proportions
3.27	0.12	3.28	0.07	2.95	0.13	2.67	0.10	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
1.90	0.16	2.68	0.09	2.70	0.12	2.63	0.09	Convert units of measure
.	.	.	.	.	.	.	.	Solve routine one-step arithmetic problems
3.18	0.13	3.61	0.05	3.62	0.08	3.63	0.06	Solve routine two- or three-step arithmetic problems
.	.	.	.	.	.	.	.	Solve nonroutine two- or three-step arithmetic problems
2.44	0.15	3.03	0.07	3.15	0.09	3.38	0.06	Solve multistep arithmetic problems that involve planning or converting units of measure
1.89	0.15	2.45	0.09	2.66	0.10	2.71	0.09	Solve word problems containing several rates, proportions, or percentages
2.82	0.15	2.76	0.08	2.68	0.12	2.94	0.08	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**
								Numbers: Concepts and Properties
.	.	.	.	.	.	.	.	Identify a digit's place
3.14	0.13	3.59	0.06	3.45	0.09	3.29	0.07	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
2.22	0.17	3.12	0.08	3.11	0.12	3.04	0.08	Order fractions
.	.	.	.	.	.	.	.	Recognize one-digit factors of a number
1.38	0.16	3.34	0.07	2.99	0.12	2.62	0.10	Find and use the least common multiple
.	.	.	.	.	.	.	.	Recognize equivalent fractions and fractions in lowest terms
2.88	0.15	3.47	0.06	3.44	0.09	3.50	0.07	Perform computations with squares and square roots of numbers
1.08	0.14	3.00	0.08	2.88	0.11	3.24	0.08	Perform computations with cubes and cube roots of numbers
2.03	0.17	3.56	0.06	3.70	0.06	3.84	0.04	Apply rules of exponents
0.50	0.10	1.09	0.10	0.95	0.12	1.15	0.10	Perform matrix addition and multiplication
0.76	0.13	1.06	0.09	1.14	0.13	1.87	0.10	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
2.29	0.17	1.70	0.10	1.59	0.14	1.67	0.10	Find union and intersection of sets
1.28	0.15	2.81	0.09	2.79	0.15	2.73	0.10	Apply properties of rational and irrational numbers
0.42	0.10	1.94	0.10	1.82	0.16	1.53	0.11	Exhibit knowledge of complex numbers
0.38	0.10	1.87	0.10	1.68	0.16	1.32	0.10	Apply properties of complex numbers
1.36	0.15	3.16	0.07	2.82	0.12	2.82	0.09	Apply number properties involving multiples and factors
2.03	0.17	2.37	0.10	2.16	0.15	1.92	0.10	Use scientific notation
1.72	0.16	3.20	0.07	3.47	0.09	3.47	0.06	Determine when an expression is undefined
0.76	0.14	1.70	0.10	2.04	0.17	2.99	0.08	Exhibit knowledge of logarithms and geometric sequences
2.03	0.13	3.16	0.06	3.13	0.10	3.21	0.06	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**

Note:
Only those courses with a sufficient number of respondants are included.
Prob = Probability and Statistics
Alg = Algebra
P-Cal = Pre-Calculus
Calc = Calculus
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2c

Statistical Details for Mathematics Topics and Skills by Course
Postsecondary Reponses Only *(continued)*

Prob Mean	Prob +/–	Alg Mean	Alg +/–	P-Cal Mean	P-Cal +/–	Calc Mean	Calc +/–	Topics and Skills
								Expressions, Equations, and Inequalities
3.15	0.14	3.61	0.06	3.62	0.10	3.68	0.06	Evaluate algebraic expressions by substituting integers for unknown quantities
.	.	.	.	.	.	.	.	Exhibit knowledge of basic expressions
2.68	0.17	3.72	0.04	3.85	0.05	3.84	0.04	Add and subtract simple algebraic expressions
.	.	.	.	.	.	.	.	Combine like terms
2.89	0.17	3.75	0.05	3.89	0.04	3.84	0.04	Solve routine first-degree equations
2.41	0.18	3.61	0.06	3.78	0.06	3.77	0.05	Solve linear equations and inequalities in one variable
.	.	.	.	.	.	.	.	Substitute whole numbers for unknown quantities
3.10	0.14	3.41	0.06	3.44	0.09	3.65	0.05	Perform word-to-symbol translations
2.66	0.17	3.40	0.06	3.42	0.09	3.64	0.05	Write expressions, equations, or inequalities for common settings
.	.	.	.	.	.	.	.	Solve one-step equations having integer or decimal values
1.22	0.15	3.53	0.06	3.49	0.11	3.76	0.05	Multiply two binomials
1.27	0.16	2.60	0.09	2.58	0.13	3.22	0.07	Solve absolute value equations and inequalities
1.00	0.15	3.39	0.08	3.60	0.09	3.73	0.05	Add, subtract, and multiply polynomials
0.73	0.12	3.37	0.08	3.64	0.09	3.67	0.05	Factor quadratics
0.86	0.14	3.16	0.09	3.65	0.08	3.73	0.05	Solve quadratic equations
.	.	.	.	.	.	.	.	Apply properties of exponential functions
0.60	0.11	2.13	0.10	2.38	0.13	2.89	0.09	Solve quadratic inequalities
0.50	0.10	1.86	0.10	2.10	0.14	2.41	0.10	Use the discriminant
0.78	0.13	2.20	0.10	2.74	0.14	3.36	0.07	Determine solutions of polynomial and rational equations
0.51	0.11	1.53	0.10	1.79	0.14	2.24	0.09	Implement remainder and factor theorems for polynomials
0.85	0.14	1.80	0.11	2.22	0.17	3.48	0.07	Apply properties of logarithmic and exponential functions
0.73	0.13	2.40	0.11	2.34	0.17	2.71	0.09	Find solutions to systems of linear equations
.	.	.	.	.	.	.	.	Solve problems using equations of parabolas and circles
0.42	0.09	1.40	0.10	1.48	0.13	2.55	0.09	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
0.48	0.10	0.85	0.09	0.84	0.12	1.85	0.11	Solve problems using parametric equations
1.04	0.14	1.91	0.11	2.16	0.15	3.16	0.08	Transform functions algebraically
0.64	0.12	0.71	0.08	0.82	0.13	2.53	0.11	Find the limit of an expression
1.75	0.13	3.12	0.08	3.27	0.09	3.71	0.04	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**
								Graphical Representations
2.92	0.16	3.56	0.06	3.56	0.09	3.55	0.07	Comprehend the concept of length on the number line
.	.	.	.	.	.	.	.	Locate points on the number line and in the first quandrant
.	.	.	.	.	.	.	.	Locate points on the number line
2.97	0.15	3.69	0.05	3.84	0.06	3.81	0.04	Locate points in the coordinate plane
3.04	0.15	3.49	0.07	3.66	0.07	3.89	0.03	Exhibit knowledge of slope
2.74	0.17	3.45	0.07	3.66	0.07	3.85	0.04	Find the slope of a line
2.32	0.19	3.21	0.08	3.44	0.10	3.37	0.08	Identify graphs on a number line
2.22	0.19	3.09	0.08	3.29	0.10	3.54	0.07	Match linear graphs with their equations
1.15	0.16	2.83	0.09	2.92	0.12	3.16	0.08	Use properties of parallel and perpendicular lines
0.79	0.13	2.18	0.10	2.25	0.16	2.51	0.10	Solve systems of equations and inequalities graphically
.	.	.	.	.	.	.	.	Recognize special characteristics of parabolas and circles
0.47	0.09	1.41	0.10	1.48	0.14	2.45	0.09	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
2.74	0.16	2.80	0.10	3.08	0.11	3.56	0.06	Interpret and use information from graphs in the coordinate plane
1.81	0.18	2.22	0.10	2.69	0.14	3.21	0.07	Identify characteristics of graphs based on a set of conditions or on a general equation
0.93	0.15	1.70	0.10	2.34	0.16	3.25	0.07	Understand the properties of graphs of rational functions (e.g., asymptotes)
1.62	0.18	2.27	0.10	2.47	0.15	2.55	0.10	Find midpoints
1.10	0.16	2.45	0.10	2.60	0.15	3.05	0.08	Use the distance formula
1.04	0.16	1.65	0.10	2.18	0.15	3.13	0.08	Work with discontinuous graphs and piecewise-defined functions
2.45	0.14	2.99	0.08	3.23	0.09	3.60	0.05	**GRAPHICAL REPRESENTATIONS as an overall topic**
								Properties of Plane Figures
0.40	0.09	1.25	0.11	1.68	0.16	1.88	0.11	Find the measure of an angle using properties of parallel lines
.	.	.	.	.	.	.	.	Exhibit some knowledge of angles associated with parallel lines
0.61	0.12	1.78	0.11	2.78	0.15	2.88	0.10	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
0.78	0.14	3.02	0.09	3.52	0.10	3.65	0.05	Use the Pythagorean theorem
0.68	0.12	1.47	0.10	2.05	0.15	2.33	0.10	Apply properties of lines, segments, and rays
0.43	0.10	1.24	0.10	1.44	0.15	1.74	0.10	Apply properties of special quadrilaterals
0.49	0.11	1.33	0.11	2.51	0.16	2.93	0.09	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
0.50	0.10	1.06	0.10	2.08	0.16	2.28	0.10	Use relationships among angles, arcs, and distances in a circle
1.06	0.16	1.01	0.09	1.42	0.14	2.26	0.11	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
0.53	0.11	0.67	0.08	0.88	0.12	1.31	0.10	Prove results by mathematical induction
0.64	0.11	1.49	0.09	2.32	0.13	2.59	0.08	**PROPERTIES OF PLANE FIGURES as an overall topic**

Note:
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Prob = Probability and Statistics
Alg = Algebra
P-Cal = Pre-Calculus
Calc = Calculus
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.2c

Statistical Details for Mathematics Topics and Skills by Course
Postsecondary Reponses Only *(continued)*

Prob Mean	Prob +/–	Alg Mean	Alg +/–	P-Cal Mean	P-Cal +/–	Calc Mean	Calc +/–	Topics and Skills
								Measurement
0.97	0.14	2.94	0.10	2.77	0.15	3.35	0.08	Compute the area and perimeter of triangles and rectangles
.	.	.	.	.	.	.	.	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
0.49	0.11	2.06	0.11	1.93	0.15	2.36	0.10	Compute the perimeter of composite geometric figures with unknown side lengths
0.54	0.12	1.88	0.11	1.73	0.15	2.36	0.10	Compute the area and perimeter of polygons
0.56	0.12	2.39	0.11	2.67	0.14	3.35	0.07	Compute the area and circumference of circles after identifying necessary information
.	.	.	.	.	.	.	.	Compute the area and perimeter of polygons with known side lengths
0.49	0.11	1.70	0.10	1.84	0.15	2.78	0.08	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
0.49	0.11	1.53	0.10	1.42	0.13	2.19	0.10	Compute the area and volume of composite geometric figures
0.64	0.12	2.38	0.10	2.47	0.14	3.12	0.08	Use geometric formulas
0.89	0.16	1.70	0.12	1.77	0.16	1.63	0.11	Understand how to read measurement tools (e.g., rulers and protractors)
0.76	0.14	1.51	0.11	1.47	0.15	1.62	0.10	Use scale factors to determine the magnitude of a size change
0.64	0.12	2.03	0.10	2.18	0.12	2.75	0.08	**MEASUREMENT as an overall topic**
								Probability, Statitics, and Data Analysis
3.51	0.11	2.53	0.11	2.43	0.17	2.35	0.11	Read and interpret graphs, charts, and other data representations
3.45	0.14	1.61	0.15	2.00	0.21	1.77	0.14	Manipulate data from tables and graphs
.	.	.	.	.	.	.	.	Perform computations on data from tables and graphs
3.11	0.15	1.34	0.11	1.29	0.16	0.85	0.08	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
2.74	0.18	0.73	0.09	0.67	0.11	0.53	0.07	Exhibit knowledge of correlation, variance, and standard deviation of data
3.03	0.16	1.17	0.11	1.00	0.15	0.68	0.08	Find the median and mode
2.78	0.18	0.83	0.09	0.74	0.12	0.62	0.08	Determine the probability of a simple event
.	.	.	.	.	.	.	.	Use the relationship between the probability of an event and the probability of its complement
2.53	0.18	0.71	0.08	0.61	0.11	0.51	0.07	Determine the probability of mutually exclusive, dependent, and independent events
2.40	0.18	0.93	0.09	0.86	0.13	0.88	0.08	Exhibit knowledge of counting techniques
2.14	0.19	0.84	0.09	0.81	0.12	0.98	0.09	Exhibit knowledge of combinations, permutations, and the binomial theorem
3.32	0.14	2.29	0.13	2.00	0.18	1.75	0.12	Calculate the average of a list of numbers
2.19	0.18	1.64	0.12	1.32	0.16	0.88	0.10	Calculate a missing data value, given the average and all the missing data values but one
.	.	.	.	.	.	.	.	Calculate the average, given the number of data values and the sum of the data values
2.55	0.18	1.01	0.10	1.03	0.14	0.78	0.09	Calculate the average, given the frequency counts of all the data values
2.23	0.18	1.03	0.10	1.11	0.15	0.80	0.08	Calculate or use a weighted average
2.93	0.16	1.25	0.10	1.15	0.13	0.95	0.09	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
								Functions
2.25	0.17	2.89	0.10	3.24	0.13	3.90	0.02	Understand the concept of function
.	.	.	.	.	.	.	.	Use function notation
.	.	.	.	.	.	.	.	Find the domain and range of functions
1.21	0.15	2.47	0.11	2.78	0.14	3.67	0.05	Find domain, range, and inverses of functions
2.24	0.17	2.87	0.11	3.26	0.13	3.90	0.03	Evaluate linear functions based on function notation
0.96	0.14	2.72	0.11	3.24	0.13	3.90	0.03	Evaluate quadratic functions based on function notation
0.73	0.13	2.41	0.11	2.92	0.14	3.85	0.03	Evaluate polynomial functions based on function notation
0.72	0.12	2.02	0.11	2.53	0.16	3.76	0.04	Evaluate composite functions based on function notation
0.46	0.11	0.82	0.09	2.15	0.18	3.43	0.07	Apply basic trigonometric ratios to solve right-triangle problems
0.44	0.10	0.75	0.09	2.04	0.18	3.42	0.07	Use trigonometric concepts and basic identities to solve problems
0.39	0.10	0.61	0.08	1.64	0.18	2.36	0.10	Use the law of sines and law of cosines
0.41	0.10	0.60	0.08	1.63	0.17	2.76	0.09	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
0.41	0.09	0.61	0.08	1.97	0.18	3.60	0.07	Use radian measure
0.42	0.10	0.56	0.08	1.03	0.14	1.69	0.11	Exhibit knowledge of vectors in a plane
1.11	0.12	2.16	0.10	2.78	0.13	3.79	0.03	**FUNCTIONS as an overall topic**

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Alg = Algebra
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Calc = Calculus
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.3
Statistical Details for Reading Topics and Skills

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						Content
.	.	2.17	0.14	1.26	0.13	Read/view and demonstrate understanding of poetry
2.24	0.13	2.28	0.15	1.15	0.12	Read/view and demonstrate understanding of drama
3.75	0.07	2.88	0.14	1.97	0.14	Read/view and demonstrate understanding of novels and short stories
2.38	0.15	1.37	0.15	1.89	0.14	Read/view and demonstrate understanding of nonfiction trade books
3.09	0.12	3.17	0.11	3.16	0.11	Read/view and demonstrate understanding of textbooks
2.35	0.15	2.58	0.14	2.35	0.13	Read/view and demonstrate understanding of research studies
2.34	0.13	2.82	0.12	2.76	0.12	Read/view and demonstrate understanding of primary sources
2.56	0.12	2.54	0.12	2.51	0.13	Read/view and demonstrate understanding of news and feature articles, editorials/opinion pieces
1.84	0.14	1.43	0.13	1.36	0.13	Read/view and demonstrate understanding of advertisements
1.45	0.13	1.90	0.12	1.74	0.12	Read/view and demonstrate understanding of film and television
2.12	0.14	2.27	0.13	1.85	0.12	Read/view and demonstrate understanding of multimedia presentations
2.26	0.14	1.75	0.14	1.41	0.12	Read/view and demonstrate understanding of functional text
2.40	0.13	2.23	0.14	1.62	0.13	Read/view and demonstrate understanding of graphs, charts, and diagrams
1.86	0.15	1.51	0.14	1.40	0.13	Read/view and demonstrate understanding of work-related texts
3.56	0.08	3.48	0.07	3.32	0.08	**CONTENT as an overall set of skills**
						Main Ideas and Author's Approach
3.77	0.06	3.46	0.08	3.78	0.05	Infer the main idea or purpose of a straightforward paragraph
3.67	0.07	.	.	.	.	Recognize a clear intent of an author or narrator
3.66	0.08	3.51	0.07	3.59	0.06	Determine the main idea or purpose of a complex paragraph
3.73	0.07	3.45	0.08	.	.	Identify the main idea or purpose of a straightforward paragraph
3.81	0.06	3.67	0.06	3.72	0.06	Determine the main idea, purpose, or theme of a text
3.64	0.07	3.55	0.08	3.43	0.07	Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used)
3.71	0.07	3.54	0.07	3.60	0.06	Summarize basic events and ideas in a text
3.82	0.05	3.64	0.06	3.72	0.05	**MAIN IDEAS AND AUTHOR'S APPROACH as an overall set of skills**
						Supporting Details
3.62	0.07	3.48	0.07	3.60	0.06	Locate important details stated in a text
3.33	0.10	.	.	.	.	Locate basic facts (e.g., names, dates, events) that are clearly stated in a text
3.49	0.08	3.26	0.08	2.94	0.08	Locate and interpret minor or subtly stated details in a text
3.34	0.10	3.17	0.10	.	.	Locate simple details at the sentence and paragraph level in a text
3.63	0.07	3.42	0.08	3.47	0.07	Make simple inferences about how details are used to support points made in a text (e.g., support for a claim)
3.56	0.08	3.40	0.09	3.31	0.07	Discern which details from different sections of a text support important points
3.40	0.10	3.18	0.10	3.06	0.08	Understand subtle or complex roles that details can play in a text
3.70	0.06	3.46	0.07	3.44	0.06	**SUPPORTING DETAILS as an overall set of skills**
						Relationships
3.29	0.10	3.05	0.11	3.29	0.09	Order simple sequences of events in a text
3.34	0.09	.	.	.	.	Determine when (e.g., first, last, before, after) or if an event occurred in a text
3.33	0.09	3.10	0.10	2.90	0.09	Order subtle or complex sequences of events in a text
3.44	0.09	.	.	.	.	Recognize clear cause-effect relationships described within a single sentence
3.60	0.07	3.45	0.08	3.52	0.07	Identify clear relationships between people, ideas, and so on in a text
3.49	0.09	3.40	0.08	3.07	0.08	Infer subtle or complex relationships between people, ideas, and so on in a text
3.59	0.08	3.51	0.08	3.50	0.07	Identify clear cause-effect relationships in a text
3.43	0.09	3.35	0.09	3.03	0.08	Infer subtle or complex cause-effect relationships in a text
3.60	0.07	3.44	0.07	3.32	0.07	**RELATIONSHIPS as an overall set of skills**
						Meaning of Words
3.72	0.06	3.45	0.08	3.49	0.07	Use context to determine the appropriate meaning of words and phrases
3.47	0.09	.	.	.	.	Understand the implication of a familiar word or phrase and of simple descriptive language
3.62	0.07	3.28	0.10	3.25	0.08	Distinguish between literal and figurative meanings of words and phrases in a text
3.60	0.07	3.49	0.07	3.49	0.07	Paraphrase concepts and ideas in a text
3.70	0.07	3.16	0.12	2.45	0.11	Understand literary devices in a text
3.76	0.05	3.57	0.07	3.41	0.06	**MEANINGS OF WORDS as an overall set of skills**
						Generalizations and Conclusions
3.61	0.07	3.49	0.07	3.54	0.06	Draw generalizations and conclusions about people, ideas, and so on in a text
3.51	0.08	.	.	.	.	Draw simple generalizations and conclusions about the main characters in a text
3.74	0.06	3.53	0.07	3.52	0.07	Draw generalizations and conclusions using details that support the main points of a text
3.62	0.08	3.26	0.10	2.72	0.10	Predict outcomes based on a text
3.58	0.08	3.40	0.09	3.44	0.08	Distinguish between fact, opinion, and reasoned judgment within a text
3.00	0.12	3.08	0.11	3.07	0.09	Identify stereotypes in a text
2.70	0.15	3.00	0.12	2.93	0.09	Identify logical fallacies in a text
3.28	0.11	3.26	0.10	3.04	0.09	Identify persuasive techniques in a text
3.13	0.13	3.26	0.10	3.25	0.09	Evaluate the range and quality of evidence used to support an argument in a text
3.33	0.11	3.24	0.10	3.21	0.09	Make connections between two or more texts
3.58	0.07	3.50	0.07	3.37	0.07	**GENERALIZATIONS AND CONCLUSIONS as an overall set of skills**

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. = This item was not asked at this grade level.

Table C.3

Statistical Details for Reading Topics and Skills *(continued)*

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						Evaluating Texts
3.32	0.10	2.79	0.12	2.69	0.14	Demonstrate skills in Uncomplicated Literary Narratives
3.47	0.08	3.05	0.11	2.47	0.13	Demonstrate skills in More Challenging Literary Narratives
2.76	0.11	2.76	0.11	2.10	0.13	Demonstrate skills in Complex Literary Narratives
3.16	0.11	2.77	0.12	3.12	0.11	Demonstrate skills in Uncomplicated Informational Texts
3.20	0.09	3.08	0.09	2.96	0.10	Demonstrate skills in More Challenging Informational Texts
2.51	0.12	2.59	0.11	2.42	0.11	Demonstrate skills in Complex Informational Texts
2.97	0.13	3.19	0.10	3.30	0.08	Evaluate information in a text for relevance
2.94	0.13	3.25	0.10	3.12	0.10	Evaluate information in a text for fair and accurate treatment of differing points of view
3.05	0.13	3.09	0.11	2.88	0.10	Evaluate information in a text for persuasive techniques
2.97	0.13	3.28	0.09	3.19	0.09	Evaluate information in a text for credibility and appropriateness of sources of information
3.07	0.13	3.29	0.09	3.29	0.09	Evaluate information in a text for sufficiency of evidence in support of an argument or claim
2.46	0.15	2.88	0.12	2.97	0.09	Evaluate information in a text for internal consistency
2.91	0.13	3.37	0.10	3.07	0.10	Evaluate information in a text for Recognize how history and culture influence a text
2.94	0.12	3.21	0.10	3.26	0.07	**EVALUATING TEXTS as an overall set of skills**

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Table C.4

Statistical Details for Science Topics and Skills

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						Interpretation of Data
3.32	0.09	.	.	.	.	Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)
2.37	0.15	2.37	0.07	2.20	0.06	Compare or combine data from one or more data presentations (e.g., categorize data from a table using a scale from another table)
2.99	0.12	3.08	0.05	3.01	0.05	Determine how the value of one variable changes as another variable changes in a data presentation
2.83	0.13	3.06	0.06	2.95	0.06	Identify and/or use a mathematical relationship between data
3.07	0.11	3.11	0.05	3.08	0.05	Analyze given information when presented with new information
2.46	0.15	2.64	0.06	2.51	0.06	Interpolate between data points in a table or graph
2.42	0.15	2.65	0.06	2.46	0.06	Extrapolate from data points in a table or graph
3.78	0.06	3.61	0.04	3.32	0.04	Understand basic scientific terminology
3.48	0.09	3.37	0.04	2.95	0.05	Translate information into a table, graph, or diagram
2.45	0.15	2.40	0.07	1.82	0.06	Apply statistical concepts and methods of data analysis to the results of an experiment
3.31	0.10	3.29	0.05	2.96	0.05	**INTERPRETATION OF DATA as an overall topic**
						Scientific Investigation
3.50	0.09	2.98	0.06	.	.	Identify a control in an experiment
3.43	0.09	3.06	0.06	2.65	0.06	Understand basic processes and designs of simple experiments (single control, 2–3 variables)
2.41	0.17	2.22	0.07	2.03	0.06	Understand the methods and tools used in an experiment featuring multiple controls and multiple variables
.	.	.	.	1.53	0.05	Understand complex experimental designs
3.41	0.10	3.02	0.06	.	.	Understand simple experimental design (single control, 2–3 variables)
1.83	0.17	1.87	0.07	.	.	Understand complex experimental design (multiple controls and multiple variables)
2.82	0.14	2.72	0.06	2.29	0.06	Predict the results of an additional trial in an experiment
2.75	0.15	2.60	0.07	2.07	0.06	Determine the experimental conditions that would produce specified results
3.63	0.08	3.15	0.06	2.62	0.06	Determine the hypothesis for an experiment
.	.	.	.	2.17	0.09	Identify an alternate method for testing a hypothesis
2.98	0.13	2.91	0.06	2.44	0.06	Understand precision and accuracy issues
2.85	0.13	2.66	0.06	.	.	Identify similarities and differences between experiments
2.71	0.14	2.65	0.06	2.21	0.06	Evaluate the similarities and differences, or the strengths and weaknesses, of experiments
2.83	0.12	2.65	0.06	2.11	0.06	Predict how modifying the design of an experiment will affect results
3.41	0.10	2.93	0.07	2.05	0.06	Design and conduct an experiment
2.45	0.15	2.41	0.07	1.94	0.06	Identify an experiment that could be performed to enhance experimental results
3.53	0.09	3.19	0.05	2.50	0.05	**SCIENTIFIC INVESTIGATION as an overall topic**
						Evaluation of Models
3.28	0.11	3.02	0.06	2.69	0.06	Identify a hypothesis, prediction, or conclusion that is supported by data presentations or models (i.e., scientific explanations)
3.27	0.11	3.01	0.06	2.85	0.06	Determine whether information (e.g., a data presentation or model) supports or contradicts a hypothesis, prediction, or conclusion, and why
2.48	0.14	2.43	0.06	2.27	0.06	Identify strengths and weaknesses in one or more models
2.53	0.14	2.45	0.06	2.32	0.06	Identify similarities and differences between models
2.26	0.14	2.34	0.07	2.39	0.06	Determine whether a model is supported or weakened by new information
2.38	0.15	2.49	0.06	2.49	0.06	Identify key issues or assumptions in a model
2.46	0.14	2.51	0.06	2.41	0.06	Use new information to make a prediction based on a model
2.95	0.14	2.94	0.07	2.54	0.07	Communicate the results of an experiment through writing a properly organized report
2.82	0.12	2.82	0.06	2.54	0.05	**EVALUATION OF MODELS, INFERENCES, AND EXPERIMENTAL RESULTS as an overall topic**
						Miscellaneous Science Topics
1.32	0.17	1.55	0.08	1.76	0.06	Familiarity with the term "experimental treatment"
2.67	0.17	2.68	0.07	2.24	0.06	Familiarity with the term "experimental variable"
3.15	0.13	3.03	0.06	2.55	0.06	Familiarity with the term "independent variable"
3.14	0.13	3.03	0.06	2.55	0.06	Familiarity with the term "dependent variable"
2.00	0.16	2.87	0.06	2.98	0.06	Familiarity with the term "directly proportional"
1.87	0.16	2.84	0.06	2.93	0.06	Familiarity with the term "inversely proportional"
3.56	0.09	3.52	0.04	3.34	0.05	Use metric units of measurement
1.85	0.17	1.63	0.08	1.94	0.07	Use English units of measurement
2.54	0.15	3.00	0.06	2.95	0.06	Convert a number expressed in one unit of measurement to a number expressed in another unit of measurement
1.23	0.16	2.58	0.08	2.39	0.07	Perform dimensional analysis
2.70	0.15	3.18	0.05	3.15	0.05	Read and interpret data plotted on a linear scale
1.12	0.16	1.54	0.08	2.04	0.06	Read and interpret data plotted on a log scale

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. = This item was not asked at this grade level.

Table C.4

Statistical Details for Science Topics and Skills *(continued)*

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						General Biology Topics
2.39	0.21	.	.	.	.	State the criteria for life and understand and be able to use organizational systems in biology (e.g., in taxonomy, in ecology)
1.96	0.20	.	.	.	.	Recognize the role of carbohydrates, lipids, proteins, and nucleic acids in a cell
.	.	3.56	0.08	2.76	0.11	Explain the criteria for life and understand and be able to use organizational systems in biology (e.g., in taxonomy, in ecology)
.	.	3.43	0.09	2.45	0.12	Recognize structure and state functions of carbohydrates, lipids, proteins, and nucleic acids
.	.	2.86	0.12	2.60	0.12	Describe pH, acidic, and basic
2.16	0.19	.	.	.	.	Use the pH scale
2.55	0.19	2.89	0.11	2.60	0.12	Describe a chemical reaction and recognize the parts of a chemical equation
1.78	0.19	3.45	0.08	2.64	0.12	Explain what enzymes are and how they function
1.24	0.19	3.49	0.09	2.41	0.12	Describe the structure and function of ATP
2.65	0.20	3.63	0.07	2.52	0.12	Describe photosynthesis and cellular respiration and state where in the cell these processes occur
.	.	2.10	0.14	2.14	0.12	Relate the laws of thermodynamics to organisms and their environment
2.30	0.21	3.63	0.08	2.71	0.12	Describe diffusion and osmosis
2.50	0.21	3.80	0.05	2.79	0.12	Describe the structure and function of cell organelles and the plasma membrane
2.16	0.21	3.66	0.07	2.45	0.12	Explain the phases of the cell cycle and how the cell cycle is regulated
2.21	0.21	3.71	0.07	2.69	0.13	Describe the difference between mitotic and meiotic division
1.92	0.20	3.68	0.07	2.52	0.13	Describe the processes of DNA replication, transcription, and translation
.	.	3.81	0.05	2.68	0.12	Describe the structure and function of DNA, chromosomes, and the genetic code
.	.	3.56	0.08	2.37	0.13	Describe the structure and function of RNA (e.g., mRNA, rRNA, tRNA)
2.59	0.20	3.55	0.08	2.48	0.12	Describe what a gene is, how genes are expressed, and how gene expression can be regulated
2.59	0.21	3.70	0.07	2.64	0.12	Use the principles of Mendelian genetics to predict the outcome of a genetic cross
.	.	3.61	0.07	2.54	0.12	Explain how meiosis results in the formation of gametes and relate the process of meiosis to the principles of Mendelian genetics
2.64	0.21	3.55	0.08	2.70	0.12	State the difference between sexual and asexual reproduction
2.27	0.20	3.42	0.10	2.77	0.12	Describe the process of evolution and state the evidence for evolution
.	.	3.41	0.10	2.50	0.13	State the biological definition of fitness, describe the importance of mutation in evolution, and explain how natural selection drives evolution
2.07	0.20	3.28	0.10	2.36	0.13	Define species and describe the process of speciation
1.14	0.19	2.61	0.13	2.03	0.13	Interpret a phylogenetic tree
.	.	1.60	0.15	1.64	0.13	Use the Hardy-Weinberg equation
2.32	0.21	3.25	0.12	2.69	0.13	Describe the major groups of organisms (e.g., bacteria, protists, fungi, plants, animals) and why they are important to Earth's ecosystems
1.86	0.21	3.08	0.12	1.91	0.12	Describe what viruses are and how they replicate
1.92	0.21	2.73	0.15	2.13	0.13	Compare vertebrates and invertebrates and list key features of fish, amphibians, reptiles, birds, and mammals
2.32	0.21	2.98	0.13	1.92	0.12	Describe the development of an animal from a single cell and the structure and function of the major organ systems
1.93	0.21	2.79	0.13	1.87	0.13	Compare the different types of biomes
2.13	0.21	3.25	0.12	2.10	0.13	Describe the biotic and abiotic factors in an ecosystem and the flow of energy and chemicals through an ecosystem
2.41	0.21	3.41	0.10	2.41	0.13	Define producers, consumers, and decomposers
2.10	0.20	3.27	0.11	2.36	0.14	Define biodiversity
.	.	3.76	0.06	2.86	0.11	**GENERAL BIOLOGY TOPICS as an overall topic**
						General Chemistry Topics
3.38	0.12	3.53	0.08	3.35	0.09	Explain the difference between mass, weight, density, and volume
3.12	0.16	3.60	0.08	3.08	0.11	Describe the physical properties and molecular models of solids, liquids, and gases
3.01	0.17	3.42	0.09	3.07	0.11	Understand what occurs when a substance melts, freezes, boils, sublimes, or condenses
.	.	3.44	0.09	3.12	0.11	Know the Celsius and Kelvin temperature scales and how they are related
.	.	2.86	0.14	2.18	0.12	Understand the features of a generic heating curve
.	.	3.40	0.11	2.47	0.13	Understand and apply Charles's law and Boyle's law
.	.	2.74	0.15	2.05	0.13	Solve problems involving Graham's law and Dalton's law
.	.	3.44	0.11	2.55	0.14	Know and apply the ideal gas law and the kinetic theory to explain the behavior of gases
.	.	3.16	0.11	2.27	0.13	Describe how different factors affect the solubility of gases, liquids, and solids
.	.	3.31	0.11	2.64	0.14	Solve problems involving molality and molarity
1.44	0.20	3.39	0.10	2.56	0.14	Understand why substances can be polar or nonpolar and how polarity relates to solubility
.	.	3.77	0.06	3.32	0.11	Explain the differences between an element, an atom, a molecule, and a compound
2.80	0.18	3.89	0.04	3.35	0.11	Correctly use basic chemical symbols and formulas
.	.	3.87	0.05	3.14	0.13	Understand and apply the mole concept
2.99	0.19	3.79	0.05	3.23	0.11	Know the basic parts of an atom, the subatomic particles contained in each part, and the charge on each type of particle
.	.	3.77	0.05	3.02	0.13	Explain the differences between atomic mass, molar mass, mass number, and atomic number
.	.	3.49	0.08	2.73	0.13	Know that the nuclei of two different isotopes of an element will contain the same number of protons but a different number of neutrons

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. = This item was not asked at this grade level.

Table C.4

Statistical Details for Science Topics and Skills *(continued)*

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						General Chemistry Topics *(continued)*
.	.	3.62	0.07	2.58	0.13	Describe the periodic trends and the properties of the elements in the most common groups of the periodic table
.	.	3.48	0.09	2.53	0.14	Generate electron configurations for different elements and their ions
.	.	3.76	0.05	2.77	0.14	Explain the difference between an ionic bond and a covalent bond
.	.	3.76	0.06	2.55	0.14	Use oxidation or valence numbers to predict chemical formulas of compounds
.	.	3.52	0.09	2.61	0.13	Represent the bonding in ionic compounds and covalent compounds using electron-dot structures
.	.	3.91	0.03	3.18	0.12	Balance a basic chemical equation
.	.	3.79	0.07	2.95	0.13	Solve stoichiometric problems involving chemical reactions
.	.	2.40	0.15	2.00	0.13	Interpret a potential energy diagram and describe the role of a catalyst in a chemical reaction
.	.	2.90	0.13	2.25	0.14	Compare different intermolecular forces that exist between atoms and molecules
.	.	2.33	0.16	2.25	0.15	Use change in Hf to determine whether a chemical reaction was endothermic or exothermic
.	.	2.26	0.17	2.18	0.15	Apply Le Chatelier's principle to predict how different factors will affect the equilibrium of a reversible reaction
.	.	1.68	0.16	1.69	0.14	Predict the composition of a solid/solution mixture using Ksp
.	.	2.65	0.15	2.00	0.14	Compare and apply the three major acid-base theories
.	.	2.90	0.14	2.34	0.14	Know the formulas and relative strengths of the most common acids and bases
.	.	1.87	0.16	1.89	0.15	Use Ka values to determine the composition of an aqueous solution of an acid or base
.	.	3.43	0.11	2.86	0.14	Determine whether a substance having a certain pH is acidic, basic, or neutral
.	.	2.03	0.17	1.97	0.15	Calculate the pH of a solution using given concentrations and Ka or pKa values
.	.	1.92	0.16	1.97	0.15	Explain why a buffer solution maintains a stable pH
.	.	2.24	0.17	2.35	0.15	Identify which species are oxidized and which are reduced in a redox reaction
.	.	1.95	0.17	1.90	0.14	Balance redox equations using oxidation numbers
.	.	1.43	0.16	1.64	0.14	Explain the parts of a basic electrochemical cell and calculate voltages for the cell
.	.	2.12	0.17	1.69	0.14	Use structural formulas to represent organic compounds
.	.	1.94	0.17	1.40	0.13	Use basic organic nomenclature to convert between the names and formulas of organic compounds
.	.	2.50	0.16	1.99	0.14	Describe the basic geometry of carbon single, double, and triple bonds
.	.	3.69	0.07	2.76	0.13	**GENERAL CHEMISTRY TOPICS as an overall topic**
						General Earth Science Topics
.	.	3.07	0.13	2.87	0.12	Find location and estimate distance on a map
.	.	3.26	0.13	2.42	0.15	Describe the properties that define a mineral
.	.	3.45	0.11	2.51	0.15	Compare the compositions and origins of sedimentary, igneous, and metamorphic rocks
2.37	0.22	3.26	0.12	2.28	0.14	Compare erosion and weathering
.	.	3.23	0.12	2.30	0.15	Identify the major agents of erosion and distinguish the two types of weathering
.	.	2.94	0.14	2.10	0.14	Understand how weathering is related to soil formation
.	.	3.10	0.12	2.35	0.14	Understand how and where sediment is deposited
.	.	3.27	0.12	1.81	0.14	Identify the layers of Earth's atmosphere
2.06	0.22	3.29	0.11	1.99	0.15	Compare weather and climate
.	.	3.08	0.13	1.56	0.14	Understand how relative humidity and dew point relate to cloud formation and precipitation
.	.	2.99	0.14	1.46	0.14	Describe the characteristics and causes of thunderstorms
.	.	2.97	0.14	1.39	0.14	Describe the characteristics and causes of tornadoes
.	.	2.97	0.13	1.56	0.14	Describe the characteristics and causes of hurricanes
.	.	2.36	0.15	1.74	0.13	Compare the chemistry of ocean water and fresh water
.	.	2.94	0.13	1.97	0.14	Understand the cause of tides
.	.	3.01	0.13	1.94	0.14	Understand how large-scale ocean currents contribute to climate
2.69	0.20	3.44	0.10	2.68	0.14	Understand how water moves through the water cycle
.	.	3.15	0.12	2.49	0.14	Identify the primary sources of fresh water (lakes, streams, groundwater, glaciers)
.	.	2.88	0.14	2.35	0.15	Describe the relationship between the water table and groundwater
2.23	0.23	3.58	0.09	2.62	0.16	Describe the three major types of tectonic plate boundaries
2.50	0.22	3.59	0.09	2.47	0.15	Understand the causes of plate movement
.	.	3.65	0.08	2.65	0.16	Understand how plate movement relates to earthquakes, volcanoes, and mountain building
.	.	2.97	0.12	2.26	0.14	Describe how radioactive materials are use to determine age
.	.	3.06	0.12	2.26	0.14	Understand how fossils are formed and what fossils tell us about the ages of rock layers
.	.	3.13	0.12	2.18	0.14	Identify renewable and nonrenewable resources
2.57	0.20	3.03	0.13	1.94	0.14	Describe types of renewable/alternative energy
.	.	2.82	0.14	1.77	0.14	Understand multiple ways to conserve and recycle resources
.	.	2.81	0.14	1.76	0.14	Identify types of air, soil, and water pollution
2.53	0.19	3.20	0.12	2.24	0.14	Understand the causes and effects of global warming
2.50	0.20	3.26	0.11	1.91	0.14	Understand the importance of the ozone layer
1.49	1.28	2.28	1.52	.	.	Describe the motions of Earth and the Moon and their implications for lunar phases, tides, and timekeeping

Note:
MS = Middle school/junior high school teachers
HS = High school teachers
PS = Postsecondary instructors (no remedial teachers)
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.4

Statistical Details for Science Topics and Skills *(continued)*

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						General Earth Science Topics *(continued)*
.	.	2.13	0.12	1.30	0.13	Describe the properties of the various solar system bodies (the Sun, planets, moons, asteroids, comets, meteoroids)
.	.	1.93	0.12	1.00	0.12	Describe and compare various theories of solar system formation
.	.	1.92	0.12	1.00	0.13	Describe the process of star formation and evolution
.	.	1.74	0.12	0.91	0.12	Describe the various types of galaxies, and their formation and evolution
.	.	2.05	0.12	1.01	0.12	Describe the large-scale structure of the universe, discuss the big bang theory, and describe the possible outcomes for the evolution of the universe
.	.	3.66	0.07	2.62	0.13	**GENERAL EARTH SCIENCE TOPICS as an overall topic**
						General Physics and Astronomy Topics
.	.	3.89	0.04	2.82	0.13	Calculate the displacement, speed, velocity, and acceleration of an object in one and two dimensions
.	.	3.72	0.06	2.67	0.13	Sketch position/time graphs and velocity/time graphs for objects undergoing simple types of motion
.	.	3.92	0.03	2.67	0.15	Apply Newton's three laws of motion to solve simple mechanics problems
.	.	3.79	0.06	2.53	0.15	Define momentum and describe momentum conservation
.	.	3.85	0.04	2.67	0.15	Define kinetic energy and potential energy
.	.	3.72	0.07	2.54	0.15	Define mechanical energy and describe simple scenarios in which mechanical energy is conserved or is not conserved
.	.	3.47	0.10	2.11	0.14	Write the formula describing Newton's law of gravitation
.	.	3.78	0.06	2.51	0.15	Solve problems involving free fall and motions on an inclined plane
.	.	3.68	0.08	2.47	0.15	Solve simple problems involving projectile motion, uniform circular motion, and circular orbits
.	.	3.21	0.12	2.28	0.14	Describe simple harmonic motion and give examples of systems in which simple harmonic motion is observed
.	.	3.77	0.06	2.49	0.15	Define work, state the work-energy theorem, and calculate the work done in simple physical situations
.	.	2.74	0.16	2.20	0.15	Relate torque to rotational motion
.	.	2.27	0.16	2.33	0.14	Distinguish among the Fahrenheit, Celsius, and Kelvin temperature scales and convert a temperature in any one of these scales to a temperature in either of the other two scales
.	.	2.15	0.17	2.02	0.15	Define the specific heat of a substance
.	.	2.24	0.17	1.96	0.14	Describe the heat transfer processes of convection, conduction, and radiation
.	.	1.82	0.17	1.95	0.15	Write the equation of state for an ideal gas and use the equation to solve problems involving transformations in ideal gases
.	.	3.35	0.12	2.29	0.16	Given wavelength and frequency of light or sound, calculate wave speed
.	.	3.15	0.13	2.10	0.15	Describe the electromagnetic spectrum in terms of energy, radiation type (gamma ray, X-ray, etc.), wavelength, and frequency
.	.	3.13	0.14	2.16	0.16	Given the angle of incidence of light on a plane mirror, predict angle of reflection
.	.	2.92	0.16	2.01	0.16	Using Snell's law, determine angle of refraction of light
.	.	2.82	0.16	1.90	0.15	For object imaged by mirror or thin lens, use ray tracing to determine position, size, and orientation of image
.	.	2.67	0.16	2.04	0.16	Sketch electric field lines emanating from point charge
.	.	2.98	0.15	2.11	0.16	Using Coulomb's law, determine the electric force between 2 point charges
.	.	3.16	0.15	2.23	0.16	Using Ohm's law, determine the voltage drop across a resistor
.	.	3.05	0.14	2.30	0.16	Explain the difference between an electrical conductor and an electrical insulator
.	.	2.70	0.15	2.05	0.16	Explain the difference between an AC circuit and a DC circuit
.	.	2.95	0.16	2.08	0.16	Calculate the power generated by an electrical current passing through a resistor
.	.	2.66	0.16	1.85	0.15	Explain how an electrical generator uses motion and magnetism to produce an electrical current
.	.	2.56	0.16	2.01	0.15	Draw lines of magnetic force emanating from a bar magnet
.	.	2.55	0.15	1.70	0.14	Describe qualitatively situations in which light behaves like a wave and situations in which light behaves like a particle
.	.	3.22	0.12	2.35	0.15	**GENERAL PHYSICS AND ASTRONOMY TOPICS as an overall topic**
						General Physical Science Topics (Middle School Only)
3.16	0.15	.	.	.	.	Understand and apply the formula for density
3.09	0.15	.	.	.	.	Understand the Celsius scale and the significance of 0°C and 100°C in the scale.
2.16	0.19	.	.	.	.	Know that a liquid having a lower viscosity flows more easily than does a substance having a higher viscosity
2.36	0.20	.	.	.	.	Explain why a chemical or physical process is endothermic or exothermic
2.40	0.19	.	.	.	.	Explain the difference between a homogeneous mixture and a heterogeneous mixture
2.27	0.20	.	.	.	.	Identify the solute(s) and solvent when describing a solution
2.12	0.20	.	.	.	.	Understand that the concentration of a solution is amount of solute dissolved in a certain amount of solvent or solution
1.82	0.20	.	.	.	.	Know that an aqueous solution is a solution in which H2O is the solvent
3.12	0.17	.	.	.	.	Understand the distinctions between an element, an atom, a molecule, and a compound
1.95	0.20	.	.	.	.	Know that organic compounds contain carbon and that hydrocarbons contain only carbon and hydrogen

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+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table C.4

Statistical Details for Science Topics and Skills *(continued)*

MS Mean	MS +/–	HS Mean	HS +/–	PS Mean	PS +/–	Topics and Skills
						General Physical Science Topics (Middle School Only*) (continued)*
2.42	0.20	.	.	.	.	Identify basic features of a chemical equation (reactants, products, reaction arrow, coefficients)
2.05	0.21	.	.	.	.	Balance a simple chemical equation
1.76	0.20	.	.	.	.	Describe the role of a catalyst in a chemical reaction
2.16	0.21	.	.	.	.	Determine whether a solution is acidic, basic, or neutral when given its pH
2.29	0.21	.	.	.	.	Define displacement, speed, velocity, and acceleration, and, for an object moving in a straight line at a constant speed, plot a graph from a table of the displacement of the object versus time, and find the object's speed from the graph
2.52	0.21	.	.	.	.	State and describe Newton's three laws of motion, and give examples of physical situations that illustrate each law
2.24	0.21	.	.	.	.	Describe qualitatively Newton's law of gravitation, describe the acceleration due to gravity at Earth's surface for objects having different masses, and define weight
2.46	0.20	.	.	.	.	Define and distinguish between kinetic energy and potential energy, define mechanical energy, and describe situations in which mechanical energy is not conserved
1.94	0.21	.	.	.	.	Define wavelength, frequency, amplitude, and wave speed
1.62	0.20	.	.	.	.	Describe the Doppler effect and give examples of its occurrences and applications
1.79	0.22	.	.	.	.	List the names associated with the various types of electromagnetic radiation, and arrange them in order of increasing wavelength
2.15	0.20	.	.	.	.	Describe the interaction between opposite charges and between like charges
1.54	0.22	.	.	.	.	Define electrical current, voltage, and resistance
1.81	0.21	.	.	.	.	Describe the interactions between the poles of two magnets
						General Earth/Space Science Topics (Middle School Only)
1.94	0.21	.	.	.	.	Know how latitude and longitude are used to designate location
1.99	0.22	.	.	.	.	Describe the properties of a mineral and understand how minerals relate to rocks
2.27	0.23	.	.	.	.	Compare how sedimentary, igneous, and metamorphic rocks are formed
2.06	0.21	.	.	.	.	Know the layers of Earth's atmosphere
1.72	0.21	.	.	.	.	Know how relative humidity and dew point relate to cloud formation
1.86	0.22	.	.	.	.	Describe the characteristics and causes of thunderstorms, tornadoes, and hurricanes
2.39	0.23	.	.	.	.	Know the causes of earthquakes and volcanoes
2.35	0.21	.	.	.	.	Know how fossils are formed and what they tell us about the ages of rock layers
2.65	0.19	.	.	.	.	Identify renewable and nonrenewable resources and ways to conserve and recycle resources
2.58	0.19	.	.	.	.	Identify types of air, land, and water pollution and ways to improve air and water quality
2.15	0.22	.	.	.	.	Compare planets, moons, asteroids, comets, and meteors
2.30	0.22	.	.	.	.	Describe the motions of the Sun, Earth, Moon system
1.73	0.22	.	.	.	.	Compare the composition, color, and life cycles of different classes of stars
1.75	0.22	.	.	.	.	Describe the different types of galaxies

Note:
MS = Middle school/junior high school teachers
HS = High school teachers
PS = Postsecondary instructors (no remedial teachers)
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

English Test Specifications

Table D.1 summarizes the specifications for the EXPLORE, PLAN, and ACT English Tests by showing the number (and proportion) of test questions in each test.

Several features of this coordinated set of English testing programs can be seen in this summary of test specifications. First, as the tests assess higher levels along the content continua, the emphasis of the assessment shifts from usage/mechanics skills like punctuation to more complex, global skills related to strategy, organization, and style. Also, as the target grade level of the testing program increases, so do the number of questions, the number of passages, and the length of the passages. These shifts reflect the expected change in level of sophistication of the examinee population.

The multiple-choice test questions derive from a domain of specific language components that educators agree are important to clear communication. The language components are not tested in isolation, but rather within the context of a passage; their listing here is not meant to be a prescription for language arts education, but merely a means of describing the kinds of writing abilities indirectly measured by the tests.

Table D.1
English Test Specifications

	Testing program		
Content area	**EXPLORE**	**PLAN**	**ACT**
Punctuation	6 (.15)	7 (.14)	10 (.13)
Grammar and Usage	8 (.20)	9 (.18)	12 (.16)
Sentence Structure	11 (.28)	14 (.28)	18 (.24)
Strategy	5 (.12)	6 (.12)	12 (.16)
Organization	5 (.12)	7 (.14)	11 (.15)
Style	5 (.12)	7 (.14)	12 (.16)
Total	**40**	**50**	**75**
Passages	4	4	5
Passage Length	300 words	300 words	325 words

English Language Continuum Content Descriptions

Punctuation. The items in this category test the examinee's understanding of the conventions of internal and end-of-sentence punctuation, with emphasis on the capabilities of punctuation to remove ambiguity and clarify meaning.

Punctuating breaks in thought
- End of a sentence (period, exclamation point, question mark)
- Between clauses of compound sentences when conjunction is omitted or when clauses contain commas
- Before a conjunctive adverb joining clauses of a compound sentence
- Parenthetical elements (comma, dash, parentheses)

Punctuating relationships and sequences
- Avoiding ambiguity
- Indicating possessives
- Indicating items or simple phrases in a series
- Indicating restrictive/essential or nonrestrictive/nonessential elements (e.g., participial phrases, subordinate clauses, appositives)

Avoiding unnecessary punctuation
- Between subject and predicate
- Between verb and object
- Between adjective and noun (modifier and modified element)
- Between noun and preposition
- Between preposition and object
- Between two coordinate elements or correlatives
- Within series already linked by conjunctions
- Between intensive and antecedent

Grammar and Usage. The items in this category test the examinee's understanding of agreement between subject and verb, between pronoun and antecedent, and between modifiers and the words modified; formation of verb tenses; pronoun case; formation of comparative and superlative adjectives and adverbs; and idiomatic usage.

Assuring grammatical agreement
- Predicate with subjects of varying complexity (including compound subjects, collective nouns, sentences beginning with *there* or *where*)
- Pronoun with antecedent (only when the relationship is clear)
- Adjectives and adverbs with their corresponding nouns and verbs

Forming verbs
- Tenses of regular and irregular verbs
- Compound tenses

Using pronouns
- Using the proper form of the possessives and distinguishing them from adverbs (*there*) and contractions (*it's* and *who's*)
- Using the appropriate case of a pronoun

Forming modifiers
- Forming comparatives and superlatives of adjectives and adverbs
- Using the appropriate comparative or superlative form depending on the context

Observing usage conventions
- Using the idioms of standard written English

Sentence Structure. The items in this category test the examinee's understanding of relationships between and among clauses, management and placement of modifiers, and shifts in construction.

Relating clauses
- Avoiding faulty subordination, coordination, and parallelism
- Avoiding run-on and fused sentences
- Avoiding comma splices
- Avoiding sentence fragments (except those required in dialogue or otherwise defensible as rhetorically appropriate in their context)

Using modifiers
- Constructing sentences so that antecedents are clear and unambiguous (avoiding squinters and danglers)
- Placing modifiers so that they modify the appropriate element

Avoiding unnecessary or inappropriate shifts in construction
- Person or number of pronoun
- Voice of verb
- Tense of verb
- Mood of verb

Strategy. The items in this category test the examinee's understanding of the appropriateness of expression in relation to audience and purpose; judgment in adding, revising, or deleting supporting material (e.g., the strengthening of compositions with appropriate supporting material); and judgment of the relevancy of statements in context. These items focus on the processes of writing: the choices made and strategies employed by a writer in the act of composing or revising.

Making decisions about the appropriateness of expression for audience and purpose

Making decisions about adding, revising, or deleting supporting material

Judging relevancy
- Omitting irrelevant material (or retaining relevant material)

Organization. The items in this category test the examinee's understanding of the organization of ideas and judgment in choosing effective opening, transitional, and closing sentences.

Establishing logical order
- Choosing the appropriate conjunctive adverb or transitional expression
- Placing sentences in a logical location
- Ordering sentences in a logical sequence (orderly movement within paragraphs)
- Ordering a series of phrases in a logical way
- Beginning a paragraph in the appropriate place
- Ordering paragraphs in a logical sequence

Making decisions about cohesion devices: openings, transitions, and closings
- Selecting an effective statement relative to the essay as a whole
- Selecting an effective statement relative to a specific paragraph or paragraphs

Style. The items in this category test the examinee's understanding of rhetorically effective management of sentence elements, clarity of pronoun references, economy in writing, and precision and appropriateness of words and images.

Managing sentence elements effectively
- Rhetorically effective and logical subordination, coordination, and parallelism
- Avoiding ambiguity of pronoun reference (only when the relationship is problematic)

Editing and revising effectively
- Avoiding clearly excessive or inappropriate wordiness
- Avoiding redundancy

Choosing words to fit meaning and function
- Maintaining the level of style and tone
- Choosing words and images that are specific, precise, and clear in terms of their context and connotation; recognizing and avoiding mixed metaphors and awkward or nonsensical expressions

No single test form is expected to assess the student's understanding of all of these areas. Rather, the content of the test is sampled from the domain described above and is measured in the context of the passages. Also, the tests do not assess memorized rules of grammar. The emphasis is on the application of sound writing practices to the revising and editing of prose that is typical of that encountered in school and in life in general.

Writing Test Specifications

The ACT Writing Test was introduced nationally as an optional component to the ACT in February 2005. It is an achievement test designed to measure students' writing proficiency and to complement the information currently provided by the ACT English Test. Students have 30 minutes to write on a single writing prompt. The prompt provides a rhetorical situation—an issue or a problem with two alternative positions or solutions. The examinees are asked to develop and support, through their writing, one of those positions or solutions or to propose a third alternative. The features embedded in the 6-point holistic scoring rubric are based on a set of descriptors of what students should be able to do in order to succeed in first-year college writing courses. (See Figure D.1.) Each essay is scored by two readers. The sum of the readers' scores is reported as the essay's score, on the score range 2–12.

Figure D.1
ACT Writing Test Descriptors (What Students Should Be Able to Do)

1. Show the ability to make and articulate judgments by
   - taking a position on an issue or problem.
   - demonstrating the ability to grasp the complexity of issues or problems by considering implications or complications.
2. Sustain a position by focusing on the topic throughout the writing.
3. Develop a position by
   - presenting support or evidence using specific details.
   - using logical reasoning that shows the writer's ability to distinguish between assertions and evidence and to make inferences based on support or evidence.
4. Organize and present ideas in a logical way by
   - logically grouping and sequencing ideas.
   - using transitional devices to identify logical connections and tie ideas together.
5. Communicate clearly by using language effectively and by observing the conventions of standard written English.

Mathematics Test Specifications

The content areas for the EXPLORE, PLAN, and ACT Mathematics Tests are summarized in Table D.2. Included in this table is the number (and proportion) of questions in each content area. As can be seen from the table, there is a clear progression in the content coverage of the tests from the 8th- to the 10th- to the 12th-grade-level programs.

Several points need to be made about the labeling of the content areas, especially at the 8th-grade level. At Grade 8, consistent with the National Council of Teachers of Mathematics (NCTM) Standards, "Basic Statistical/ Probability Concepts" does not refer to the content of a formal statistics course, but to the ability to process data. Similarly, 8th-grade "Pre-Geometry" deals with use of figures and diagrams to solve mathematical problems. At levels higher than Grade 8, content definitions are consistent with standard course titles in high school.

The cognitive levels assessed by the Mathematics Tests are summarized in Table D.3. The numbers (and proportions) of questions at each cognitive level are reported in this table. Although at first sight the increase in the proportion of "Knowledge and Skills" questions, and the decline in the proportion of "Understanding Concepts/Integrating Conceptual Understanding" questions, with increasing grade level may seem surprising, it must be remembered that at the higher grade levels the content areas are more challenging.

Table D.2
Mathematics Test Specifications

	Testing program		
Content area	**EXPLORE**	**PLAN**	**ACT**
Basic Statistical/Probability Concepts	4 (.13)	*	*
Pre-Algebra	10 (.33)	14 (.35)	14 (.23)
Elementary Algebra	9 (.30)	8 (.20)	10 (.17)
Pre-Geometry	7 (.23)		
Plane Geometry		11 (.27)	14 (.23)
Coordinate Geometry		7 (.18)	9 (.15)
Intermediate Algebra			9 (.15)
Trigonometry			4 (.07)
Total	**30**	**40**	**60**

*On PLAN and the ACT, questions involving statistics/probability are included in the Pre-Algebra category.

Table D.3
Cognitive Specifications for the Mathematics Tests

	Testing program		
Cognitive level	**EXPLORE**	**PLAN**	**ACT**
Knowledge and Skills	8 (.267)	14 (.350)	30 (.500)
Direct Application	8 (.267)	12 (.300)	17 (.283)
Understanding Concepts/Integrating Conceptual Understanding	14 (.467)	14 (.350)	13 (.217)
Total	**30**	**40**	**60**

Mathematics Test forms are produced by sampling from the domains, rather than by testing every specific skill on every form. Students are advised to prepare for these tests by obtaining a thorough grounding in the full content domain rather than by trying to guess the specific content that will appear on a test form. Each form is a unique sample from the broad content domain; no particular topic in the content areas is guaranteed to appear on a given test form.

Mathematics Continuum Content and Cognitive Level Descriptions

Cognitive Levels

Knowledge and skills. Questions at this level require the student to use one or more facts, definitions, formulas, or procedures to solve problems that are presented in purely mathematical terms.

Direct application. Questions at this level require the student to use one or more facts, definitions, formulas, or procedures to solve straightforward problems set in real-world situations.

Understanding concepts. Questions at this level test the student's depth of understanding of major concepts by requiring reasoning from a concept to reach an inference or a conclusion.

Integrating conceptual understanding. Questions at this level test the student's ability to achieve an integrated understanding of two or more major concepts so as to solve nonroutine problems.

Content Areas

Basic Statistical/Probability Concepts. Questions in this content area (which is treated explicitly in EXPLORE, and implicitly as part of the Pre-Algebra content area in PLAN and the ACT) involve elementary counting and rudimentary probability; data collection, representation, and interpretation; reading and relating graphs, charts, and other representations of data; and other appropriate topics. All of these topics are addressed at a level preceding formal statistics. Questions in this content area cover the following topics:

- Counting and counting techniques
- The concept of probability
- Mean, median, and mode
- Data collection and representation
- Reading and interpreting graphs, charts, and other representations of data

Pre-Algebra. Questions in this content area are based (as appropriate for the grade levels across EXPLORE, PLAN, and the ACT) on basic operations using whole numbers, decimals, fractions, and integers; place value; square roots and approximations; the concept of exponents; scientific notation; factors; ratio, proportion, and percent; linear equations in one variable; absolute value and ordering numbers by value; elementary counting techniques and simple probability; data collection, representation, and interpretation; and understanding simple descriptive statistics. Questions in pre-algebra cover the following topics:

- Addition, subtraction, multiplication, and division of whole numbers, decimals, fractions, and integers
- Positive integer exponents
- Prime factorization
- Comparison of fractions
- Ratio and proportion
- Conversion of fractions to decimals, and conversion of decimals to fractions
- Absolute value
- Solution of linear equations in one variable (This is an Elementary Algebra topic for EXPLORE.)
- Percent
- Scientific notation
- Square roots and irrational numbers
- Operations with real numbers (field axioms)
- Order properties for real numbers
- Common factors and common multiples

Elementary Algebra. Questions in this content area are based (as appropriate for the grade levels across EXPLORE, PLAN, and the ACT) on properties of exponents and square roots, evaluation of algebraic expressions through substitution, using variables to express functional relationships, understanding algebraic operations, and the solution of quadratic equations by factoring. Questions in elementary algebra cover the following topics:

- Evaluation of algebraic expressions by substitution
- Simplification of algebraic expressions
- Addition, subtraction, and multiplication of polynomials
- Factorization of polynomials
- Solution of quadratic equations by factoring
- Formula manipulation and field properties of algebraic expressions

Pre-Geometry. Questions in this category (which applies to EXPLORE only) involve the use of scales and measurement systems, plane and solid geometric figures and associated relationships and concepts, the concept of angles and their measures, parallelism, relationships of triangles, properties of a circle, the Pythagorean theorem, and other appropriate topics. All of these topics are addressed at a level preceding formal geometry. Questions in pre-geometry cover the following topics:

- Using measurement systems
- Using rulers and other scales
- Concepts and relationships for plane and solid geometric figures
- Calculation of perimeter, area, and volume with formulas for selected geometric figures
- The concept of angle and angle measure
- Parallelism
- Properties of triangles
- Properties of circles
- Pythagorean theorem

Plane Geometry. Questions in this content area are based (as appropriate for the grade levels across PLAN and the ACT) on the properties and relations of plane figures, including angles and relations among perpendicular and parallel lines; properties of circles, triangles, rectangles, parallelograms, and trapezoids; transformations; the concept of proof and proof techniques; volume; and applications of geometry to three dimensions. Items in plane geometry cover the following topics:

- Identification of plane geometric figures
- Basic properties of a circle: radius, diameter, and circumference
- Measurement and construction of right, acute, and obtuse angles
- Parallel lines and transversals
- Congruent and similar triangles
- Areas of circles, triangles, rectangles, parallelograms, trapezoids, and, with formulas, other figures
- Pythagorean theorem
- Lines, segments, and rays
- Perpendicular lines
- Properties of triangles
- Ratio of sides in 45°-45°-90° triangles and 30°-60°-90° triangles
- Circumference and arc length

Coordinate Geometry. Questions in this content area are based (as appropriate for the grade levels across PLAN and the ACT) on graphing and the relations between equations and graphs, including points, lines, polynomials, circles, and other curves; graphing inequalities; slope; parallel and perpendicular lines; distance; midpoints; and conics. Questions in coordinate geometry cover the following topics:

- Graphing on the number line
- Identification and location of points in the coordinate plane
- Determination of graphs of functions and relations in the plane by plotting points
- Graphs of linear equations in two variables
- Slope of a line
- Distance formula for points in the plane

Intermediate Algebra. Questions in this content area (which applies to the ACT only) are based on an understanding of the quadratic formula, rational and radical expressions, absolute value equations and inequalities, sequences and patterns, systems of equations, quadratic inequalities, functions, modeling, matrices, roots of polynomials, and complex numbers. Questions in intermediate algebra cover the following topics:

- Solution of linear inequalities in one variable
- Operations with integer exponents
- Operations with rational expressions
- Slope-intercept form of a linear equation
- Operations with radical expressions
- Quadratic formula
- Graphs of parabolas, circles, ellipses, and hyperbolas
- Zeros of polynomials
- Rational exponents
- Equations of circles
- Solution of systems of two linear equations in two variables
- Simple absolute value equations and inequalities
- Graphical solutions to systems of equations and/or inequalities
- Equations of parallel and perpendicular lines

Trigonometry. Questions in this content area (which applies to the ACT only) are based on understanding trigonometric relations in right triangles; values and properties of trigonometric functions; graphing trigonometric functions; modeling using trigonometric functions; use of trigonometric identities; and solving trigonometric equations. Questions in trigonometry cover the following topics:

- Right triangle trigonometry
- Trigonometric functions
- Graphs of trigonometric functions, including amplitude, period, and phase shift
- Trigonometric identities
- Addition formulas for sine and cosine
- Simple trigonometric equations

Reading Test Specifications

The text content areas, number of passages, passage lengths, and number (and proportion) of items for the EXPLORE, PLAN, and ACT Reading Tests are summarized in Table D.4.

Table D.4
Reading Test Specifications

	Testing program		
Content area	**EXPLORE**	**PLAN**	**ACT**
Prose Fiction	10 (.33)	8 (.32)	10 (.25)
Humanities	10 (.33)	9 (.36)	10 (.25)
Social Sciences	10 (.33)	8 (.32)	10 (.25)
Natural Sciences			10 (.25)
Total	**30**	**25**	**40**
Passages	3	3	4
Passage Length	500 words	500 words	750 words

Reading Continuum Content and Cognitive Level Descriptions

Cognitive Levels

Questions in the Reading Tests are classified in the general categories of Referring and Reasoning.

Referring. The questions in this category ask about material explicitly stated in a passage. These questions are designed to measure literal reading comprehension. A question is classified in the Referring category if the information required to answer it is directly given in the passage text. In such questions, there are usually relationships between the language of the passage and that of the question, and the answer to the question is typically evident in a single sentence, or two adjacent sentences, in the passage. Some Referring questions paraphrase the language of the passage.

Main ideas
- Recognizing the main idea of a passage
- Recognizing the main idea of a paragraph or paragraphs

Significant details
- Recognizing the information in a written passage that answers the questions who, what, where, when, why, and how

Relationships
- Recognizing sequences
- Recognizing cause-effect relationships
- Recognizing comparative relationships (comparisons and contrasts)

Reasoning. The questions in this category ask about meaning implicit in a passage and require cogent reasoning about a passage. These questions are designed to measure "meaning making" by logical inference, analysis, and synthesis. A question is classified in the Reasoning category if it requires inferring or applying a logical process to elicit an answer from the passage, or if it demands that the examinee combine many statements in the passage or interpret entire sections of the text.

Inferences from the text
- Inferring the main idea or purpose of a passage
- Inferring the main idea or purpose of a paragraph or paragraphs
- Showing how details are related to the main idea (e.g., how they support the main idea)
- Inferring sequences
- Inferring cause-effect relationships

Critical understanding of the text
- Drawing conclusions from information given
- Making comparisons and contrasts using stated information
- Making appropriate generalizations
- Recognizing logical fallacies, rhetorical flaws, or limitations in texts
- Recognizing stereotypes
- Understanding point of view
- Distinguishing between fact and opinion

Vocabulary
- Determining specific meanings of words or short phrases within the context of a passage

Content Areas

The content of the Reading Tests ranges widely among topics under the content areas named in Table D.4. As is true of the other content domains, the stimulus material for the Reading Tests becomes more challenging with the increase in the grade level being assessed; as Table D.4 shows, at the 8th-/9th- and 10th-grade levels, three content areas are used to assess reading skill (prose fiction, humanities, and social sciences). At the 11th-/12th-grade level, natural sciences text material is added.

Prose fiction. The questions in this area are based on intact short stories or passages from short stories or novels.

Humanities. The questions in this area are based on passages from memoirs, personal essays, and essays on architecture, art, dance, ethics, film, language, literary criticism, music, philosophy, radio, television, or theater. Passages describe or analyze works of art, ideas, or values.

Social sciences. The questions in this area are based on passages in anthropology, archaeology, biography, business, economics, education, geography, history, political science, psychology, or sociology. Passages typically present information gathered by research into written records or survey sampling rather than data gained by scientific experimentation.

Natural sciences. The questions in this area are based on passages in anatomy, astronomy, biology, botany, chemistry, ecology, geology, medicine, meteorology, microbiology, natural history, physiology, physics, technology, or zoology. Passages present a science topic with a lucid explanation of its significance.

Question Ordering

Reading Test questions are arranged according to a protocol that places more general questions ahead of more specific questions and that places questions about portions of the passage in the order in which those portions appear in the passage. ACT adopted this protocol, with the approval of reading consultants from outside ACT and after careful consideration of the measurement issues involved, to provide examinees with as natural and logical a sequence of items as possible.

Science Test Specifications

The EPAS Science Tests measure the student's interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences. A test for a given program is made up of five to seven test units, each of which consists of some scientific information (the stimulus) and a set of multiple-choice test items. Knowledge acquired in grade-level-appropriate science courses is needed to answer some of the questions. The tests emphasize scientific reasoning skills over recall of science content, skill in mathematics, or reading ability. The use of calculators is not permitted on the Science Tests. Table D.5 summarizes the test specifications for the EXPLORE, PLAN, and ACT Science Tests. Under the "Format" heading are the numbers (and proportions) of test questions associated with each of the three types of presentations used in the three tests. Under the "Cognitive Level" heading are the distributions of questions assessing the three cognitive levels. Finally, under the "Subject Matter" heading are the distributions of test questions by content domain being assessed. The terms used in the tables are defined in the next section.

Table D.5
Science Test Specifications

	Testing program		
Format	**EXPLORE**	**PLAN**	**ACT**
Data Representation	12 (.43)	10 (.33)	15 (.38)
Research Summaries	10 (.36)	14 (.47)	18 (.45)
Conflicting Viewpoints	6 (.21)	6 (.20)	7 (.17)
Total	**28**	**30**	**40**
Cognitive level			
Understanding	12 (.43)	9 (.30)	7 (.18)
Analysis	10 (.36)	13 (.43)	20 (.50)
Generalization	6 (.21)	8 (.27)	13 (.32)
Total	**28**	**30**	**40**
Subject matter			
Life Science	3		
Physical Science	2		
Earth/Space Science	1	1–2*	1–2*
Biology		1–2*	1–2*
Chemistry		1–2*	1–2*
Physics		1–2*	1–2*
Total	**6**	**5**	**7**

*At least one topic is required in this content area, and some test forms may have two topics. No more than two topics in a particular content area are allowed.

The following section provides detailed descriptions of the materials used in the EPAS Science Tests. These descriptions are presented in the order in which the information was summarized in Table D.5: first the formats for the stimulus material, then the definitions of the cognitive levels being assessed, and finally lists of the content included in the fields of science covered at each test level.

Science Continuum Stimulus Material, Cognitive Level, and Content Area Descriptions

Stimulus Material

Each stimulus used in the Science Tests as the basis for the test questions follows one of three formats. These formats are very specific in their intent and style, each being used to tap a specific subset of scientific reasoning skills.

Data representation format. The data representation format is intended to test the examinee's ability to understand, evaluate, and interpret information presented in a graphic or tabular format. The information may consist of any type of data that can be presented with minimal explanation. Examples include the results of simple experiments, observations, summarized data, figures, or flowcharts.

Research summaries format. The research summaries format is intended to evaluate an examinee's abilities to comprehend, evaluate, analyze, and interpret the design of experiments. In particular, the skills to be assessed using this format include the following:

- The understanding of the premise of the experiment (observation, confirmation, or hypothesis testing)
- The relationship of the design to the premise
- The understanding of control groups
- Variations in experimental designs
- Weaknesses of the experiment due to assumptions or limitations embedded in the design

Almost anything that relates to how scientists view experiments is a valid topic in this type of format. However, since the data representation format covers the aspects of interpretation of data, the tabular or graphic presentation of the experiments alone is not a major point of consideration. The simulated research studies are of sufficient complexity to allow significant comparisons of results. Often, a number of linked, related experiments are presented that build on each other and provide an extended simulation of several research studies.

Conflicting viewpoints format. The conflicting viewpoints format is intended to test the examinee's ability to evaluate two or more alternative theories, hypotheses, or viewpoints on a specific, observable phenomenon. This phenomenon may be a simple observation or a more complex process. The alternative viewpoints disagree in some clear fashion that is plausible, but they need not necessarily be based on a contemporary scientific controversy. The main restriction is that they be logical and complete. The alternative viewpoints are based on realistic assumptions and have logical conclusions.

Cognitive Levels

The questions in the Science Tests are classified according to three primary cognitive levels: understanding, analysis, and generalization. Within each of the three major cognitive classifications there are a number of subclassifications. These are presented to clarify the types of test questions that are within the major categories, but they are not meant to provide an exhaustive list. Some of the subclassifications do not apply to some of the stimulus formats. For example, a classification referring to experimental design is not appropriate for a data representation format. The stimulus formats that support questions with each subclassification are coded at the end of each description using DR for data representation, RS for research summaries, and CV for conflicting viewpoints.

Understanding. Understanding questions test students' ability to comprehend the information presented and, to a limited extent, their understanding of how it fits into the general scheme of the particular stimulus format. Examples of this ability include comprehending how the information in a bar graph is organized, understanding the control group's function in an experiment, and identifying unstated assumptions and the concept that serves as the basis for a particular theory. A question in the understanding classification does not merely ask the student to understand what is written, but to understand how that information is related to other parts of the material provided in the stimulus. An understanding question specifically deals with only a small part of the material in the stimulus, such as a single data point, graph axis, hypothesis, or experimental step.

Understanding—The ability to:

- Explain, describe, identify, or compare the basic features of, and concepts related to, the provided information. (DR, RS, CV)
- Explain, describe, identify, or compare the components of the experimental design or process. (RS)
- Explain, describe, identify or compare the basic features or data points in graphs, charts, or tables. (DR)
- Explain, describe, or identify basic scientific concepts or assumptions underlying the provided information. (DR, RS, CV)
- Select the appropriate translation of the provided information into a graph, figure, or diagram. (DR, RS, CV)

Analysis. Analysis questions should go beyond the level of understanding questions in testing the student's ability to relate a number of components of the presented material to each other on a higher, more abstract level. Examples of this question type include relating hypotheses to experimental design or data, and evaluating how a viewpoint is related to another viewpoint or to an observable phenomenon. Essentially, the student is required to exhibit the ability to see how each piece of information in the presentation fits in with the rest of the stimulus and what importance each piece has in reference to the topic. Often, an analysis question will prompt a student to carefully pick apart the details presented and piece them back together to get an overall view of the presented topic. An analysis question typically deals with a major portion of the presented information, such as a graphed relationship, one or more experiments, or one or more viewpoints. An analysis question does not extend beyond the scope of the presented material.

Analysis—The ability to:

- Critically examine the relationships between the information provided and the conclusions drawn or the hypotheses developed. (DR, RS, CV)
- Determine whether information or results support or are consistent with a point of view, hypothesis, or conclusion. (DR, RS, CV)
- Determine whether a hypothesis or conclusion supports or is consistent with a point of view, the results of a single experiment, or the information presented in a single graph or table. (DR, RS, CV)
- Evaluate experimental procedures, viewpoints, or theories for their strengths, weaknesses, similarities, or differences. (RS, CV)
- Specify alternative ways of testing the point of view or hypothesis, or specify alternative ways of producing the same results. (RS, CV)

Generalization. Generalization questions test the student's ability to see how the stimulus material relates to the rest of the world. A generalization question may ask for a general model of a scientific concept that is embedded in the presented data (for example, deduce a gas law from a set of data), how the results of an experiment could be used to assist someone in resolving a problem in the real world, or how a theory could be modified to account for some new, unforeseen data or phenomena. While generalization questions may not always be the most difficult for a student, they are intended to demand that the student assimilate all of the material presented and extend discovered concepts to new situations.

Generalization—The ability to:

- Generalize from given information to gain new information, generate a model, or make predictions. (DR, RS, CV)
- Extend concepts, procedures, or hypotheses to new situations to gain new information. (RS, CV)
- Generalize beyond the given information to a broader context, or generate a model consistent with the provided information. (DR, RS, CV)
- Predict outcomes on the basis of the provided information. (DR, RS, CV)

Content Areas

The content areas used to assess Science skills parallel the content courses commonly taught at Grades 7–12, and at the entry level at colleges and universities. Each test activity uses stimulus materials from one of these areas. Materials are produced specifically for the Science Tests. They are required to match the level of complexity of those used in the classroom. Often, students are confronted with a new situation to engage their reasoning skills.

The topics included in each content area are summarized below.

Life Science. The stimulus materials and questions in this content area cover such topics as biology, botany, ecology, health, human behavior, and zoology.

Physical Science. The stimulus materials and questions in this content area cover such topics as simple chemical formulas and equations and other basic chemistry, weights and measures, and basic principles of physics.

Earth/Space Science. The stimulus materials and questions in this content area cover such topics as geology, meteorology, astronomy, environmental science, and oceanography.

Biology. The stimulus materials and questions in this content area cover such topics as cell biology, botany, zoology, microbiology, ecology, genetics, and evolution.

Chemistry. The stimulus materials and questions in this content area cover such topics as atomic theory, inorganic chemical reactions, chemical bonding, reaction rates, solutions, equilibriums, gas laws, electrochemistry, and properties and states of matter.

Physics. The stimulus materials and questions in this content area cover such topics as mechanics, energy, thermodynamics, electromagnetism, fluids, solids, and light waves.

Table E.1

Rank Order of Average Importance Ratings of 21st Century Skills in Specific Courses Taught by Postsecondary Instructors*

English/Writing		Math		Reading		Science		
HS	PS	HS	PS	HS	PS	HS	PS	Skill
2	4	11	7	4	2	12	7	English or language arts
1	2	5	3	1	1	3	1	Reading
2	1	14	10	2	3	13	11	Writing
26	26	1	1	26	26	7	4	Mathematics
25	25	13	13	24	25	1	3	Science
17	17	22	20	12	14	21	21	History
19	19	25	23	18	18	22	23	Government and civics
24	24	18	18	21	21	23	22	Economics
20	20	24	24	19	19	20	19	Geography
21	23	26	26	25	23	26	26	World languages
18	18	20	24	20	20	24	25	Arts
16	16	20	22	17	16	17	17	Understanding of and ability to address global issues
23	22	16	16	22	22	24	24	Financial, economic, business, and entrepreneurial literacy
22	21	23	21	23	24	18	19	Health literacy
11	10	12	12	13	12	15	13	Creativity and innovation skills
5	5	2	2	3	4	2	2	Critical thinking and problem-solving skills
2	3	8	6	4	5	8	9	Communication skills
12	12	10	14	10	13	9	12	Collaboration skills
8	8	7	9	7	7	6	6	Information literacy
14	15	19	19	15	15	16	16	Media literacy
13	14	15	15	13	16	14	15	Using digital technology to research and organize information
10	9	9	8	11	9	10	10	Flexibility and adaptability
6	6	4	4	8	6	5	4	Initiative and self-direction
15	13	17	17	16	10	19	18	Social and cross-cultural skills
6	7	3	5	6	8	4	8	Productivity and accountability
9	11	6	11	9	10	10	13	Leadership and responsibility

*The skills and descriptions used in the survey instrument were adapted from Partnership for 21st Century Skills, 2008.

Table F.1

How Course Content Topics Are Taught
Writing

MS %			HS %			REM %			
1	2	3	1	2	3	1	2	3	Topics and Skills
									Composition Process and Purpose
1	25	74	1	33	67	5	11	84	Determine purpose and audience
0	27	72	2	45	54	2	13	85	Use prewriting, brainstorming, or other techniques of invention
1	31	67	8	48	43	3	19	78	Use mapping, clustering, outlining, or other organizational tools
11	26	63	4	18	78	34	14	52	Gather and synthesize resources
16	29	56	5	18	77	34	18	48	Evaluate source materials critically
0	22	78	2	27	71	4	6	90	Develop a cohesive first draft
0	22	78	1	24	75	4	4	92	Revise for content
0	23	77	1	32	67	1	10	89	Edit and proofread for usage and mechanics
14	21	65	4	13	83	39	15	45	Cite sources accurately
3	24	73	4	22	74	11	12	77	Avoid plagiarism
6	17	77	5	25	70	22	21	58	Develop one's own voice as a writer
48	19	33	54	16	30	88	6	6	Make use of and adapt elements of the writing process to create media productions
5	29	66	4	34	62	7	14	79	Write to explore ideas
2	30	68	9	42	49	20	24	56	Write to express one's feelings
5	26	68	26	33	41	31	20	49	Write to tell a story through fiction or nonfiction
10	17	73	3	12	85	59	13	28	Write to analyze literature
36	28	36	29	30	41	57	21	22	Write to analyze media
2	22	76	2	24	74	5	5	91	Write to convey information
6	14	81	2	16	82	11	10	80	Write to argue or persuade readers
19	30	51	32	33	35	22	17	61	Write to describe a process or how to do something
52	20	28	57	21	22	77	12	11	Write to produce work-related texts
19	20	62	8	17	74	59	11	30	Write to present research
0	11	88	0	14	86	5	1	94	**COMPOSITION PROCESS AND PURPOSE as an overall set of skills**
									Topic and Idea Development
6	11	84	2	18	80	2	3	95	Present a thesis that establishes focus on the topic
0	17	83	1	21	78	1	4	95	Maintain a focus on the general topic throughout a piece of writing
4	21	75	2	21	77	3	7	90	Narrow the focus to a specific issue within the general topic
4	31	64	2	36	61	5	15	80	Provide appropriate context or background information for readers
1	14	86	0	18	82	2	2	96	Develop ideas by using some specific reasons, details, and examples
6	14	80	3	19	78	11	8	81	Take and maintain a position on an issue
9	18	72	3	15	82	27	11	62	Support claims with multiple and appropriate sources of evidence
31	28	41	13	31	56	31	23	46	Differentiate between assertions and evidence
22	28	50	11	35	54	29	24	47	Fairly and accurately represent different points of view on an issue
32	21	47	14	32	54	36	17	47	Anticipate and respond to counterarguments to a position taken on an issue
14	26	60	10	33	57	10	15	75	Show some movement between general and specific ideas and examples
18	30	52	12	37	51	16	23	61	Identify the basic purpose or role of a phrase or sentence within a piece of writing
3	25	72	2	27	70	4	18	78	Determine the appropriateness of wording for audience and purpose
4	33	63	6	38	55	5	14	82	Delete a clause or sentence because it is obviously irrelevant to a piece of writing
4	33	62	6	39	55	5	14	80	Delete material that disturbs the development or flow of a piece of writing
6	20	74	3	23	74	7	10	84	Determine whether a piece of writing has accomplished its intended purpose
0	13	86	0	15	85	1	4	94	**TOPIC AND IDEA DEVELOPMENT as an overall set of skills**
									Organization, Unity, and Coherence
1	21	78	2	28	70	2	5	94	Provide an adequate organization with a logical grouping of ideas
1	17	83	2	27	71	2	7	91	Use discernible introductions and conclusions
1	24	75	1	35	64	3	9	88	Use appropriate transition words and phrases within a sentence or to connect sentences within a paragraph
2	24	74	1	37	62	6	10	84	Use effective transition sentences to connect paragraphs
8	32	59	.	.	.	.	.	.	Use conjunctive adverbs to show time relationships (e.g., then, this time)
17	33	51	12	43	46	14	21	65	Use conjunctive adverbs or phrases to express straightforward logical relationships
12	39	49	14	45	41	12	20	67	Select the most logical place to add a sentence in a paragraph
8	35	57	9	41	50	9	18	73	Determine the most logical place to add information to a piece of writing
1	18	81	1	28	72	2	6	91	**ORGANIZATION, UNITY, AND COHERENCE as an overall set of skills**

Note:
MS = Middle school teachers
HS = High school teachers
REM = Remedial teachers
1 = Not taught in course
2 = Taught in the course but mainly as Review
3 = Taught in course as part of the Standard Course Content
. = This item was not asked at this grade level.

Table F.1

How Course Content Topics Are Taught
Writing *(continued)*

MS %			HS %			REM %			
1	2	3	1	2	3	1	2	3	Topics and Skills
									Word Choice in Terms of Style, Tone, Clarity, and Economy
18	36	47	16	45	38	24	28	48	Revise expressions that deviate from the style of a piece of writing
2	32	66	.	.	.	.	.	.	Revise sentences to correct awkward and confusing arrangements of sentence elements
13	30	57	10	37	53	18	28	54	Maintain consistency of tone
1	24	75	2	30	67	7	17	77	Choose words and images that are specific, precise, and clear in terms of their context
1	26	73	2	30	68	4	19	77	Use appropriate vocabulary
5	35	60	5	42	52	10	21	69	Delete obviously synonymous and wordy material in a sentence
3	25	72	3	33	64	12	28	60	Use varied words and images
3	35	62	.	.	.	.	.	.	Revise vague nouns and pronouns
4	30	66	4	39	57	5	18	77	Avoid vague pronouns (i.e., pronouns without a clear antecedent)
13	38	49	10	49	41	10	26	65	Determine the clearest and most logical conjunction to link clauses
34	23	44	14	32	54	10	22	69	Use rhetorically effective subordination, coordination, and parallelism
2	32	66	2	33	65	5	23	72	**WORD CHOICE IN TERMS OF STYLE, TONE, CLARITY, AND ECONOMY as an overall set of skills**
									Sentence Structure and Formation
34	24	42	12	39	50	6	19	76	Avoid faulty subordination, coordination, and parallelism
2	24	74	4	43	54	1	13	86	Use punctuation and conjunctions to avoid awkward sentence fragments and fused sentences (i.e., comma splices, run-on sentences)
3	26	71	.	.	.	.	.	.	Use punctuation and conjunctions to join clauses
18	32	49	9	47	44	12	22	65	Avoid dangling and misplaced modifiers
7	31	62	7	46	47	6	17	77	Decide on appropriate verb tense and voice by considering the meaning of an entire sentence
10	31	59	.	.	.	.	.	.	Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences
6	29	64	7	45	49	6	17	77	Decide on appropriate verb tense and voice in terms of a paragraph or a piece of writing
13	30	57	8	46	46	6	21	73	Avoid inappropriate shifts of mood, number, or person
19	37	44	14	51	35	9	25	66	Identify missing or incorrect relative pronouns
6	25	69	4	40	57	9	22	69	Use some varied kinds of sentence structures to vary pace and to support meaning
4	26	70	3	47	50	3	17	79	**SENTENCE STRUCTURE AND FORMATION as an overall set of skills**
									Conventions of Usage
16	38	46	31	47	22	13	29	58	Form simple and compound tenses of regular and irregular verbs
18	38	44	.	.	.	.	.	.	Form past and past participle of irregular and commonly used verbs
15	43	42	.	.	.	.	.	.	Form comparative and superlative adjectives
17	40	43	29	49	22	19	34	47	Form modifiers
17	37	46	34	44	22	19	37	43	Choose between using an adverb and using an adjective in a particular situation
3	35	62	13	48	40	3	23	75	Ensure straightforward subject-verb agreement
5	37	58	12	46	42	5	23	72	Ensure straightforward pronoun-antecedent agreement
16	27	57	17	43	40	12	25	63	Ensure subject-verb and pronoun-antecedent agreement in unusual or tricky situations (e.g., subject-verb order is inverted; subject is an indefinite pronoun)
4	38	58	17	51	32	8	25	67	Use the proper form of possessive pronouns
7	38	55	19	49	32	9	25	66	Use the appropriate case of a pronoun
16	36	48	23	49	28	20	31	49	Use the idioms of standard written English
13	46	41	30	49	21	19	31	50	Determine which preposition to use in simple contexts
28	38	34	31	47	23	33	31	36	Determine the appropriate preposition to use in situations involving sophisticated language or ideas
5	45	49	15	56	30	8	29	63	Use the appropriate word in frequently confused pairs of words (e.g., past and passed)
4	35	61	11	54	35	5	25	70	**CONVENTIONS OF USAGE as an overall set of skills**
									Conventions of Punctuation
11	35	54	14	51	36	9	30	62	Delete commas that disturb sentence flow (e.g., between modifier and modified element)
3	39	58	11	52	37	3	25	72	Provide appropriate punctuation in straightforward situations (e.g., items in a series)
7	29	65	11	50	39	4	23	73	Punctuate between clauses of compound sentences when the conjunction is omitted
13	28	59	15	48	37	9	23	68	Punctuate before a conjunctive adverb joining clauses of a compound sentence
14	28	58	12	48	40	12	30	58	Punctuate parenthetical elements with commas, parentheses, and dashes
15	23	62	12	50	38	8	25	67	Punctuate essential/nonessential elements, subordinate clauses, and restrictive/nonrestrictive appositives
5	36	58	13	52	35	7	29	64	Punctuate possessive nouns and pronouns
2	31	67	14	45	42	17	35	48	Punctuate dialogue
10	26	64	9	43	48	5	21	74	Use a semicolon to indicate a close relationship between two independent clauses
22	24	54	14	45	41	20	27	53	Use semicolons when items in a series have internal punctuation (e.g., when items have their own commas)
11	29	60	12	48	40	16	28	56	Use a colon to introduce a series of phrases (e.g., a list of examples)
29	26	46	18	46	36	27	27	45	Use a colon to introduce one or more sentences
3	32	65	8	51	41	5	25	70	**CONVENTIONS OF PUNCTUATION as an overall set of skills**

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Table F.2

How Course Content Topics Are Taught
Mathematics

MS %			HS %			REM %			
1	2	3	1	2	3	1	2	3	Topics and Skills
									Process Skills
12	47	41	16	46	39	21	30	49	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
6	53	41	15	54	31	16	35	49	Estimate a reasonable result without using a calculator
18	37	44	44	27	29	60	22	18	Demonstrate concepts using manipulatives
5	32	62	8	29	63	15	29	56	Demonstrate concepts using pictorial representations
1	8	92	1	9	90	3	6	91	Solve problems posed in real-world settings and interpret the solutions
10	40	50	12	34	53	27	27	45	Recognize when essential information is missing
1	9	90	1	12	87	2	6	91	Plan and carry out a strategy for solving multistep problems
5	33	61	4	25	70	7	17	75	Recognize generalizations of mathematical ideas
1	15	84	3	22	76	6	16	77	Recognize and use patterns to solve problems
3	14	83	3	13	83	7	16	77	Apply mathematical ideas to new contexts
12	19	69	14	23	64	42	21	37	Formulate new patterns or structures
13	16	71	8	17	76	27	17	56	Solve several problems representing different aspects/components of one larger problem or scenario
30	18	52	16	25	59	41	19	40	Understand roles of definitions, proof, and counterexamples
1	27	72	3	34	63	2	17	80	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
38	19	43	11	23	66	42	19	39	Recall theorems and more complex formulas when needed to solve a problem
43	13	44	16	18	66	43	14	43	Apply theorems to solve a problem
80	11	9	48	17	35	84	11	6	Construct and/or critique proofs, either informal or formal
18	46	36	21	41	38	27	31	42	Perform basic operations with a calculator
65	12	23	47	16	37	84	7	9	Use the statistical capabilities of a calculator
58	7	35	26	12	62	70	11	19	Use the graphical capabilities of a calculator
58	13	28	49	18	33	75	12	14	Use the symbolic algebra capabilities of a calculator
76	13	11	86	8	5	93	6	2	Use spreadsheets
77	11	12	74	12	14	86	8	6	Use dynamic geometry
6	42	52	10	44	46	10	24	66	Solve routine problems quickly
24	33	44	20	38	42	39	26	35	Solve novel problems quickly
1	22	78	2	19	79	1	7	92	Use mathematical symbols correctly
16	26	58	14	30	55	20	22	58	Understand new material from reading a textbook
18	25	57	20	31	49	45	17	38	Work in a self-directed group
6	22	72	7	28	66	16	16	68	**PROCESS SKILLS as an overall topic**
									Basic Operations and Applications
3	32	65	29	43	28	8	24	69	Perform addition, subtraction, multiplication, and division on signed rational numbers
10	50	40	.	.	.	.	.	.	Perform one-step computations with whole numbers and decimals
2	20	78	15	34	51	5	15	79	Solve problems using ratios and proportions
4	24	72	32	39	29	5	19	76	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
10	37	53	28	44	29	26	27	46	Convert units of measure
9	48	43	38	39	24	12	27	61	Solve routine one-step arithmetic problems
5	31	64	25	40	35	5	23	72	Solve routine two- or three-step arithmetic problems
11	27	63	20	35	45	14	25	61	Solve nonroutine two- or three-step arithmetic problems
10	26	64	25	37	39	28	23	48	Solve multistep arithmetic problems that involve planning or converting units of measure
7	15	78	19	35	46	16	12	72	Solve word problems containing several rates, proportions, or percentages
4	30	67	19	47	34	5	14	81	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**
									Numbers: Concepts and Properties
30	55	15	.	.	.	.	.	.	Identify a digit's place
13	59	27	32	50	18	10	30	60	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
10	46	44	50	38	13	17	26	57	Order fractions
18	57	25	.	.	.	.	.	.	Recognize one-digit factors of a number
12	51	37	35	45	20	5	24	71	Find and use the least common multiple
8	56	36	.	.	.	.	.	.	Recognize equivalent fractions and fractions in lowest terms
3	15	82	9	32	59	6	14	80	Perform computations with squares and square roots of numbers
32	12	56	25	28	48	28	14	58	Perform computations with cubes and cube roots of numbers
9	9	81	12	33	55	8	8	84	Apply rules of exponents
72	11	16	52	9	39	84	6	11	Perform matrix addition and multiplication
16	18	66	35	14	51	77	10	14	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
56	16	28	47	27	27	64	11	24	Find union and intersection of sets
9	13	78	17	30	53	27	16	57	Apply properties of rational and irrational numbers
.	.	.	46	8	45	61	5	35	Exhibit knowledge of complex numbers
.	.	.	48	7	45	66	4	30	Apply properties of complex numbers
5	30	65	20	39	41	11	17	72	Apply number properties involving multiples and factors
8	21	71	34	41	25	27	16	56	Use scientific notation
.	.	.	19	23	59	12	7	81	Determine when an expression is undefined
.	.	.	41	11	48	79	5	16	Exhibit knowledge of logarithms and geometric sequences
2	25	73	14	32	54	5	16	78	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**

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Table F.2

How Course Content Topics Are Taught
Mathematics *(continued)*

MS %			HS %			REM %			
1	2	3	1	2	3	1	2	3	Topics and Skills
									Expressions, Equations, and Inequalities
2	12	86	19	43	39	7	12	81	Evaluate algebraic expressions by substituting integers for unknown quantities
2	32	66	.	.	.	.	.	.	Exhibit knowledge of basic expressions
4	12	84	20	46	34	9	10	81	Add and subtract simple algebraic expressions
6	12	82	.	.	.	.	.	.	Combine like terms
6	13	81	20	46	34	7	11	82	Solve routine first-degree equations
9	6	85	17	44	39	11	9	80	Solve linear equations and inequalities in one variable
2	18	80	.	.	.	.	.	.	Substitute whole numbers for unknown quantities
4	14	82	14	36	50	6	10	84	Perform word-to-symbol translations
2	8	91	13	38	49	11	9	80	Write expressions, equations, or inequalities for common settings
2	16	82	.	.	.	.	.	.	Solve one-step equations having integer or decimal values
50	3	47	18	40	42	24	7	69	Multiply two binomials
30	8	62	25	28	47	40	4	56	Solve absolute value equations and inequalities
47	4	49	19	34	46	23	7	70	Add, subtract, and multiply polynomials
66	2	32	20	32	48	33	6	61	Factor quadratics
66	3	32	18	31	52	33	2	65	Solve quadratic equations
57	3	40	.	.	.	.	.	.	Apply properties of exponential functions
.	.	.	44	16	40	69	4	28	Solve quadratic inequalities
.	.	.	43	15	43	67	3	29	Use the discriminant
.	.	.	29	17	53	43	3	55	Determine solutions of polynomial and rational equations
.	.	.	51	9	41	79	5	16	Implement remainder and factor theorems for polynomials
.	.	.	44	8	48	80	4	17	Apply properties of logarithmic and exponential functions
43	3	54	17	30	53	43	2	55	Find solutions to systems of linear equations
74	3	23	.	.	.	.	.	.	Solve problems using equations of parabolas and circles
.	.	.	44	11	45	79	4	17	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
.	.	.	75	4	21	91	3	6	Solve problems using parametric equations
59	4	37	33	16	52	77	3	20	Transform functions algebraically
.	.	.	72	2	25	92	2	7	Find the limit of an expression
5	5	89	10	30	60	18	9	73	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**
									Graphical Representations
10	47	43	34	38	28	18	24	58	Comprehend the concept of length on the number line
5	47	48	.	.	.	.	.	.	Locate points on the number line and in the first quandrant
.	.	.	38	39	23	13	22	64	Locate points on the number line
2	36	62	23	45	31	22	13	65	Locate points in the coordinate plane
17	6	77	11	43	46	26	8	67	Exhibit knowledge of slope
22	5	73	11	41	48	27	5	67	Find the slope of a line
13	11	76	26	38	36	26	12	62	Identify graphs on a number line
20	5	74	21	37	42	30	7	63	Match linear graphs with their equations
24	8	68	12	28	60	31	7	62	Use properties of parallel and perpendicular lines
40	4	56	21	28	51	46	5	50	Solve systems of equations and inequalities graphically
72	5	23	.	.	.	.	.	.	Recognize special characteristics of parabolas and circles
.	.	.	43	12	45	81	5	15	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
18	8	74	9	23	68	34	10	56	Interpret and use information from graphs in the coordinate plane
34	7	58	17	19	64	49	9	42	Identify characteristics of graphs based on a set of conditions or on a general equation
.	.	.	43	8	49	81	5	14	Understand the properties of graphs of rational functions (e.g., asymptotes)
52	7	40	19	32	49	61	9	30	Find midpoints
43	7	50	16	32	52	56	8	36	Use the distance formula
.	.	.	48	8	44	78	6	16	Work with discontinuous graphs and piecewise-defined functions
8	10	82	6	30	64	22	12	67	**GRAPHICAL REPRESENTATIONS as an overall topic**
									Properties of Plane Figures
25	18	57	54	17	29	69	9	22	Find the measure of an angle using properties of parallel lines
21	21	58	.	.	.	.	.	.	Exhibit some knowledge of angles associated with parallel lines
13	23	64	39	26	34	39	22	38	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
18	8	73	17	35	47	29	13	58	Use the Pythagorean theorem
25	27	48	51	20	29	68	13	19	Apply properties of lines, segments, and rays
30	19	51	50	20	30	69	13	18	Apply properties of special quadrilaterals
34	14	52	37	23	40	64	13	23	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
69	8	23	47	17	36	85	6	10	Use relationships among angles, arcs, and distances in a circle
81	7	12	59	12	29	90	3	7	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
76	9	15	61	12	28	90	4	6	Prove results by mathematical induction
23	21	56	41	27	32	59	22	18	**PROPERTIES OF PLANE FIGURES as an overall topic**

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Table F.2

How Course Content Topics Are Taught
Mathematics *(continued)*

MS %			HS %			REM %			
1	2	3	1	2	3	1	2	3	Topics and Skills
									Measurement
6	36	59	27	38	35	14	24	62	Compute the area and perimeter of triangles and rectangles
32	23	45	.	.	.	.	.	.	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
19	23	58	41	25	34	44	15	41	Compute the perimeter of composite geometric figures with unknown side lengths
11	24	65	34	32	35	34	19	47	Compute the area and circumference of circles after identifying necessary information
11	25	65	39	26	35	39	18	44	Compute the area and perimeter of polygons with known side lengths
20	14	66	40	25	35	57	14	29	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
33	14	53	46	22	32	63	9	28	Compute the area and volume of composite geometric figures
11	17	72	27	37	36	37	20	44	Use geometric formulas
14	41	46	49	27	25	68	16	16	Understand how to read measurement tools (e.g., rulers and protractors)
19	17	64	42	22	35	75	10	14	Use scale factors to determine the magnitude of a size change
7	23	70	33	33	33	34	29	37	**MEASUREMENT as an overall topic**
									Probability, Statitics, and Data Analysis
3	29	68	24	34	42	26	20	54	Read and interpret graphs, charts, and other data representations
10	22	68	34	28	38	54	13	34	Manipulate data from tables and graphs
6	24	70	28	31	41	35	17	48	Perform computations on data from tables and graphs
7	23	71	45	22	33	67	8	24	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
68	9	23	69	7	24	93	2	5	Exhibit knowledge of correlation, variance, and standard deviation of data
6	41	53	46	30	25	51	14	35	Find the median and mode
10	26	64	42	22	36	82	5	13	Determine the probability of a simple event
34	15	51	.	.	.	.	.	.	Use the relationship between the probability of an event and the probability of its complement
31	13	56	56	12	32	91	3	6	Determine the probability of mutually exclusive, dependent, and independent events
26	19	55	56	16	28	85	2	13	Exhibit knowledge of counting techniques
.	.	.	61	7	31	93	1	6	Exhibit knowledge of combinations, permutations, and the binomial theorem
7	45	48	39	38	24	27	21	53	Calculate the average of a list of numbers
21	20	59	52	25	23	57	10	33	Calculate a missing data value, given the average and all the missing data values but one
11	35	54	.	.	.	.	.	.	Calculate the average, given the number of data values and the sum of the data values
32	20	48	61	19	20	80	6	14	Calculate the average, given the frequency counts of all the data values
73	9	18	71	14	15	76	5	19	Calculate or use a weighted average
6	26	68	45	25	30	60	20	20	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
									Functions
23	5	73	19	21	60	45	5	50	Understand the concept of function
40	6	53	.	.	.	.	.	.	Use function notation
40	5	55	.	.	.	.	.	.	Find the domain and range of functions
.	.	.	25	14	61	51	4	44	Find domain, range, and inverses of functions
30	4	67	19	25	55	45	3	52	Evaluate linear functions based on function notation
66	2	32	26	18	56	53	4	43	Evaluate quadratic functions based on function notation
75	3	22	35	13	52	63	4	34	Evaluate polynomial functions based on function notation
86	2	12	43	11	47	80	3	17	Evaluate composite functions based on function notation
78	2	19	31	16	53	86	4	10	Apply basic trigonometric ratios to solve right-triangle problems
84	2	13	39	10	50	92	2	6	Use trigonometric concepts and basic identities to solve problems
.	.	.	52	9	39	94	1	5	Use the law of sines and law of cosines
.	.	.	66	8	26	94	2	4	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
.	.	.	63	8	29	93	2	5	Use radian measure
96	1	3	69	7	25	94	2	4	Exhibit knowledge of vectors in a plane
44	12	44	24	18	57	61	9	30	**FUNCTIONS as an overall topic**

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Table F.3a

How Course Content Topics Are Taught
Middle School Mathematics

(N = 101) 7th-grade math			(N = 97) 8th-grade math			(N = 72) Pre-Algebra			(N = 65) Algebra			
1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
												Process Skills
11	42	47	14	50	36	13	53	34	11	57	32	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
4	42	54	3	54	43	9	61	30	8	69	23	Estimate a reasonable result without using a calculator
14	29	57	13	44	43	24	33	43	27	44	30	Demonstrate concepts using manipulatives
2	32	66	5	29	65	4	33	63	8	42	50	Demonstrate concepts using pictorial representations
0	9	91	1	7	92	1	6	93	0	8	92	Solve problems posed in real-world settings and interpret the solutions
7	41	51	14	40	46	10	43	47	6	43	51	Recognize when essential information is missing
1	16	83	0	11	89	1	6	93	0	6	94	Plan and carry out a strategy for solving multistep problems
7	45	48	5	31	64	6	29	65	2	27	71	Recognize generalizations of mathematical ideas
0	15	85	1	15	84	1	13	86	0	19	81	Recognize and use patterns to solve problems
5	15	80	2	18	80	1	10	89	2	16	83	Apply mathematical ideas to new contexts
10	15	75	12	24	64	13	16	71	8	24	68	Formulate new patterns or structures
14	13	73	15	26	60	10	13	76	8	17	75	Solve several problems representing different aspects/components of one larger problem or scenario
33	19	47	35	14	52	33	26	41	14	23	63	Understand roles of definitions, proof, and counterexamples
2	26	72	2	25	73	0	36	64	0	27	73	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
53	18	29	35	16	49	36	14	49	21	32	48	Recall theorems and more complex formulas when needed to solve a problem
49	15	36	43	9	48	41	7	52	32	29	40	Apply theorems to solve a problem
88	6	6	80	13	7	85	11	4	74	16	10	Construct and/or critique proofs, either informal or formal
10	49	41	21	47	32	16	47	37	30	42	28	Perform basic operations with a calculator
71	10	19	71	11	19	70	10	20	40	19	41	Use the statistical capabilities of a calculator
71	8	21	60	4	36	71	7	21	25	13	63	Use the graphical capabilities of a calculator
69	14	17	66	12	22	64	16	20	38	14	48	Use the symbolic algebra capabilities of a calculator
80	7	13	81	11	8	72	18	10	66	20	14	Use spreadsheets
74	12	14	81	8	11	70	17	13	86	13	2	Use dynamic geometry
9	42	49	4	49	47	3	40	57	8	47	45	Solve routine problems quickly
25	34	41	26	34	40	23	32	45	18	42	40	Solve novel problems quickly
0	20	80	1	20	79	1	26	73	0	31	69	Use mathematical symbols correctly
11	34	55	21	21	57	19	24	57	16	32	52	Understand new material from reading a textbook
15	26	59	23	25	52	20	17	62	8	38	54	Work in a self-directed group
4	18	77	10	20	70	4	22	73	10	30	60	**PROCESS SKILLS as an overall topic**
												Basic Operations and Applications
0	16	84	1	37	62	0	33	67	9	55	35	Perform addition, subtraction, multiplication, and division on signed rational numbers
1	53	46	9	59	33	7	55	38	25	51	25	Perform one-step computations with whole numbers and decimals
1	6	92	4	20	76	0	14	86	2	51	48	Solve problems using ratios and proportions
2	12	86	3	20	76	3	17	80	3	58	38	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
10	30	60	9	41	51	4	39	57	12	58	29	Convert units of measure
4	51	45	5	50	45	12	48	41	18	52	29	Solve routine one-step arithmetic problems
3	24	73	4	29	67	6	35	59	11	40	49	Solve routine two- or three-step arithmetic problems
15	28	57	10	16	74	12	20	68	5	42	53	Solve nonroutine two- or three-step arithmetic problems
13	15	72	9	24	67	4	22	74	9	51	40	Solve multistep arithmetic problems that involve planning or converting units of measure
9	2	89	11	11	78	1	16	83	3	40	57	Solve word problems containing several rates, proportions, or percentages
1	20	79	4	29	67	0	30	70	11	48	41	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**

Note:
N = Number of respondents
Missing classes did not have a high enough N-count to include.
1 = Not taught in course
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Table F.3a

How Course Content Topics Are Taught
Middle School Mathematics *(continued)*

(N = 101) 7th-grade math			(N = 97) 8th-grade math			(N = 72) Pre-Algebra			(N = 65) Algebra			
1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
												Numbers: Concepts and Properties
16	73	11	32	56	12	25	65	10	59	30	11	Identify a digit's place
5	62	32	11	68	22	7	68	25	31	53	16	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
1	43	56	9	45	46	6	48	46	28	61	11	Order fractions
8	70	23	14	65	22	15	59	26	39	50	11	Recognize one-digit factors of a number
4	58	38	15	53	32	9	49	42	19	61	20	Find and use the least common multiple
1	56	43	8	57	35	3	62	35	20	64	16	Recognize equivalent fractions and fractions in lowest terms
7	4	89	0	12	88	1	13	86	0	39	61	Perform computations with squares and square roots of numbers
48	5	47	36	8	57	32	14	54	14	25	61	Perform computations with cubes and cube roots of numbers
18	9	73	9	8	84	6	12	83	0	13	88	Apply rules of exponents
81	14	5	78	13	9	84	10	6	45	9	45	Perform matrix addition and multiplication
13	12	75	16	15	69	19	19	62	19	28	53	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
68	13	19	63	11	27	63	16	21	29	22	49	Find union and intersection of sets
15	10	75	7	13	80	6	14	80	3	19	78	Apply properties of rational and irrational numbers
.	.	.	.	.	.	.	.	.	.	.	.	Exhibit knowledge of complex numbers
.	.	.	.	.	.	.	.	.	.	.	.	Apply properties of complex numbers
3	26	71	3	39	57	3	29	68	6	36	58	Apply number properties involving multiples and factors
20	12	68	2	17	81	1	13	86	3	44	53	Use scientific notation
.	.	.	.	.	.	.	.	.	.	.	.	Determine when an expression is undefined
.	.	.	.	.	.	.	.	.	.	.	.	Exhibit knowledge of logarithms and geometric sequences
0	16	84	3	28	68	0	22	78	3	43	54	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**
												Expressions, Equations, and Inequalities
2	5	93	0	14	86	0	10	90	2	21	78	Evaluate algebraic expressions by substituting integers for unknown quantities
2	30	68	2	26	72	0	40	60	5	44	51	Exhibit knowledge of basic expressions
11	4	85	4	14	82	0	10	90	2	22	76	Add and subtract simple algebraic expressions
17	9	74	3	9	88	0	7	93	0	22	78	Combine like terms
14	5	81	3	13	84	1	10	88	0	25	75	Solve routine first-degree equations
17	2	81	1	7	91	4	9	87	0	8	92	Solve linear equations and inequalities in one variable
0	13	87	1	21	78	1	16	83	3	29	68	Substitute whole numbers for unknown quantities
6	10	84	2	18	80	3	14	83	0	21	79	Perform word-to-symbol translations
3	3	94	1	8	91	0	7	93	0	11	89	Write expressions, equations, or inequalities for common settings
3	3	94	2	18	80	0	11	89	2	32	67	Solve one-step equations having integer or decimal values
84	5	11	51	1	48	50	4	46	3	3	94	Multiply two binomials
47	5	48	36	8	56	30	7	63	3	11	86	Solve absolute value equations and inequalities
82	3	15	44	4	52	43	7	49	5	2	94	Add, subtract, and multiply polynomials
98	1	1	64	2	34	86	1	13	5	3	92	Factor quadratics
96	1	3	66	1	33	86	4	10	5	5	90	Solve quadratic equations
91	1	8	58	4	38	61	1	38	11	6	82	Apply properties of exponential functions
.	.	.	.	.	.	.	.	.	.	.	.	Solve quadratic inequalities
.	.	.	.	.	.	.	.	.	.	.	.	Use the discriminant
.	.	.	.	.	.	.	.	.	.	.	.	Determine solutions of polynomial and rational equations
.	.	.	.	.	.	.	.	.	.	.	.	Implement remainder and factor theorems for polynomials
.	.	.	.	.	.	.	.	.	.	.	.	Apply properties of logarithmic and exponential functions
77	3	20	32	3	65	49	1	49	3	3	94	Find solutions to systems of linear equations
93	3	4	81	3	16	87	0	13	30	6	63	Solve problems using equations of parabolas and circles
.	.	.	.	.	.	.	.	.	.	.	.	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
.	.	.	.	.	.	.	.	.	.	.	.	Solve problems using parametric equations
85	3	12	61	5	34	76	3	21	6	8	86	Transform functions algebraically
.	.	.	.	.	.	.	.	.	.	.	.	Find the limit of an expression
11	11	78	1	1	98	0	6	94	0	2	98	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**

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Table F.3a

How Course Content Topics Are Taught
Middle School Mathematics *(continued)*

(N = 101) 7th-grade math			(N = 97) 8th-grade math			(N = 72) Pre-Algebra			(N = 65) Algebra			
1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
												Graphical Representations
5	45	49	13	52	36	9	53	39	14	54	32	Comprehend the concept of length on the number line
1	46	53	3	49	48	0	53	47	13	49	38	Locate points on the number line and in the first quandrant
.	.	.	.	.	.	.	.	.	.	.	.	Locate points on the number line
1	18	81	1	48	51	0	37	63	5	46	49	Locate points in the coordinate plane
37	9	55	6	4	89	11	4	84	0	10	90	Exhibit knowledge of slope
52	5	43	8	3	88	14	3	83	0	8	92	Find the slope of a line
24	7	68	12	12	77	7	13	80	2	17	81	Identify graphs on a number line
37	7	55	14	5	81	17	4	79	0	5	95	Match linear graphs with their equations
35	9	56	23	9	67	36	1	63	2	6	92	Use properties of parallel and perpendicular lines
74	2	24	34	2	64	43	6	51	2	5	94	Solve systems of equations and inequalities graphically
91	5	4	76	5	19	89	1	10	30	6	63	Recognize special characteristics of parabolas and circles
.	.	.	.	.	.	.	.	.	.	.	.	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
28	5	67	9	13	79	33	6	61	0	6	94	Interpret and use information from graphs in the coordinate plane
54	6	39	32	5	63	40	10	50	0	5	95	Identify characteristics of graphs based on a set of conditions or on a general equation
.	.	.	.	.	.	.	.	.	.	.	.	Understand the properties of graphs of rational functions (e.g., asymptotes)
69	8	22	60	4	36	50	6	44	27	8	65	Find midpoints
56	5	39	53	4	43	43	9	48	21	8	71	Use the distance formula
.	.	.	.	.	.	.	.	.	.	.	.	Work with discontinuous graphs and piecewise-defined functions
14	15	72	6	4	89	6	11	83	0	3	97	**GRAPHICAL REPRESENTATIONS as an overall topic**
												Properties of Plane Figures
26	11	64	20	15	65	16	12	72	36	41	23	Find the measure of an angle using properties of parallel lines
20	15	65	20	15	65	14	16	70	29	41	30	Exhibit some knowledge of angles associated with parallel lines
11	15	74	9	20	71	3	23	74	25	47	28	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
38	5	57	2	4	94	16	4	80	5	23	72	Use the Pythagorean theorem
20	21	59	24	30	46	19	29	52	41	33	25	Apply properties of lines, segments, and rays
20	14	66	28	20	52	23	17	60	45	31	23	Apply properties of special quadrilaterals
33	7	60	32	14	54	30	16	54	44	27	30	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
66	6	27	69	6	25	75	7	17	69	17	14	Use relationships among angles, arcs, and distances in a circle
89	2	8	84	6	10	87	3	10	66	14	20	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
87	4	9	77	11	12	77	10	13	66	11	23	Prove results by mathematical induction
19	12	69	16	18	66	19	23	58	35	40	25	**PROPERTIES OF PLANE FIGURES as an overall topic**
												Measurement
1	32	67	6	35	59	4	34	61	11	50	39	Compute the area and perimeter of triangles and rectangles
25	16	59	30	26	45	29	21	50	39	41	20	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
18	16	66	18	22	60	14	17	69	17	45	38	Compute the perimeter of composite geometric figures with unknown side lengths
3	15	82	9	24	67	6	19	76	25	49	25	Compute the area and circumference of circles after identifying necessary information
6	16	78	10	27	64	7	19	74	16	48	36	Compute the area and perimeter of polygons with known side lengths
21	5	74	16	6	78	10	6	84	32	38	30	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
43	8	48	27	10	64	20	9	71	37	32	32	Compute the area and volume of composite geometric figures
3	11	86	9	11	81	11	7	81	22	44	33	Use geometric formulas
4	32	64	10	48	43	10	47	43	38	48	14	Understand how to read measurement tools (e.g., rulers and protractors)
11	2	87	13	18	69	20	21	59	31	31	38	Use scale factors to determine the magnitude of a size change
0	8	92	7	21	72	5	13	83	16	58	26	**MEASUREMENT as an overall topic**

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Table F.3a

How Course Content Topics Are Taught
Middle School Mathematics *(continued)*

(N = 101) 7th-grade math			(N = 97) 8th-grade math			(N = 72) Pre-Algebra			(N = 65) Algebra			
1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
												Probability, Statitics, and Data Analysis
0	18	82	2	34	63	3	41	56	6	36	58	Read and interpret graphs, charts, and other data representations
11	6	83	4	28	67	10	26	64	10	40	51	Manipulate data from tables and graphs
3	13	84	5	28	67	4	30	66	8	38	55	Perform computations on data from tables and graphs
2	13	85	10	21	70	4	27	69	9	41	50	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
82	4	14	64	8	28	74	9	17	51	19	30	Exhibit knowledge of correlation, variance, and standard deviation of data
0	34	66	8	46	46	0	44	56	14	53	33	Find the median and mode
7	11	82	11	24	66	3	26	71	16	53	31	Determine the probability of a simple event
41	6	53	28	12	60	26	11	63	37	37	27	Use the relationship between the probability of an event and the probability of its complement
37	7	56	24	8	69	23	9	69	32	33	35	Determine the probability of mutually exclusive, dependent, and independent events
26	16	58	24	17	59	26	9	66	29	33	38	Exhibit knowledge of counting techniques
.	.	.	.	.	.	.	.	.	.	.	.	Exhibit knowledge of combinations, permutations, and the binomial theorem
0	44	56	9	45	46	1	44	54	16	62	22	Calculate the average of a list of numbers
23	7	69	22	22	57	14	16	70	19	44	37	Calculate a missing data value, given the average and all the missing data values but one
4	29	67	15	38	47	6	30	64	16	56	29	Calculate the average, given the number of data values and the sum of the data values
36	10	54	32	19	48	29	16	56	30	40	30	Calculate the average, given the frequency counts of all the data values
83	5	12	78	3	18	67	13	20	60	17	22	Calculate or use a weighted average
1	11	88	10	19	71	0	29	71	11	52	37	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
												Functions
30	5	65	16	4	80	26	3	71	5	5	91	Understand the concept of function
59	7	33	36	6	57	43	4	53	9	6	84	Use function notation
65	1	34	39	1	60	31	7	61	6	11	83	Find the domain and range of functions
.	.	.	.	.	.	.	.	.	.	.	.	Find domain, range, and inverses of functions
46	2	52	20	4	75	33	4	63	5	5	91	Evaluate linear functions based on function notation
95	1	4	59	2	39	85	3	13	16	2	83	Evaluate quadratic functions based on function notation
97	2	1	80	1	18	85	7	8	33	3	64	Evaluate polynomial functions based on function notation
99	0	1	91	1	8	93	4	3	59	3	38	Evaluate composite functions based on function notation
89	3	7	80	2	18	70	1	28	70	2	29	Apply basic trigonometric ratios to solve right-triangle problems
96	2	2	84	1	15	82	3	15	75	2	24	Use trigonometric concepts and basic identities to solve problems
.	.	.	.	.	.	.	.	.	.	.	.	Use the law of sines and law of cosines
.	.	.	.	.	.	.	.	.	.	.	.	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
.	.	.	.	.	.	.	.	.	.	.	.	Use radian measure
99	1	0	97	0	3	99	0	1	89	2	10	Exhibit knowledge of vectors in a plane
62	5	33	43	14	43	47	15	38	10	15	75	**FUNCTIONS as an overall topic**

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Table F.3b

How Course Content Topics Are Taught
High School Mathematics

(N = 110) Algebra 1			(N = 187) Algebra 2			(N = 144) Geometry			(N = 88) Pre-Calculus			(N = 52) Calculus			
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
															Process Skills
11	51	38	20	44	36	17	47	36	17	47	36	8	41	51	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
10	56	34	17	58	25	13	58	29	20	53	28	17	40	42	Estimate a reasonable result without using a calculator
35	31	35	59	24	16	18	31	51	63	19	19	52	25	23	Demonstrate concepts using manipulatives
7	41	52	11	38	50	5	13	83	6	28	66	6	25	69	Demonstrate concepts using pictorial representations
1	7	92	0	11	89	2	14	84	0	3	97	0	4	96	Solve problems posed in real-world settings and interpret the solutions
15	35	50	16	35	49	3	35	62	20	36	45	15	33	52	Recognize when essential information is missing
0	6	94	2	10	88	1	17	82	1	14	85	0	12	88	Plan and carry out a strategy for solving multistep problems
5	28	68	5	20	75	3	28	68	7	23	70	0	37	63	Recognize generalizations of mathematical ideas
1	16	83	1	23	76	1	20	79	3	25	71	8	19	73	Recognize and use patterns to solve problems
7	12	81	4	14	82	1	13	85	2	13	85	0	10	90	Apply mathematical ideas to new contexts
19	21	61	13	24	63	8	23	69	20	21	59	10	19	71	Formulate new patterns or structures
10	14	75	9	16	76	9	21	71	6	14	80	6	13	81	Solve several problems representing different aspects/components of one larger problem or scenario
34	17	50	23	37	40	0	4	97	11	36	53	2	33	65	Understand roles of definitions, proof, and counterexamples
1	19	81	1	33	66	3	28	69	6	53	41	4	48	48	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
37	13	50	7	29	64	1	6	93	3	40	56	0	35	65	Recall theorems and more complex formulas when needed to solve a problem
45	11	44	18	30	51	1	1	99	1	26	72	2	10	88	Apply theorems to solve a problem
83	7	10	68	19	13	6	6	88	40	23	37	31	40	29	Construct and/or critique proofs, either informal or formal
11	38	51	16	38	46	22	50	28	34	39	26	35	37	29	Perform basic operations with a calculator
63	6	31	28	10	62	72	17	10	33	23	44	44	40	15	Use the statistical capabilities of a calculator
40	6	55	9	5	86	58	22	20	6	18	76	0	17	83	Use the graphical capabilities of a calculator
51	9	40	47	11	42	60	26	14	44	25	31	27	23	50	Use the symbolic algebra capabilities of a calculator
86	6	7	88	8	5	92	6	1	86	11	2	81	13	6	Use spreadsheets
89	8	4	85	10	5	48	15	37	71	20	9	61	16	24	Use dynamic geometry
3	37	60	7	39	54	9	52	39	16	49	34	17	56	27	Solve routine problems quickly
22	28	50	21	36	43	22	39	40	17	43	40	15	50	35	Solve novel problems quickly
0	16	84	1	20	79	1	15	85	9	22	69	0	23	77	Use mathematical symbols correctly
16	23	61	16	33	52	13	31	56	20	36	45	6	29	65	Understand new material from reading a textbook
19	22	60	23	32	45	20	37	43	23	30	47	13	37	50	Work in a self-directed group
8	17	75	5	34	61	10	23	67	5	30	65	6	27	67	**PROCESS SKILLS as an overall topic**
															Basic Operations and Applications
3	39	58	17	49	34	30	53	17	49	42	9	77	19	4	Perform addition, subtraction, multiplication, and division on signed rational numbers
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Perform one-step computations with whole numbers and decimals
0	20	80	9	46	45	1	20	79	35	50	15	62	29	10	Solve problems using ratios and proportions
4	19	77	18	53	29	48	44	8	43	43	14	81	15	4	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
22	29	49	32	47	21	11	59	30	27	46	27	58	35	8	Convert units of measure
9	32	58	29	48	23	31	53	15	69	26	6	83	15	2	Solve routine one-step arithmetic problems
6	24	70	14	45	41	21	54	25	47	40	14	67	27	6	Solve routine two- or three-step arithmetic problems
5	20	75	11	32	58	20	49	31	31	42	27	54	35	12	Solve nonroutine two- or three-step arithmetic problems
18	22	60	22	39	40	16	48	36	33	34	33	46	44	10	Solve multistep arithmetic problems that involve planning or converting units of measure
7	12	81	15	39	46	20	42	38	26	45	29	40	37	23	Solve word problems containing several rates, proportions, or percentages
3	26	71	10	51	39	15	63	22	38	47	15	62	33	6	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**

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Table F.3b

How Course Content Topics Are Taught
High School Mathematics *(continued)*

(N = 110) Algebra 1			(N = 187) Algebra 2			(N = 144) Geometry			(N = 88) Pre-Calculus			(N = 52) Calculus			
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
															Numbers: Concepts and Properties
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Identify a digit's place
8	58	34	22	55	23	31	59	10	55	39	6	77	15	8	Exhibit knowledge of elementary number concepts (e.g., rounding, decimal ordering, pattern identification, absolute value, primes, and greatest common factor)
14	51	35	45	44	11	53	42	6	71	26	2	87	10	4	Order fractions
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Recognize one-digit factors of a number
13	47	40	15	58	27	52	40	8	46	47	7	79	15	6	Find and use the least common multiple
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Recognize equivalent fractions and fractions in lowest terms
1	7	92	2	30	69	3	31	66	14	61	25	54	38	8	Perform computations with squares and square roots of numbers
33	14	53	2	17	81	40	28	33	13	57	30	52	38	10	Perform computations with cubes and cube roots of numbers
4	2	94	0	14	86	29	59	12	2	54	44	29	52	19	Apply rules of exponents
55	4	41	24	5	71	85	5	10	33	24	43	79	13	8	Perform matrix addition and multiplication
40	11	49	23	7	70	49	21	31	14	12	74	50	27	23	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
50	18	32	38	27	35	51	26	22	38	40	22	67	29	4	Find union and intersection of sets
10	11	78	2	13	85	28	47	26	8	51	41	44	46	10	Apply properties of rational and irrational numbers
78	3	19	4	1	95	89	7	4	7	21	72	65	23	12	Exhibit knowledge of complex numbers
81	2	17	5	1	93	91	6	3	8	16	76	63	25	12	Apply properties of complex numbers
8	25	67	4	33	64	34	49	17	13	56	31	50	42	8	Apply number properties involving multiples and factors
9	22	69	24	52	25	53	41	6	40	46	0	63	31	6	Use scientific notation
13	7	80	2	13	85	45	38	17	6	25	69	25	35	40	Determine when an expression is undefined
92	1	7	11	2	86	76	14	10	0	3	97	12	50	38	Exhibit knowledge of logarithms and geometric sequences
6	13	81	2	8	90	28	60	12	3	42	55	41	51	8	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**
															Expressions, Equations, and Inequalities
0	9	91	8	46	45	14	65	21	37	48	15	58	35	8	Evaluate algebraic expressions by substituting integers for unknown quantities
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Exhibit knowledge of basic expressions
0	10	90	5	54	40	16	68	15	45	47	8	65	31	4	Add and subtract simple algebraic expressions
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Combine like terms
0	9	91	7	59	34	12	68	20	48	45	7	63	33	4	Solve routine first-degree equations
0	5	95	3	50	47	14	68	18	37	52	11	56	40	4	Solve linear equations and inequalities in one variable
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Substitute whole numbers for unknown quantities
1	8	91	5	42	53	13	44	43	30	44	26	37	37	27	Perform word-to-symbol translations
0	7	93	2	38	60	17	52	31	21	51	29	40	42	17	Write expressions, equations, or inequalities for common settings
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Solve one-step equations having integer or decimal values
7	2	92	0	36	64	30	60	10	23	62	15	46	48	6	Multiply two binomials
15	5	80	4	16	80	58	35	7	10	56	33	33	54	13	Solve absolute value equations and inequalities
7	1	93	1	21	77	35	57	8	21	59	21	44	50	6	Add, subtract, and multiply polynomials
16	1	83	1	15	84	37	54	8	10	60	30	40	54	6	Factor quadratics
18	3	79	0	9	91	36	52	11	3	60	37	31	60	10	Solve quadratic equations
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Apply properties of exponential functions
62	2	36	16	4	79	82	15	4	10	39	51	38	52	10	Solve quadratic inequalities
49	3	48	8	6	87	88	9	3	13	46	41	59	35	6	Use the discriminant
42	4	54	4	2	94	63	31	6	1	21	78	27	60	13	Determine solutions of polynomial and rational equations
84	1	15	18	2	80	93	5	2	6	10	84	33	58	10	Implement remainder and factor theorems for polynomials
83	1	16	11	1	88	93	4	3	0	7	93	15	48	37	Apply properties of logarithmic and exponential functions
5	1	94	2	16	83	33	53	14	9	47	44	35	56	10	Find solutions to systems of linear equations
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Solve problems using equations of parabolas and circles
77	1	22	25	3	71	62	17	21	7	9	84	25	52	23	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
94	1	5	77	3	20	94	2	4	37	0	63	27	25	48	Solve problems using parametric equations
50	5	45	13	5	82	62	26	13	2	15	83	25	52	23	Transform functions algebraically
94	1	5	76	2	23	96	1	2	33	2	64	2	8	90	Find the limit of an expression
5	3	92	1	6	94	26	66	9	2	32	66	13	67	19	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**

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Table F.3b

How Course Content Topics Are Taught
High School Mathematics *(continued)*

(N = 110) Algebra 1			(N = 187) Algebra 2			(N = 144) Geometry			(N = 88) Pre-Calculus			(N = 52) Calculus			
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
															Graphical Representations
11	39	50	35	49	16	6	39	55	71	23	6	77	21	2	Comprehend the concept of length on the number line
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Locate points on the number line and in the first quandrant
8	37	55	32	51	17	19	50	31	81	17	1	85	13	2	Locate points on the number line
2	31	67	19	58	23	3	53	44	57	38	5	77	19	4	Locate points in the coordinate plane
1	3	96	4	59	38	1	44	55	35	57	8	33	47	20	Exhibit knowledge of slope
1	2	97	4	55	40	3	41	56	28	63	9	35	37	27	Find the slope of a line
2	18	80	15	48	38	26	42	33	42	47	11	63	33	4	Identify graphs on a number line
1	4	95	9	44	47	25	45	30	38	49	13	54	38	8	Match linear graphs with their equations
8	4	88	3	38	59	0	7	93	19	64	17	35	52	13	Use properties of parallel and perpendicular lines
6	3	92	2	19	79	40	42	18	13	51	36	48	42	10	Solve systems of equations and inequalities graphically
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Recognize special characteristics of parabolas and circles
75	3	23	24	3	73	63	13	24	7	13	80	31	58	12	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
5	3	92	3	15	81	17	37	46	5	22	73	15	52	33	Interpret and use information from graphs in the coordinate plane
19	5	76	2	9	90	42	34	24	1	22	77	12	44	44	Identify characteristics of graphs based on a set of conditions or on a general equation
82	3	15	14	2	84	84	11	6	1	7	92	10	31	60	Understand the properties of graphs of rational functions (e.g., asymptotes)
31	3	66	13	47	40	1	9	90	17	63	20	44	52	4	Find midpoints
29	2	69	11	46	43	1	8	91	12	69	20	31	60	10	Use the distance formula
86	2	12	24	5	71	91	6	3	3	10	86	4	29	67	Work with discontinuous graphs and piecewise-defined functions
2	0	98	1	21	79	10	42	48	2	46	52	19	52	29	**GRAPHICAL REPRESENTATIONS as an overall topic**
															Properties of Plane Figures
84	8	8	68	23	9	0	1	99	49	47	5	85	13	2	Find the measure of an angle using properties of parallel lines
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Exhibit some knowledge of angles associated with parallel lines
67	18	15	49	37	14	0	1	99	23	60	16	63	31	6	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
20	16	64	19	52	29	0	3	97	12	71	17	38	56	6	Use the Pythagorean theorem
77	12	10	63	29	8	0	0	100	56	41	3	75	24	2	Apply properties of lines, segments, and rays
79	8	13	62	29	9	1	1	99	51	44	5	67	31	2	Apply properties of special quadrilaterals
80	7	13	49	31	20	0	0	100	8	53	38	37	52	12	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
91	2	8	67	21	13	1	1	98	15	42	43	52	37	12	Use relationships among angles, arcs, and distances in a circle
87	2	11	80	12	8	3	2	95	64	30	6	65	29	6	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
86	1	13	79	15	6	18	6	76	52	19	29	63	21	15	Prove results by mathematical induction
73	14	12	56	34	10	0	0	100	22	62	16	47	51	2	**PROPERTIES OF PLANE FIGURES as an overall topic**
															Measurement
17	42	42	37	52	11	0	13	87	40	47	14	52	40	8	Compute the area and perimeter of triangles and rectangles
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
39	24	38	55	34	12	3	10	87	56	34	10	62	31	8	Compute the perimeter of composite geometric figures with unknown side lengths
40	30	30	43	43	13	0	8	92	43	44	13	44	48	8	Compute the area and circumference of circles after identifying necessary information
37	33	30	53	35	12	0	4	96	55	30	15	58	37	6	Compute the area and perimeter of polygons with known side lengths
55	21	25	49	39	13	0	4	96	57	34	9	35	40	25	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
61	18	21	57	32	11	4	4	92	63	29	8	40	44	15	Compute the area and volume of composite geometric figures
42	26	31	33	53	14	0	0	100	27	65	8	29	60	12	Use geometric formulas
46	35	19	62	32	7	1	23	75	68	29	2	90	8	2	Understand how to read measurement tools (e.g., rulers and protractors)
48	14	38	54	33	13	3	6	92	56	34	10	62	33	6	Use scale factors to determine the magnitude of a size change
35	35	31	44	45	11	0	4	96	46	50	4	44	52	4	**MEASUREMENT as an overall topic**

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Missing classes did not have a high enough N-count to include.
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. = This item was not asked at this grade level.

Table F.3b

How Course Content Topics Are Taught
High School Mathematics *(continued)*

(N = 110) Algebra 1			(N = 187) Algebra 2			(N = 144) Geometry			(N = 88) Pre-Calculus			(N = 52) Calculus			
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Topics and Skills
															Probability, Statitics, and Data Analysis
7	23	70	15	40	45	41	40	18	31	33	36	37	35	29	Read and interpret graphs, charts, and other data representations
27	18	55	19	34	46	61	30	9	36	27	37	31	35	35	Manipulate data from tables and graphs
14	20	66	16	34	50	51	39	10	32	32	36	31	33	37	Perform computations on data from tables and graphs
22	16	62	33	28	39	67	23	10	51	25	24	77	15	8	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
74	6	20	52	7	40	94	5	1	58	11	31	87	10	4	Exhibit knowledge of correlation, variance, and standard deviation of data
13	32	54	33	39	28	67	27	6	54	35	12	90	4	6	Find the median and mode
20	17	63	34	24	42	53	27	20	40	31	29	87	8	6	Determine the probability of a simple event
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Use the relationship between the probability of an event and the probability of its complement
49	11	40	43	13	44	78	12	10	45	17	38	85	10	6	Determine the probability of mutually exclusive, dependent, and independent events
52	14	33	44	17	39	77	15	9	40	23	37	77	17	6	Exhibit knowledge of counting techniques
75	3	22	45	5	49	88	8	4	30	12	57	79	13	8	Exhibit knowledge of combinations, permutations, and the binomial theorem
12	37	50	29	45	26	49	42	9	54	38	8	79	17	4	Calculate the average of a list of numbers
32	14	53	36	38	26	70	26	4	64	21	14	85	13	2	Calculate a missing data value, given the average and all the missing data values but one
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Calculate the average, given the number of data values and the sum of the data values
53	10	37	46	31	23	80	16	4	62	21	17	88	8	4	Calculate the average, given the frequency counts of all the data values
68	6	27	64	21	15	87	11	2	61	23	17	88	8	4	Calculate or use a weighted average
27	19	54	30	31	38	69	27	4	46	24	30	76	18	6	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
															Functions
6	0	94	1	10	89	60	33	7	1	35	64	14	57	29	Understand the concept of function
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Use function notation
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Find the domain and range of functions
18	2	80	1	7	93	78	16	6	0	13	87	4	63	33	Find domain, range, and inverses of functions
8	0	92	1	19	80	54	34	12	6	37	57	20	59	22	Evaluate linear functions based on function notation
29	0	71	1	5	95	70	23	7	0	35	65	14	63	24	Evaluate quadratic functions based on function notation
60	1	39	3	3	94	84	11	5	0	19	81	8	65	27	Evaluate polynomial functions based on function notation
84	2	14	9	3	88	91	7	2	1	13	86	6	55	39	Evaluate composite functions based on function notation
74	5	21	39	18	43	4	1	94	1	26	73	16	63	22	Apply basic trigonometric ratios to solve right-triangle problems
85	3	12	49	9	42	22	5	73	1	5	94	6	61	33	Use trigonometric concepts and basic identities to solve problems
93	2	5	56	7	37	50	3	47	1	7	92	29	59	12	Use the law of sines and law of cosines
97	1	2	71	2	26	94	2	4	1	6	93	14	65	22	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
98	0	2	63	3	34	89	4	7	1	7	92	14	60	26	Use radian measure
99	0	1	85	5	9	60	6	33	17	6	77	47	31	22	Exhibit knowledge of vectors in a plane
38	7	56	7	10	83	54	28	18	2	5	93	6	67	27	**FUNCTIONS as an overall topic**

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Table F.4a

How Course Content Topics Are Taught
Middle School Reading

MS %			
1	2	3	**Topics and Skills**
			Content
12	16	71	Read/view and demonstrate understanding of poetry
22	23	55	Read/view and demonstrate understanding of drama
2	3	95	Read/view and demonstrate understanding of novels and short stories
34	25	41	Read/view and demonstrate understanding of nonfiction trade books
9	21	71	Read/view and demonstrate understanding of textbooks
30	21	49	Read/view and demonstrate understanding of research studies
20	34	46	Read/view and demonstrate understanding of primary sources
16	33	52	Read/view and demonstrate understanding of news and feature articles, editorials/opinion pieces
37	31	32	Read/view and demonstrate understanding of advertisements
51	29	20	Read/view and demonstrate understanding of film and television
31	30	40	Read/view and demonstrate understanding of multimedia presentations
26	35	39	Read/view and demonstrate understanding of functional text
16	46	38	Read/view and demonstrate understanding of graphs, charts, and diagrams
43	31	27	Read/view and demonstrate understanding of work-related texts
1	13	86	**CONTENT as an overall set of skills**
			Main Ideas and Author's Approach
0	9	91	Infer the main idea or purpose of a straightforward paragraph
2	10	88	Recognize a clear intent of an author or narrator
2	9	90	Determine the main idea or purpose of a complex paragraph
0	13	87	Identify the main idea or purpose of a straightforward paragraph
1	8	92	Determine the main idea, purpose, or theme of a text
2	10	87	Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used)
0	16	84	Summarize basic events and ideas in a text
0	7	93	**MAIN IDEAS AND AUTHOR'S APPROACH as an overall set of skills**
			Supporting Details
1	19	80	Locate important details stated in a text
2	38	59	Locate basic facts (e.g., names, dates, events) that are clearly stated in a text
2	20	78	Locate and interpret minor or subtly stated details in a text
2	38	59	Locate simple details at the sentence and paragraph level in a text
2	12	87	Make simple inferences about how details are used to support points made in a text (e.g., support for a claim)
3	16	81	Discern which details from different sections of a text support important points
7	16	77	Understand subtle or complex roles that details can play in a text
1	12	87	**SUPPORTING DETAILS as an overall set of skills**
			Relationships
5	41	54	Order simple sequences of events in a text
5	37	58	Determine when (e.g., first, last, before, after) or if an event occurred in a text
5	28	66	Order subtle or complex sequences of events in a text
3	29	68	Recognize clear cause-effect relationships described within a single sentence
1	19	80	Identify clear relationships between people, ideas, and so on in a text
4	14	82	Infer subtle or complex relationships between people, ideas, and so on in a text
2	23	75	Identify clear cause-effect relationships in a text
4	20	76	Infer subtle or complex cause-effect relationships in a text
1	18	80	**RELATIONSHIPS as an overall set of skills**
			Meanings of Words
1	18	81	Use context to determine the appropriate meaning of words and phrases
4	29	67	Understand the implication of a familiar word or phrase and of simple descriptive language
2	16	83	Distinguish between literal and figurative meanings of words and phrases in a text
1	20	79	Paraphrase concepts and ideas in a text
2	10	89	Understand literary devices in a text
0	9	91	**MEANINGS OF WORDS as an overall set of skills**
			Generalizations and Conclusions
1	21	78	Draw generalizations and conclusions about people, ideas, and so on in a text
1	28	71	Draw simple generalizations and conclusions about the main characters in a text
0	13	86	Draw generalizations and conclusions using details that support the main points of a text
1	18	82	Predict outcomes based on a text
2	22	76	Distinguish between fact, opinion, and reasoned judgment within a text
16	25	59	Identify stereotypes in a text
31	20	49	Identify logical fallacies in a text
10	20	70	Identify persuasive techniques in a text
17	17	65	Evaluate the range and quality of evidence used to support an argument in a text
8	17	75	Make connections between two or more texts
0	16	84	**GENERALIZATIONS AND CONCLUSIONS as an overall set of skills**

Note:
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Table F.4a

How Course Content Topics Are Taught
Middle School Reading *(continued)*

MS %			
1	2	3	**Topics and Skills**
			Evaluating Texts
12	31	57	Evaluate information in a text for relevance
14	27	59	Evaluate information in a text for fair and accurate treatment of differing points of view
14	22	64	Evaluate information in a text for persuasive techniques
13	27	60	Evaluate information in a text for credibility and appropriateness of sources of information
11	21	68	Evaluate information in a text for sufficiency of evidence in support of an argument or claim
32	30	38	Evaluate information in a text for internal consistency
16	27	56	Recognize how history and culture influence a text
12	31	57	**EVALUATING TEXTS as an overall set of skills**

Note:
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Table F.4b

How Course Content Topics Are Taught
High School Reading

Language Arts Courses			Social Studies Courses			
1	2	3	1	2	3	Topics and Skills
						Content
7	17	76	71	17	13	Read/view and demonstrate understanding of poetry
12	7	81	75	16	9	Read/view and demonstrate understanding of drama
2	5	94	63	21	16	Read/view and demonstrate understanding of novels and short stories
62	14	24	68	24	9	Read/view and demonstrate understanding of nonfiction trade books
13	21	66	1	7	92	Read/view and demonstrate understanding of textbooks
25	21	55	21	37	42	Read/view and demonstrate understanding of research studies
17	27	56	2	19	79	Read/view and demonstrate understanding of primary sources
23	33	44	8	32	60	Read/view and demonstrate understanding of news and feature articles, editorials/opinion pieces
57	24	19	39	37	24	Read/view and demonstrate understanding of advertisements
45	32	24	12	48	40	Read/view and demonstrate understanding of film and television
31	34	35	8	40	51	Read/view and demonstrate understanding of multimedia presentations
53	25	23	23	36	40	Read/view and demonstrate understanding of functional text
42	35	23	2	28	70	Read/view and demonstrate understanding of graphs, charts, and diagrams
61	22	17	46	29	25	Read/view and demonstrate understanding of work-related texts
3	16	82	2	19	79	**CONTENT as an overall set of skills**
						Main Ideas and Author's Approach
1	28	71	6	34	61	Infer the main idea or purpose of a straightforward paragraph
2	19	79	6	37	57	Determine the main idea or purpose of a complex paragraph
1	31	68	6	38	55	Identify the main idea or purpose of a straightforward paragraph
0	10	90	7	23	70	Determine the main idea, purpose, or theme of a text
0	10	89	13	33	54	Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used)
2	24	74	1	25	74	Summarize basic events and ideas in a text
0	10	90	3	36	61	**MAIN IDEAS AND AUTHOR'S APPROACH as an overall set of skills**
						Supporting Details
0	28	72	6	27	67	Locate important details stated in a text
1	22	77	10	51	39	Locate and interpret minor or subtly stated details in a text
6	40	54	17	39	45	Locate simple details at the sentence and paragraph level in a text
2	22	76	7	38	55	Make simple inferences about how details are used to support points made in a text (e.g., support for a claim)
2	20	78	10	38	52	Discern which details from different sections of a text support important points
4	18	78	19	40	41	Understand subtle or complex roles that details can play in a text
0	17	83	4	40	56	**SUPPORTING DETAILS as an overall set of skills**
						Relationships
12	43	45	12	33	55	Order simple sequences of events in a text
5	37	58	15	38	48	Order subtle or complex sequences of events in a text
2	27	72	3	25	72	Identify clear relationships between people, ideas, and so on in a text
1	19	80	4	36	60	Infer subtle or complex relationships between people, ideas, and so on in a text
2	27	71	1	18	80	Identify clear cause-effect relationships in a text
3	21	77	7	34	59	Infer subtle or complex cause-effect relationships in a text
0	21	79	2	28	69	**RELATIONSHIPS as an overall set of skills**
						Meaning of Words
4	28	68	8	35	57	Use context to determine the appropriate meaning of words and phrases
2	21	77	20	45	36	Distinguish between literal and figurative meanings of words and phrases in a text
1	25	74	4	36	60	Paraphrase concepts and ideas in a text
2	12	86	40	36	24	Understand literary devices in a text
1	14	85	4	38	58	**MEANINGS OF WORDS as an overall set of skills**
						Generalizations and Conclusions
2	31	67	1	26	73	Draw generalizations and conclusions about people, ideas, and so on in a text
1	23	76	3	28	69	Draw generalizations and conclusions using details that support the main points of a text
4	31	65	9	38	54	Predict outcomes based on a text
6	27	67	5	21	74	Distinguish between fact, opinion, and reasoned judgment within a text
8	34	58	13	35	51	Identify stereotypes in a text
14	23	62	21	33	46	Identify logical fallacies in a text
6	22	72	13	34	53	Identify persuasive techniques in a text
8	20	72	12	34	54	Evaluate the range and quality of evidence used to support an argument in a text
3	16	81	23	30	48	Make connections between two or more texts
1	20	80	3	30	67	**GENERALIZATIONS AND CONCLUSIONS as an overall set of skills**

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Table F.4b

How Course Content Topics Are Taught
High School Reading *(continued)*

Language Arts Courses			Social Studies Courses			
1	2	3	1	2	3	Topics and Skills
						Evaluating Texts
10	31	59	7	31	62	Evaluate information in a text for relevance
9	30	61	6	21	73	Evaluate information in a text for fair and accurate treatment of differing points of view
8	25	66	13	39	48	Evaluate information in a text for persuasive techniques
3	32	64	7	26	67	Evaluate information in a text for credibility and appropriateness of sources of information
4	24	73	8	28	64	Evaluate information in a text for sufficiency of evidence in support of an argument or claim
13	35	52	22	43	35	Evaluate information in a text for internal consistency
6	23	71	5	16	79	Recognize how history and culture influence a text
5	24	71	9	31	60	**EVALUATING TEXTS as an overall set of skills**

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Table F.5

How Course Content Topics Are Taught
Science

MS %			HS %			
1	2	3	1	2	3	Topics and Skills
						Interpretation of Data
2	37	61	.	.	.	Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)
25	32	43	20	34	46	Compare or combine data from one or more data presentations (e.g., categorize data from a table using a scale from another table)
8	30	63	6	25	69	Determine how the value of one variable changes as another variable changes in a data presentation
13	32	54	7	24	70	Identify and/or use a mathematical relationship between data
5	32	63	5	21	74	Analyze given information when presented with new information
21	36	43	12	36	51	Interpolate between data points in a table or graph
22	35	43	12	37	51	Extrapolate from data points in a table or graph
0	9	91	1	14	85	Understand basic scientific terminology
2	24	75	2	26	72	Translate information into a table, graph, or diagram
26	25	49	27	23	49	Apply statistical concepts and methods of data analysis to the results of an experiment
4	23	73	2	20	78	**INTERPRETATION OF DATA as an overall topic**
						Scientific Investigation
1	26	73	8	36	56	Identify a control in an experiment
1	25	74	7	33	60	Understand basic processes and designs of simple experiments (single control, 2–3 variables)
35	24	41	32	31	37	Understand the methods and tools used in an experiment featuring multiple controls and multiple variables
1	24	75	7	33	60	Understand simple experimental design (single control, 2–3 variables)
53	19	28	44	27	29	Understand complex experimental design (multiple controls and multiple variables)
13	26	61	13	32	55	Predict the results of an additional trial in an experiment
17	26	57	18	30	51	Determine the experimental conditions that would produce specified results
2	20	78	7	30	64	Determine the hypothesis for an experiment
13	29	58	11	27	63	Understand precision and accuracy issues
14	29	58	14	37	49	Identify similarities and differences between experiments
18	28	54	16	33	51	Evaluate the similarities and differences, or the strengths and weaknesses, of experiments
9	25	66	16	32	52	Predict how modifying the design of an experiment will affect results
5	14	80	15	22	63	Design and conduct an experiment
28	29	43	27	30	43	Identify an experiment that could be performed to enhance experimental results
2	15	83	4	25	71	**SCIENTIFIC INVESTIGATION as an overall topic**
						Evaluation of Models, Inferences, and Experimental Results
6	17	77	7	29	64	Identify a hypothesis, prediction, or conclusion that is supported by data presentations or models (i.e., scientific explanations)
6	18	76	7	30	63	Determine whether information (e.g., a data presentation or model) supports or contradicts a hypothesis, prediction, or conclusion, and why
23	32	45	21	37	42	Identify strengths and weaknesses in one or more models
20	32	49	19	37	44	Identify similarities and differences between models
32	32	37	25	33	42	Determine whether a model is supported or weakened by new information
27	30	43	19	33	48	Identify key issues or assumptions in a model
24	29	47	19	32	49	Use new information to make a prediction based on a model
18	20	63	13	24	63	Communicate the results of an experiment through writing a properly organized report
11	27	62	9	33	58	**EVALUATION OF MODELS, INFERENCES, AND EXPERIMENTAL RESULTS as an overall topic**
						Miscellaneous Science Topics
69	15	16	57	25	19	Familiarity with the term "experimental treatment"
21	23	56	16	35	49	Familiarity with the term "experimental variable"
8	21	71	8	34	58	Familiarity with the term "independent variable"
8	21	71	7	35	58	Familiarity with the term "dependent variable"
38	25	37	13	33	54	Familiarity with the term "directly proportional"
43	23	33	14	33	53	Familiarity with the term "inversely proportional"
1	18	81	3	25	73	Use metric units of measurement
40	34	26	47	34	20	Use English units of measurement
24	28	48	11	29	60	Convert a number expressed in one unit of measurement to a number expressed in another unit of measurement
67	14	18	29	20	51	Perform dimensional analysis
15	31	54	5	30	65	Read and interpret data plotted on a linear scale
70	13	16	58	19	23	Read and interpret data plotted on a log scale
						General Biology Topics
35	11	54	.	.	.	State the criteria for life and understand and be able to use organizational systems in biology (e.g., in taxonomy, in ecology)
47	11	42	.	.	.	Recognize the role of carbohydrates, lipids, proteins, and nucleic acids in a cell
.	.	.	1	7	92	Explain the criteria for life and understand and be able to use organizational systems in biology (e.g., in taxonomy, in ecology)
.	.	.	1	7	92	Recognize structure and state functions of carbohydrates, lipids, proteins, and nucleic acids
.	.	.	8	28	64	Describe pH, acidic, and basic
34	21	45	.	.	.	Use the pH scale
24	15	61	7	31	62	Describe a chemical reaction and recognize the parts of a chemical equation
47	16	37	3	7	90	Explain what enzymes are and how they function
70	9	22	3	7	90	Describe the structure and function of ATP
26	17	56	1	5	94	Describe photosynthesis and cellular respiration and state where in the cell these processes occur
.	.	.	36	28	36	Relate the laws of thermodynamics to organisms and their environment
35	15	50	1	5	94	Describe diffusion and osmosis

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Table F.5

How Course Content Topics Are Taught
Science *(continued)*

MS %			HS %			
1	2	3	1	2	3	Topics and Skills
						General Biology Topics *(continued)*
36	12	52	1	5	94	Describe the structure and function of cell organelles and the plasma membrane
42	13	45	2	4	94	Explain the phases of the cell cycle and how the cell cycle is regulated
40	11	49	1	3	96	Describe the difference between mitotic and meiotic division
49	10	41	1	3	95	Describe the processes of DNA replication, transcription, and translation
			1	4	96	Describe the structure and function of DNA, chromosomes, and the genetic code
			2	4	93	Describe the structure and function of RNA (e.g., mRNA, rRNA, tRNA)
30	10	60	2	6	93	Describe what a gene is, how genes are expressed, and how gene expression can be regulated
35	7	58	2	3	95	Use the principles of Mendelian genetics to predict the outcome of a genetic cross
.	.	.	1	3	96	Explain how meiosis results in the formation of gametes and relate the process of meiosis to the principles of Mendelian genetics
31	12	57	2	8	90	State the difference between sexual and asexual reproduction
36	16	48	7	8	85	Describe the process of evolution and state the evidence for evolution
.	.	.	5	8	88	State the biological definition of fitness, describe the importance of mutation in evolution, and explain how natural selection drives evolution
38	21	42	5	9	86	Define species and describe the process of speciation
74	8	18	16	18	66	Interpret a phylogenetic tree
.	.	.	55	13	32	Use the Hardy-Weinberg equation
37	18	46	8	8	84	Describe the major groups of organisms (e.g., bacteria, protists, fungi, plants, animals) and why they are important to Earth's ecosystems
51	14	36	11	9	80	Describe what viruses are and how they replicate
49	16	36	24	14	61	Compare vertebrates and invertebrates and list key features of fish, amphibians, reptiles, birds, and mammals
37	15	48	16	12	73	Describe the development of an animal from a single cell and the structure and function of the major organ systems
49	16	36	17	17	66	Compare the different types of biomes
41	15	44	9	10	81	Describe the biotic and abiotic factors in an ecosystem and the flow of energy and chemicals through an ecosystem
34	17	48	5	9	86	Define producers, consumers, and decomposers
39	20	41	6	11	83	Define biodiversity
.	.	.	1	4	95	**GENERAL BIOLOGY TOPICS as an overall topic**
						General Chemistry Topics
.	.	.	2	14	84	Know the Celsius and Kelvin temperature scales and how they are related
.	.	.	18	13	69	Understand the features of a generic heating curve
.	.	.	10	5	85	Understand and apply Charles's law and Boyle's law
.	.	.	23	9	68	Solve problems involving Graham's law and Dalton's law
.	.	.	9	4	87	Know and apply the ideal gas law and the kinetic theory to explain the behavior of gases
.	.	.	10	8	82	Describe how different factors affect the solubility of gases, liquids, and solids
.	.	.	10	4	86	Solve problems involving molality and molarity
62	12	26	6	6	88	Understand why substances can be polar or nonpolar and how polarity relates to solubility
.	.	.	1	13	87	Explain the differences between an element, an atom, a molecule, and a compound
20	14	66	0	8	92	Correctly use basic chemical symbols and formulas
.	.	.	1	5	94	Understand and apply the mole concept
21	10	69	1	17	83	Know the basic parts of an atom, the subatomic particles contained in each part, and the charge on each type of particle
.	.	.	1	9	90	Explain the differences between atomic mass, molar mass, mass number, and atomic number
.	.	.	1	9	91	Know that the nuclei of two different isotopes of an element will contain the same number of protons but a different number of neutrons
.	.	.	1	5	94	Describe the periodic trends and the properties of the elements in the most common groups of the periodic table
.	.	.	4	5	91	Generate electron configurations for different elements and their ions
.	.	.	1	7	92	Explain the difference between an ionic bond and a covalent bond
.	.	.	2	4	93	Use oxidation or valence numbers to predict chemical formulas of compounds
.	.	.	4	5	90	Represent the bonding in ionic compounds and covalent compounds using electron-dot structures
.	.	.	1	8	91	Balance a basic chemical equation
.	.	.	3	4	93	Solve stoichiometric problems involving chemical reactions
.	.	.	32	8	60	Interpret a potential energy diagram and describe the role of a catalyst in a chemical reaction
.	.	.	13	9	78	Compare different intermolecular forces that exist between atoms and molecules
.	.	.	36	7	57	Use change in Hf to determine whether a chemical reaction was endothermic or exothermic
.	.	.	41	4	55	Apply Le Chatelier's principle to predict how different factors will affect the equilibrium of a reversible reaction
.	.	.	58	6	35	Predict the composition of a solid/solution mixture using Ksp
.	.	.	23	8	68	Compare and apply the three major acid-base theories
.	.	.	14	6	79	Know the formulas and relative strengths of the most common acids and bases
.	.	.	50	7	43	Use Ka values to determine the composition of an aqueous solution of an acid or base
.	.	.	6	10	84	Determine whether a substance having a certain pH is acidic, basic, or neutral
.	.	.	46	5	48	Calculate the pH of a solution using given concentrations and Ka or pKa values
.	.	.	42	11	47	Explain why a buffer solution maintains a stable pH
.	.	.	42	5	53	Identify which species are oxidized and which are reduced in a redox reaction
.	.	.	53	5	43	Balance redox equations using oxidation numbers
.	.	.	70	5	26	Explain the parts of a basic electrochemical cell and calculate voltages for the cell
.	.	.	39	8	53	Use structural formulas to represent organic compounds
.	.	.	47	7	46	Use basic organic nomenclature to convert between the names and formulas of organic compounds
.	.	.	27	7	66	Describe the basic geometry of carbon single, double, and triple bonds
.	.	.	2	3	95	**GENERAL CHEMISTRY TOPICS as an overall topic**

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. = This item was not asked at this grade level.

Table F.5

How Course Content Topics Are Taught
Science *(continued)*

MS %			HS %			
1	2	3	1	2	3	Topics and Skills
						General Earth Science Topics
.	.	.	12	17	71	Find location and estimate distance on a map
.	.	.	8	8	84	Describe the properties that define a mineral
.	.	.	6	6	89	Compare the compositions and origins of sedimentary, igneous, and metamorphic rocks
35	13	52	7	12	81	Compare erosion and weathering
.	.	.	8	10	82	Identify the major agents of erosion and distinguish the two types of weathering
.	.	.	11	13	76	Understand how weathering is related to soil formation
.	.	.	7	10	83	Understand how and where sediment is deposited
.	.	.	7	7	86	Identify the layers of Earth's atmosphere
43	18	39	7	7	86	Compare weather and climate
.	.	.	14	10	76	Understand how relative humidity and dew point relate to cloud formation and precipitation
.	.	.	13	13	74	Describe the characteristics and causes of thunderstorms
.	.	.	14	12	74	Describe the characteristics and causes of tornadoes
.	.	.	12	14	75	Describe the characteristics and causes of hurricanes
.	.	.	28	18	54	Compare the chemistry of ocean water and fresh water
.	.	.	14	11	74	Understand the cause of tides
.	.	.	13	15	72	Understand how large-scale ocean currents contribute to climate
24	27	49	4	18	78	Understand how water moves through the water cycle
.	.	.	7	19	73	Identify the primary sources of fresh water (lakes, streams, groundwater, glaciers)
.	.	.	16	15	69	Describe the relationship between the water table and groundwater
40	9	50	2	7	90	Describe the three major types of tectonic plate boundaries
32	13	56	3	7	90	Understand the causes of plate movement
.	.	.	2	8	90	Understand how plate movement relates to earthquakes, volcanoes, and mountain building
.	.	.	9	19	72	Describe how radioactive materials are use to determine age
.	.	.	9	17	74	Understand how fossils are formed and what fossils tell us about the ages of rock layers
.	.	.	10	22	68	Identify renewable and nonrenewable resources
31	20	50	12	21	67	Describe types of renewable/alternative energy
.	.	.	16	27	57	Understand multiple ways to conserve and recycle resources
.	.	.	17	25	58	Identify types of air, soil, and water pollution
25	30	45	9	17	74	Understand the causes and effects of global warming
28	25	47	7	11	81	Understand the importance of the ozone layer
.	.	.	33	15	52	Describe the motions of Earth and the Moon and their implications for lunar phases, tides, and timekeeping
.	.	.	39	14	47	Describe the properties of the various solar system bodies (the Sun, planets, moons, asteroids, comets, meteoroids)
.	.	.	46	12	43	Describe and compare various theories of solar system formation
.	.	.	47	10	43	Describe the process of star formation and evolution
.	.	.	52	10	38	Describe the various types of galaxies, and their formation and evolution
.	.	.	41	11	47	Describe the large-scale structure of the universe, discuss the big bang theory, and describe the possible outcomes for the evolution of the universe
.	.	.	1	5	94	**GENERAL EARTH SCIENCE TOPICS as an overall topic**
						General Physics and Astronomy Topics
.	.	.	0	3	97	Calculate the displacement, speed, velocity, and acceleration of an object in one and two dimensions
.	.	.	1	3	96	Sketch position/time graphs and velocity/time graphs for objects undergoing simple types of motion
.	.	.	0	3	97	Apply Newton's three laws of motion to solve simple mechanics problems
.	.	.	2	3	95	Define momentum and describe momentum conservation
.	.	.	0	5	95	Define kinetic energy and potential energy
.	.	.	1	5	94	Define mechanical energy and describe simple scenarios in which mechanical energy is conserved or is not conserved
.	.	.	4	5	91	Write the formula describing Newton's law of gravitation
.	.	.	1	2	97	Solve problems involving free fall and motions on an inclined plane
.	.	.	2	2	96	Solve simple problems involving projectile motion, uniform circular motion, and circular orbits
.	.	.	11	8	81	Describe simple harmonic motion and give examples of systems in which simple harmonic motion is observed
.	.	.	1	3	96	Define work, state the work-energy theorem, and calculate the work done in simple physical situations
.	.	.	25	6	69	Relate torque to rotational motion
.	.	.	27	26	47	Distinguish among the Fahrenheit, Celsius, and Kelvin temperature scales and convert a temperature in any one of these scales to a temperature in either of the other two scales
.	.	.	40	14	46	Define the specific heat of a substance
.	.	.	37	19	45	Describe the heat transfer processes of convection, conduction, and radiation
.	.	.	53	16	31	Write the equation of state for an ideal gas and use the equation to solve problems involving transformations in ideal gases
.	.	.	9	7	84	Given wavelength and frequency of light or sound, calculate wave speed
.	.	.	11	12	77	Describe the electromagnetic spectrum in terms of energy, radiation type (gamma ray, X-ray, etc.), wavelength, and frequency
.	.	.	17	5	79	Given the angle of incidence of light on a plane mirror, predict angle of reflection
.	.	.	23	4	73	Using Snell's law, determine angle of refraction of light
.	.	.	25	4	71	For object imaged by mirror or thin lens, use ray tracing to determine position, size, and orientation of image
.	.	.	26	7	67	Sketch electric field lines emanating from point charge
.	.	.	22	3	75	Using Coulomb's law, determine the electric force between 2 point charges
.	.	.	18	2	80	Using Ohm's law, determine the voltage drop across a resistor
.	.	.	15	11	74	Explain the difference between an electrical conductor and an electrical insulator

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Table F.5

How Course Content Topics Are Taught
Science *(continued)*

MS %			HS %			
1	2	3	1	2	3	Topics and Skills
						General Physics and Astronomy Topics *(continued)*
.	.	.	22	10	67	Explain the difference between an AC circuit and a DC circuit
.	.	.	22	4	75	Calculate the power generated by an electrical current passing through a resistor
.	.	.	27	10	63	Explain how an electrical generator uses motion and magnetism to produce an electrical current
.	.	.	28	11	61	Draw lines of magnetic force emanating from a bar magnet
.	.	.	24	11	64	Describe qualitatively situations in which light behaves like a wave and situations in which light behaves like a particle
.	.	.	8	9	83	**GENERAL PHYSICS AND ASTRONOMY TOPICS as an overall topic**
						General Physical Science Topics
5	19	76	1	22	78	Explain the difference between mass, weight, density, and volume
11	16	73	.	.	.	Understand and apply the formula for density
9	28	63	.	.	.	Understand the Celsius scale and the significance of 0°C and 100°C in the scale.
14	19	67	1	13	86	Describe the physical properties and molecular models of solids, liquids, and gases
16	22	62	3	12	85	Understand what occurs when a substance melts, freezes, boils, sublimes, or condenses
36	16	48	.	.	.	Know that a liquid having a lower viscosity flows more easily than does a substance having a higher viscosity
35	13	52	.	.	.	Explain why a chemical or physical process is endothermic or exothermic
31	15	54	.	.	.	Explain the difference between a homogeneous mixture and a heterogeneous mixture
35	13	52	.	.	.	Identify the solute(s) and solvent when describing a solution
39	18	43	.	.	.	Understand that the concentration of a solution is amount of solute dissolved in a certain amount of solvent or solution
51	16	33	.	.	.	Know that an aqueous solution is a solution in which H2O is the solvent
16	10	73	.	.	.	Understand the distinctions between an element, an atom, a molecule, and a compound
43	15	43	.	.	.	Know that organic compounds contain carbon and that hydrocarbons contain only carbon and hydrogen
33	13	54	.	.	.	Identify basic features of a chemical equation (reactants, products, reaction arrow, coefficients)
45	9	46	.	.	.	Balance a simple chemical equation
51	14	35	.	.	.	Describe the role of a catalyst in a chemical reaction
41	13	46	.	.	.	Determine whether a solution is acidic, basic, or neutral when given its pH
40	9	51	.	.	.	Define displacement, speed, velocity, and acceleration, and, for an object moving in a straight line at a constant speed, plot a graph from a table of the displacement of the object versus time, and find the object's speed from the graph
32	10	58	.	.	.	State and describe Newton's three laws of motion, and give examples of physical situations that illustrate each law
39	10	51	.	.	.	Describe qualitatively Newton's law of gravitation, describe the acceleration due to gravity at Earth's surface for objects having different masses, and define weight
34	13	54	.	.	.	Define and distinguish between kinetic energy and potential energy, define mechanical energy, and describe situations in which mechanical energy is not conserved
47	9	44	.	.	.	Define wavelength, frequency, amplitude, and wave speed
53	13	35	.	.	.	Describe the Doppler effect and give examples of its occurrences and applications
48	13	39	.	.	.	List the names associated with the various types of electromagnetic radiation, and arrange them in order of increasing wavelength
33	21	46	.	.	.	Describe the interaction between opposite charges and between like charges
60	10	30	.	.	.	Define electrical current, voltage, and resistance
						General Earth/Space Science Topics
47	22	31	.	.	.	Describe the interactions between the poles of two magnets
43	28	29	.	.	.	Know how latitude and longitude are used to designate location
45	14	41	.	.	.	Describe the properties of a mineral and understand how minerals relate to rocks
41	13	46	.	.	.	Compare how sedimentary, igneous, and metamorphic rocks are formed
41	17	42	.	.	.	Know the layers of Earth's atmosphere
55	13	32	.	.	.	Know how relative humidity and dew point relate to cloud formation
52	13	36	.	.	.	Describe the characteristics and causes of thunderstorms, tornadoes, and hurricanes
36	11	53	.	.	.	Know the causes of earthquakes and volcanoes
35	16	50	.	.	.	Know how fossils are formed and what they tell us about the ages of rock layers
27	20	54	.	.	.	Identify renewable and nonrenewable resources and ways to conserve and recycle resources
25	25	50	.	.	.	Identify types of air, land, and water pollution and ways to improve air and water quality
44	14	42	.	.	.	Compare planets, moons, asteroids, comets, and meteors
38	16	47	.	.	.	Describe the motions of the Sun, Earth, Moon system
55	10	35	.	.	.	Compare the composition, color, and life cycles of different classes of stars
54	8	37	.	.	.	Describe the different types of galaxies

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Strand Rankings for ACT's College Readiness Standards™

Strand	MS Mean	SD	Rank	% at Top Rank	HS Mean	SD	Rank	% at Top Rank	PS Mean	SD	Rank	% at Top Rank	REM Mean	SD	Rank	% at Top Rank
English/Writing																
Rank Ordering of Six Writing Categories																
(1 = most important, 6 = least)																
Topic and Idea Development	1.83	1.26	1	59	1.65	1.13	1	63	2.18	1.66	1	55	1.99	1.47	1	57
Organization, Unity, and Coherence	2.38	1.26	2	23	2.22	1.15	2	24	2.61	1.36	2	18	2.53	1.25	2	14
Word Choice in Terms of Style, Tone, Clarity, and Economy	4.10	1.44	4	4	3.76	1.25	4	3	4.40	1.27	5	2	4.79	1.24	6	1
Sentence Structure and Formation	3.59	1.25	3	6	3.53	1.12	3	5	3.12	1.21	3	13	2.79	1.15	3	21
Conventions of Usage	4.40	1.37	5	4	4.85	1.11	5	2	4.08	1.53	4	8	4.34	1.41	4	6
Conventions of Punctuation	4.71	1.46	6	4	5.00	1.31	6	3	4.61	1.56	6	5	4.56	1.37	5	1
Math, Middle School and Developmental																
Rank Ordering of Eight Math Categories																
(1 = most important, 8 = least)																
Basic Operations and Applications	2.96	2.12	2	37	—	—	—	—	—	—	—	—	1.53	1.21	1	74
Numbers, Concepts, and Properties	3.07	1.70	3	16	—	—	—	—	—	—	—	—	2.53	1.27	2	9
Expressions, Equations, and Inequalities	2.66	1.74	1	38	—	—	—	—	—	—	—	—	3.00	1.26	3	13
Graphical Representations	4.29	1.78	4	3	—	—	—	—	—	—	—	—	4.41	1.26	4	1
Properties of Plane Figures	6.09	1.59	7	1	—	—	—	—	—	—	—	—	6.14	1.28	7	0
Measurement	5.04	1.76	5	3	—	—	—	—	—	—	—	—	5.40	1.49	5	1
Probability, Statistics, and Data Analysis	5.45	1.78	6	2	—	—	—	—	—	—	—	—	6.91	1.31	8	1
Functions	6.45	2.09	8	1	—	—	—	—	—	—	—	—	6.08	1.86	6	2
Math, High School by course																
Rank Ordering of Eight Math Categories	**Alg 1**				**Alg 2**				**Geo**				**P-Calc**			
(1 = most important, 8 = least)	**Mean**				**Mean**				**Mean**				**Mean**			
Basic Operations and Applications	2.86	1.85	2	37	4.18	1.84	5	14	4.19	1.61	4	7	5.55	1.98	5	4
Numbers, Concepts, and Properties	3.35	1.59	3	6	3.55	1.39	4	6	4.93	1.48	6	1	4.12	1.53	4	4
Expressions, Equations, and Inequalities	1.99	1.25	1	51	2.33	1.45	1	33	4.91	1.34	5	1	2.96	1.13	2	5
Graphical Representations	3.46	1.39	4	2	3.41	1.40	3	6	3.92	1.45	3	1	3.13	1.28	3	1
Properties of Plane Figures	7.20	1.05	8	0	6.93	1.23	8	1	1.44	1.04	1	76	5.87	1.31	6	0
Measurement	6.35	1.34	7	0	6.62	1.33	7	1	2.46	1.38	2	13	6.86	1.17	8	0
Probability, Statistics, and Data Analysis	5.92	1.46	6	1	6.08	1.66	6	1	7.49	0.86	8	0	6.19	1.76	7	0
Functions	4.86	1.85	5	3	2.90	2.07	2	38	6.66	1.34	7	0	1.31	0.97	1	87
Math, Postsecondary by course																
Rank Ordering of Eight Math Categories	**Prob**				**Alg**				**P-Calc**				**Calc**			
(1 = most important, 8 = least)	**Mean**				**Mean**				**Mean**				**Mean**			
Basic Operations and Applications	2.06	1.17	1	35	2.01	1.48	1	56	2.35	1.59	1	43	3.38	1.70	3	15
Numbers, Concepts, and Properties	3.40	1.22	3	5	2.78	1.34	3	13	3.26	1.65	3	10	4.12	1.44	5	4
Expressions, Equations, and Inequalities	4.62	1.58	5	3	2.68	1.22	2	20	2.74	1.35	2	22	2.48	1.28	2	24
Graphical Representations	3.51	1.61	4	8	3.94	1.33	4	3	3.88	1.32	4	1	3.78	1.39	4	2
Properties of Plane Figures	7.15	1.24	8	0	6.41	1.23	7	1	5.75	1.39	6	1	5.92	1.01	6	0
Measurement	6.29	1.30	7	0	6.00	1.28	6	0	6.44	1.06	7	0	6.39	1.12	7	0
Probability, Statistics, and Data Analysis	3.02	2.37	2	48	7.39	1.00	8	0	7.66	1.05	8	1	7.87	0.50	8	0
Functions	5.95	1.67	6	2	4.80	1.90	5	8	3.91	2.00	5	21	2.06	1.47	1	55
Reading, Language Arts courses only																
Rank Ordering of Five Reading Categories	**MS**				**HS**				**PS**				**REM**			
(1 = most important, 5 = least)	**Mean**				**Mean**				**Mean**				**Mean**			
Main Ideas and Author's Approach	1.76	1.12	1	60	1.84	1.26	1	60	1.47	0.92	1	73	1.33	0.70	1	75
Supporting Details	3.05	1.18	2	6	2.97	1.08	2	5	2.88	1.05	2	4	2.93	0.94	3	0
Relationships	3.80	1.15	5	4	3.68	1.19	5	5	3.82	1.06	5	2	4.01	0.88	5	1
Meaning of Words	3.08	1.41	3	18	3.30	1.35	4	13	3.71	1.23	4	7	2.92	1.39	2	19
Generalizations and Conclusions	3.32	1.34	4	12	3.22	1.46	3	17	3.12	1.38	3	14	3.81	1.21	4	5
Reading, Social Studies courses only																
Rank Ordering of Five Reading Categories																
(1 = most important, 5 = least)																
Main Ideas and Author's Approach	—	—	—	—	2.27	1.45	1	44	1.62	1.10	1	67	—	—	—	—
Supporting Details	—	—	—	—	3.39	1.14	5	4	3.30	1.08	3	4	—	—	—	—
Relationships	—	—	—	—	3.19	1.32	3	12	3.32	1.07	4	3	—	—	—	—
Meaning of Words	—	—	—	—	3.37	1.39	4	14	4.03	1.25	5	5	—	—	—	—
Generalizations and Conclusions	—	—	—	—	2.78	1.44	2	26	2.73	1.32	2	21	—	—	—	—

Note:
MS = Middle school/junior high school teachers
HS = High school teachers
PS = Postsecondary instructors (no remedial)
SD = Standard deviation. A measure of the range of values in a set of numbers. The more spread apart the data, the higher the standard deviation.
REM = Remedial teachers

Alg = College Algebra
Alg1 = Algebra 1
Alg2 = Algebra 2
Calc = Calculus
Geo = Geometry
P-Calc = Pre-Calculus
Prob = Probability and/or Statistics

Strand Rankings for ACT's College Readiness Standards *(continued)*

Strand	MS Mean	MS SD	MS Rank	MS % at Top Rank	HS Mean	HS SD	HS Rank	HS % at Top Rank	PS Mean	PS SD	PS Rank	PS % at Top Rank	REM Mean	REM SD	REM Rank	REM % at Top Rank
All Sciences Combined																
Rank Ordering of All Science Categories Combined (1 = most important, 3 = least)																
Interpretation of Data	1.97	0.57	2	18	1.73	0.68	1	41	1.58	0.70	1	54	—	—	—	—
Scientific Investigation	1.37	0.64	1	72	1.76	0.78	2	45	2.13	0.79	2	25	—	—	—	—
Evaluation of Models, Inferences, and Experimental Results	2.66	0.65	3	10	2.51	0.73	3	14	2.29	0.78	3	20	—	—	—	—
Biology																
Rank Ordering of Three Biology Categories (1 = most important, 3 = least)																
Interpretation of Data	—	—	—	—	1.89	0.63	2	26	1.68	0.70	1	46	—	—	—	—
Scientific Investigation	—	—	—	—	1.41	0.64	1	67	1.77	0.76	2	43	—	—	—	—
Evaluation of Models, Inferences, and Experimental Results	—	—	—	—	2.70	0.59	3	7	2.55	0.68	3	11	—	—	—	—
Chemistry																
Rank Ordering of Three Chemistry Categories (1 = most important, 3 = least)																
Interpretation of Data	—	—	—	—	1.74	0.70	1	41	1.44	0.63	1	63	—	—	—	—
Scientific Investigation	—	—	—	—	1.82	0.79	2	42	2.28	0.76	t2	19	—	—	—	—
Evaluation of Models, Inferences, and Experimental Results	—	—	—	—	2.44	0.77	3	17	2.28	0.74	t2	18	—	—	—	—
Earth Science																
Rank Ordering of Three Earth Science Categories (1 = most important, 3 = least)																
Interpretation of Data	—	—	—	—	1.71	0.69	1	43	1.61	0.72	1	53	—	—	—	—
Scientific Investigation	—	—	—	—	1.96	0.82	2	36	2.28	0.76	3	19	—	—	—	—
Evaluation of Models, Inferences, and Experimental Results	—	—	—	—	2.34	0.80	3	21	2.11	0.82	2	28	—	—	—	—
Physics																
Rank Ordering of Three Physics Categories (1 = most important, 3 = least)																
Interpretation of Data	—	—	—	—	1.56	0.67	1	54	1.59	0.74	1	57	—	—	—	—
Scientific Investigation	—	—	—	—	1.89	0.73	2	33	2.20	0.74	2	19	—	—	—	—
Evaluation of Models, Inferences, and Experimental Results	—	—	—	—	2.56	0.70	3	12	2.21	0.79	3	23	—	—	—	—

Note:
MS = Middle school/junior high school teachers
HS = High school teachers
PS = Postsecondary instructors (no remedial)
SD = Standard deviation. A measure of the range of values in a set of numbers. The more spread apart the data, the higher the standard deviation.
REM = Remedial teachers
A "t" before a number in the rank column indicates a tie.

Table H.1
Statistical Details for Remedial English/Writing Topics and Skills

REM Mean	REM +/–	Topics and Skills
		Composition Process and Purpose
3.38	0.12	Determine purpose and audience
3.47	0.11	Use prewriting, brainstorming, or other techniques of invention
3.21	0.12	Use mapping, clustering, outlining, or other organizational tools
2.83	0.16	Gather and synthesize resources
2.80	0.17	Evaluate source materials critically
3.56	0.11	Develop a cohesive first draft
3.79	0.08	Revise for content
3.74	0.08	Edit and proofread for usage and mechanics
2.75	0.18	Cite sources accurately
3.50	0.13	Avoid plagiarism
2.72	0.16	Develop one's own voice as a writer
0.93	0.14	Make use of and adapt elements of the writing process to create media productions
3.36	0.12	Write to explore ideas
2.47	0.17	Write to express one's feelings
2.31	0.18	Write to tell a story through fiction or nonfiction
2.19	0.19	Write to analyze literature
2.02	0.18	Write to analyze media
3.64	0.09	Write to convey information
3.42	0.13	Write to argue or persuade readers
2.82	0.16	Write to describe a process or how to do something
1.40	0.17	Write to produce work-related texts
2.26	0.21	Write to present research
3.74	0.09	**COMPOSITION PROCESS AND PURPOSE as an overall set of skills**
		Topic and Idea Development
3.84	0.07	Present a thesis that establishes focus on the topic
3.87	0.06	Maintain a focus on the general topic throughout a piece of writing
3.67	0.08	Narrow the focus to a specific issue within the general topic
3.40	0.12	Provide appropriate context or background information for readers
3.81	0.07	Develop ideas by using some specific reasons, details, and examples
3.51	0.11	Take and maintain a position on an issue
3.05	0.17	Support claims with multiple and appropriate sources of evidence
2.87	0.16	Differentiate between assertions and evidence
2.91	0.16	Fairly and accurately represent different points of view on an issue
2.79	0.16	Anticipate and respond to counterarguments to a position taken on an issue
3.41	0.11	Show some movement between general and specific ideas and examples
3.02	0.15	Identify the basic purpose or role of a phrase or sentence within a piece of writing
3.33	0.11	Determine the appropriateness of wording for audience and purpose
3.44	0.11	Delete a clause or sentence because it is obviously irrelevant to a piece of writing
3.43	0.11	Delete material that disturbs the development or flow of a piece of writing
3.42	0.12	Determine whether a piece of writing has accomplished its intended purpose
3.79	0.07	**TOPIC AND IDEA DEVELOPMENT as an overall set of skills**
		Organization, Unity, and Coherence
3.83	0.06	Provide an adequate organization with a logical grouping of ideas
3.74	0.09	Use discernible introductions and conclusions
3.60	0.10	Use appropriate transition words and phrases within a sentence or to connect sentences within a paragraph
3.49	0.11	Use effective transition sentences to connect paragraphs
.	.	Use conjunctive adverbs to show time relationships (e.g., then, this time)
3.14	0.14	Use conjunctive adverbs or phrases to express straightforward logical relationships
3.09	0.13	Select the most logical place to add a sentence in a paragraph
3.23	0.12	Determine the most logical place to add information to a piece of writing
3.72	0.08	**ORGANIZATION, UNITY, AND COHERENCE as an overall set of skills**
		Word Choice in Terms of Style, Tone, Clarity, and Economy
2.78	0.14	Revise expressions that deviate from the style of a piece of writing
.	.	Revise sentences to correct awkward and confusing arrangements of sentence elements
2.91	0.13	Maintain consistency of tone
3.41	0.10	Choose words and images that are specific, precise, and clear in terms of their context
3.41	0.10	Use appropriate vocabulary
3.26	0.12	Delete obviously synonymous and wordy material in a sentence
3.10	0.12	Use varied words and images
.	.	Revise vague nouns and pronouns
3.44	0.11	Avoid vague pronouns (i.e., pronouns without a clear antecedent)
3.18	0.13	Determine the clearest and most logical conjunction to link clauses
3.23	0.12	Use rhetorically effective subordination, coordination, and parallelism
3.30	0.10	**WORD CHOICE IN TERMS OF STYLE, TONE, CLARITY, AND ECONOMY as an overall set of skills**

Note:
REM = Remedial teachers
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table H.1

Statistical Details for Remedial English/Writing Topics and Skills *(continued)*

REM Mean	REM +/–	Topics and Skills
		Sentence Structure and Formation
3.39	0.11	Avoid faulty subordination, coordination, and parallelism
3.69	0.08	Use punctuation and conjunctions to avoid awkward sentence fragments and fused sentences
.	.	Use punctuation and conjunctions to join clauses
3.22	0.12	Avoid dangling and misplaced modifiers
3.52	0.10	Decide on appropriate verb tense and voice by considering the meaning of an entire sentence
.	.	Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences
3.54	0.10	Decide on appropriate verb tense and voice in terms of a paragraph or a piece of writing
3.37	0.11	Avoid inappropriate shifts of mood, number, or person
3.23	0.12	Identify missing or incorrect relative pronouns
3.27	0.12	Use some varied kinds of sentence structures to vary pace and to support meaning
3.56	0.10	**SENTENCE STRUCTURE AND FORMATION as an overall set of skills**
		Conventions of Usage
3.33	0.12	Form simple and compound tenses of regular and irregular verbs
.	.	Form past and past participle of irregular and commonly used verbs
.	.	Form comparative and superlative adjectives
3.04	0.13	Form modifiers
3.06	0.14	Choose between using an adverb and using an adjective in a particular situation
3.63	0.09	Ensure straightforward subject-verb agreement
3.50	0.10	Ensure straightforward pronoun-antecedent agreement
3.22	0.13	Ensure subject-verb and pronoun-antecedent agreement in unusual or tricky situations
3.36	0.12	Use the proper form of possessive pronouns
3.39	0.11	Use the appropriate case of a pronoun
3.14	0.13	Use the idioms of standard written English
3.12	0.14	Determine which preposition to use in simple contexts
2.80	0.15	Determine the appropriate preposition to use in situations involving sophisticated language or ideas
3.36	0.12	Use the appropriate word in frequently confused pairs of words (e.g., past and passed)
3.40	0.11	**CONVENTIONS OF USAGE as an overall set of skills**
		Conventions of Punctuation
3.28	0.12	Delete commas that disturb sentence flow (e.g., between modifier and modified element)
3.49	0.10	Provide appropriate punctuation in straightforward situations (e.g., items in a series)
3.39	0.11	Punctuate between clauses of compound sentences when the conjunction is omitted
3.35	0.11	Punctuate before a conjunctive adverb joining clauses of a compound sentence
3.16	0.13	Punctuate parenthetical elements with commas, parentheses, and dashes
3.29	0.12	Punctuate essential/nonessential elements, subordinate clauses, and restrictive/nonrestrictive appositives
3.38	0.11	Punctuate possessive nouns and pronouns
2.86	0.16	Punctuate dialogue
3.28	0.12	Use a semicolon to indicate a close relationship between two independent clauses
2.96	0.15	Use semicolons when items in a series have internal punctuation (e.g., when items have their own commas)
2.95	0.14	Use a colon to introduce a series of phrases (e.g., a list of examples)
2.78	0.16	Use a colon to introduce one or more sentences
3.42	0.11	**CONVENTIONS OF PUNCTUATION as an overall set of skills**
		Evaluation of Writing
3.35	0.11	Writing appropriately for purpose and audience
3.85	0.06	Writing unified and coherent text
3.63	0.09	Developing ideas using appropriate organizational strategy
3.77	0.07	Developing ideas using relevant examples and details
3.71	0.08	Using a clear beginning, middle, and ending
2.61	0.12	Using voice
2.84	0.10	Using precise word choice
2.74	0.11	Using appropriate tone
2.97	0.13	Using sentence variety
3.60	0.10	Using correct grammar, usage, and mechanics
3.77	0.07	**EVALUATION OF WRITING as an overall topic**

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. = This item was not asked at this grade level.

Table H.2
Statistical Details for Remedial Mathematics Topics and Skills

REM Mean	REM +/–	Topics and Skills
		Process Skills
2.99	0.15	Choose an appropriate method for calculating (e.g., mental, paper and pencil, calculator, or estimation)
2.97	0.13	Estimate a reasonable result without using a calculator
1.50	0.17	Demonstrate concepts using manipulatives
2.58	0.15	Demonstrate concepts using pictorial representations
3.48	0.11	Solve problems posed in real-world settings and interpret the solutions
2.80	0.14	Recognize when essential information is missing
3.62	0.09	Plan and carry out a strategy for solving multistep problems
3.17	0.13	Recognize generalizations of mathematical ideas
3.29	0.12	Recognize and use patterns to solve problems
3.20	0.13	Apply mathematical ideas to new contexts
2.29	0.15	Formulate new patterns or structures
2.75	0.16	Solve several problems representing different aspects/components of one larger problem or scenario
2.33	0.17	Understand roles of definitions, proof, and counterexamples
3.52	0.10	Recall basic facts, definitions, formulas, and algebraic procedures as needed to solve a problem
2.36	0.18	Recall theorems and more complex formulas when needed to solve a problem
2.22	0.18	Apply theorems to solve a problem
1.10	0.16	Construct and/or critique proofs, either informal or formal
2.76	0.18	Perform basic operations with a calculator
1.29	0.18	Use the statistical capabilities of a calculator
1.65	0.21	Use the graphical capabilities of a calculator
1.37	0.19	Use the symbolic algebra capabilities of a calculator
0.82	0.15	Use spreadsheets
0.88	0.15	Use dynamic geometry
2.93	0.15	Solve routine problems quickly
1.98	0.17	Solve novel problems quickly
3.65	0.09	Use mathematical symbols correctly
2.86	0.13	Understand new material from reading a textbook
2.21	0.18	Work in a self-directed group
3.14	0.14	**PROCESS SKILLS as an overall topic**
		Basic Operations and Applications
3.78	0.08	Perform addition, subtraction, multiplication, and division on signed rational numbers
.	.	Perform one-step computations with whole numbers and decimals
3.51	0.11	Solve problems using ratios and proportions
3.46	0.11	Solve problems involving percents (e.g., simple interest, tax, and markdowns)
2.81	0.17	Convert units of measure
3.65	0.10	Solve routine one-step arithmetic problems
3.69	0.08	Solve routine two- or three-step arithmetic problems
3.15	0.13	Solve nonroutine two- or three-step arithmetic problems
2.78	0.16	Solve multistep arithmetic problems that involve planning or converting units of measure
3.09	0.14	Solve word problems containing several rates, proportions, or percentages
3.69	0.08	**BASIC OPERATIONS AND APPLICATIONS as an overall topic**
		Numbers: Concepts and Properties
.	.	Identify a digit's place
3.63	0.10	Exhibit knowledge of elementary number concepts
3.26	0.14	Order fractions
.	.	Recognize one-digit factors of a number
3.47	0.11	Find and use the least common multiple
.	.	Recognize equivalent fractions and fractions in lowest terms
3.38	0.12	Perform computations with squares and square roots of numbers
2.69	0.17	Perform computations with cubes and cube roots of numbers
3.47	0.12	Apply rules of exponents
1.14	0.19	Perform matrix addition and multiplication
1.30	0.19	Exhibit knowledge of series and sequences (e.g., arithmetic and geometric)
1.83	0.19	Find union and intersection of sets
2.73	0.18	Apply properties of rational and irrational numbers
1.75	0.21	Exhibit knowledge of complex numbers
1.66	0.21	Apply properties of complex numbers
3.11	0.15	Apply number properties involving multiples and factors
2.47	0.18	Use scientific notation
3.18	0.14	Determine when an expression is undefined
1.35	0.20	Exhibit knowledge of logarithms and geometric sequences
3.25	0.12	**NUMBERS: CONCEPTS AND PROPERTIES as an overall topic**

Note:
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+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table H.2

Statistical Details for Remedial Mathematics Topics and Skills *(continued)*

REM Mean	REM +/–	Topics and Skills
		Expressions, Equations, and Inequalities
3.46	0.13	Evaluate algebraic expressions by substituting integers for unknown quantities
.	.	Exhibit knowledge of basic expressions
3.55	0.12	Add and subtract simple algebraic expressions
.	.	Combine like terms
3.68	0.10	Solve routine first-degree equations
3.50	0.13	Solve linear equations and inequalities in one variable
.	.	Substitute whole numbers for unknown quantities
3.51	0.12	Perform word-to-symbol translations
3.31	0.13	Write expressions, equations, or inequalities for common settings
.	.	Solve one-step equations having integer or decimal values
3.21	0.17	Multiply two binomials
2.62	0.19	Solve absolute value equations and inequalities
3.25	0.16	Add, subtract, and multiply polynomials
3.00	0.19	Factor quadratics
2.92	0.20	Solve quadratic equations
.	.	Apply properties of exponential functions
1.92	0.21	Solve quadratic inequalities
1.58	0.20	Use the discriminant
2.42	0.21	Determine solutions of polynomial and rational equations
1.45	0.20	Implement remainder and factor theorems for polynomials
1.41	0.20	Apply properties of logarithmic and exponential functions
2.49	0.21	Find solutions to systems of linear equations
.	.	Solve problems using equations of parabolas and circles
1.38	0.20	Solve problems using equations of parabolas, circles, ellipses, and hyperbolas
0.97	0.18	Solve problems using parametric equations
1.45	0.21	Transform functions algebraically
0.98	0.19	Find the limit of an expression
3.14	0.15	**EXPRESSIONS, EQUATIONS, AND INEQUALITIES as an overall topic**
		Graphical Representations
3.26	0.15	Comprehend the concept of length on the number line
.	.	Locate points on the number line and in the first quandrant
3.52	0.13	Locate points on the number line
3.31	0.17	Locate points in the coordinate plane
3.08	0.19	Exhibit knowledge of slope
3.00	0.20	Find the slope of a line
2.96	0.18	Identify graphs on a number line
2.87	0.19	Match linear graphs with their equations
2.70	0.19	Use properties of parallel and perpendicular lines
2.36	0.20	Solve systems of equations and inequalities graphically
.	.	Recognize special characteristics of parabolas and circles
1.38	0.20	Recognize special characteristics of parabolas, circles, ellipses, and hyperbolas
2.63	0.20	Interpret and use information from graphs in the coordinate plane
2.16	0.20	Identify characteristics of graphs based on a set of conditions or on a general equation
1.36	0.20	Understand the properties of graphs of rational functions (e.g., asymptotes)
1.88	0.21	Find midpoints
2.05	0.21	Use the distance formula
1.36	0.19	Work with discontinuous graphs and piecewise-defined functions
2.85	0.17	**GRAPHICAL REPRESENTATIONS as an overall topic**
		Properties of Plane Figures
1.69	0.21	Find the measure of an angle using properties of parallel lines
.	.	Exhibit some knowledge of angles associated with parallel lines
2.22	0.20	Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)
2.75	0.19	Use the Pythagorean theorem
1.70	0.20	Apply properties of lines, segments, and rays
1.59	0.20	Apply properties of special quadrilaterals
1.79	0.20	Apply properties of 30°-60°-90°, isosceles, similar, and congruent triangles
1.26	0.18	Use relationships among angles, arcs, and distances in a circle
1.13	0.18	Use logical relationships to answer problems (e.g., converse, contrapositive, and if-then)
0.96	0.17	Prove results by mathematical induction
1.75	0.19	**PROPERTIES OF PLANE FIGURES as an overall topic**

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. = This item was not asked at this grade level.

Table H.2

Statistical Details for Remedial Mathematics Topics and Skills *(continued)*

REM Mean	REM +/–	Topics and Skills
		Measurement
3.13	0.16	Compute the area and perimeter of triangles and rectangles
.	.	Estimate or calculate of length of a line segment based on other lengths given on a geometric figure
2.36	0.20	Compute the perimeter of composite geometric figures with unknown side lengths
.	.	Compute the area and perimeter of polygons
2.67	0.20	Compute the area and circumference of circles after identifying necessary information
2.45	0.21	Compute the area and perimeter of polygons with known side lengths
2.05	0.20	Compute volume and surface area (e.g., cylinders, prisms, cones, and pyramids)
1.83	0.21	Compute the area and volume of composite geometric figures
2.58	0.20	Use geometric formulas
2.04	0.22	Understand how to read measurement tools (e.g., rulers and protractors)
1.59	0.20	Use scale factors to determine the magnitude of a size change
2.36	0.18	**MEASUREMENT as an overall topic**
		Probability, Statitics, and Data Analysis
2.83	0.18	Read and interpret graphs, charts, and other data representations
2.16	0.21	Manipulate data from tables and graphs
2.57	0.19	Perform computations on data from tables and graphs
1.89	0.21	Represent data (e.g., circle graphs, scatterplots, and frequency distributions)
1.05	0.18	Exhibit knowledge of correlation, variance, and standard deviation of data
2.15	0.21	Find the median and mode
1.54	0.20	Determine the probability of a simple event
.	.	Use the relationship between the probability of an event and the probability of its complement
1.17	0.18	Determine the probability of mutually exclusive, dependent, and independent events
1.38	0.19	Exhibit knowledge of counting techniques
1.03	0.17	Exhibit knowledge of combinations, permutations, and the binomial theorem
2.82	0.20	Calculate the average of a list of numbers
2.01	0.20	Calculate a missing data value, given the average and all the missing data values but one
.	.	Calculate the average, given the number of data values and the sum of the data values
1.57	0.20	Calculate the average, given the frequency counts of all the data values
1.51	0.20	Calculate or use a weighted average
1.84	0.18	**PROBABILITY, STATISTICS, AND DATA ANALYSIS as an overall topic**
		Functions
2.48	0.21	Understand the concept of function
.	.	Use function notation
.	.	Find the domain and range of functions
2.17	0.21	Find domain, range, and inverses of functions
2.47	0.22	Evaluate linear functions based on function notation
2.16	0.22	Evaluate quadratic functions based on function notation
1.86	0.22	Evaluate polynomial functions based on function notation
1.44	0.20	Evaluate composite functions based on function notation
1.26	0.20	Apply basic trigonometric ratios to solve right-triangle problems
1.05	0.18	Use trigonometric concepts and basic identities to solve problems
0.96	0.17	Use the law of sines and law of cosines
0.91	0.17	Apply properties of trigonometric functions and their graphs, including amplitude, period, and phase shift
0.92	0.18	Use radian measure
0.80	0.17	Exhibit knowledge of vectors in a plane
1.74	0.21	**FUNCTIONS as an overall topic**

Note:
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+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table H.3
Statistical Details for Remedial Reading Topics and Skills

REM Mean	REM +/–	Topics and Skills
		Content
1.33	0.13	Read/view and demonstrate understanding of poetry
1.28	0.13	Read/view and demonstrate understanding of drama
2.67	0.13	Read/view and demonstrate understanding of novels and short stories
2.22	0.17	Read/view and demonstrate understanding of nonfiction trade books
3.77	0.07	Read/view and demonstrate understanding of textbooks
2.38	0.15	Read/view and demonstrate understanding of research studies
2.29	0.14	Read/view and demonstrate understanding of primary sources
2.95	0.12	Read/view and demonstrate understanding of news and feature articles, editorials/opinion pieces
1.67	0.14	Read/view and demonstrate understanding of advertisements
1.36	0.13	Read/view and demonstrate understanding of film and television
2.12	0.15	Read/view and demonstrate understanding of multimedia presentations
2.17	0.14	Read/view and demonstrate understanding of functional text
2.99	0.13	Read/view and demonstrate understanding of graphs, charts, and diagrams
2.46	0.16	Read/view and demonstrate understanding of work-related texts
3.68	0.08	**CONTENT as an overall set of skills**
		Main Ideas and Author's Approach
3.90	0.04	Infer the main idea or purpose of a straightforward paragraph
.	.	Recognize a clear intent of an author or narrator
3.87	0.05	Determine the main idea or purpose of a complex paragraph
3.93	0.03	Identify the main idea or purpose of a straightforward paragraph
3.84	0.06	Determine the main idea, purpose, or theme of a text
3.70	0.07	Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used)
3.81	0.06	Summarize basic events and ideas in a text
3.90	0.05	**MAIN IDEAS AND AUTHOR'S APPROACH as an overall set of skills**
		Supporting Details
3.84	0.05	Locate important details stated in a text
.	.	Locate basic facts (e.g., names, dates, events) that are clearly stated in a text
3.59	0.08	Locate and interpret minor or subtly stated details in a text
3.78	0.06	Locate simple details at the sentence and paragraph level in a text
3.74	0.06	Make simple inferences about how details are used to support points made in a text (e.g., support for a claim)
3.63	0.08	Discern which details from different sections of a text support important points
3.41	0.10	Understand subtle or complex roles that details can play in a text
3.82	0.06	**SUPPORTING DETAILS as an overall set of skills**
		Relationships
3.60	0.09	Order simple sequences of events in a text
.	.	Determine when (e.g., first, last, before, after) or if an event occurred in a text
3.44	0.09	Order subtle or complex sequences of events in a text
.	.	Recognize clear cause-effect relationships described within a single sentence
3.64	0.08	Identify clear relationships between people, ideas, and so on in a text
3.51	0.08	Infer subtle or complex relationships between people, ideas, and so on in a text
3.77	0.06	Identify clear cause-effect relationships in a text
3.48	0.08	Infer subtle or complex cause-effect relationships in a text
3.71	0.06	**RELATIONSHIPS as an overall set of skills**
		Meanings of Words
3.82	0.06	Use context to determine the appropriate meaning of words and phrases
.	.	Understand the implication of a familiar word or phrase and of simple descriptive language
3.48	0.09	Distinguish between literal and figurative meanings of words and phrases in a text
3.63	0.08	Paraphrase concepts and ideas in a text
3.05	0.13	Understand literary devices in a text
3.80	0.06	**MEANINGS OF WORDS as an overall set of skills**

Note:
REM = Remedial teachers
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Table H.3

Statistical Details for Remedial Reading Topics and Skills *(continued)*

REM Mean	REM +/–	Topics and Skills
		Generalizations and Conclusions
3.68	0.07	Draw generalizations and conclusions about people, ideas, and so on in a text
.	.	Draw simple generalizations and conclusions about the main characters in a text
3.75	0.06	Draw generalizations and conclusions using details that support the main points of a text
3.48	0.10	Predict outcomes based on a text
3.71	0.07	Distinguish between fact, opinion, and reasoned judgment within a text
3.03	0.13	Identify stereotypes in a text
3.08	0.12	Identify logical fallacies in a text
3.25	0.11	Identify persuasive techniques in a text
3.33	0.11	Evaluate the range and quality of evidence used to support an argument in a text
3.10	0.12	Make connections between two or more texts
3.63	0.08	**GENERALIZATIONS AND CONCLUSIONS as an overall set of skills**
		Evaluating Texts
3.36	0.11	Demonstrate skills in uncomplicated literary narratives
3.04	0.11	Demonstrate skills in more challenging literary narratives
2.34	0.12	Demonstrate skills in complex literary narratives
3.56	0.10	Demonstrate skills in uncomplicated informational texts
3.35	0.10	Demonstrate skills in more challenging informational texts
2.58	0.12	Demonstrate skills in complex informational texts
3.07	0.12	Evaluate information in a text for relevance
3.12	0.11	Evaluate information in a text for fair and accurate treatment of differing points of view
3.06	0.12	Evaluate information in a text for persuasive techniques
3.20	0.11	Evaluate information in a text for credibility and appropriateness of sources of information
3.23	0.11	Evaluate information in a text for sufficiency of evidence in support of an argument or claim
2.59	0.13	Evaluate information in a text for internal consistency
2.64	0.13	Recognize how history and culture influence a text
3.00	0.12	**EVALUATING TEXTS as an overall set of skills**

Note:
REM = Remedial teachers
+/– = The value given under +/– is the confidence interval (CI) for the mean, at a confidence level of 95%. For example, for a mean of 3.27 with a CI of 0.09, there is a 95% probability that the actual mean for the population is within the range 3.27 plus or minus 0.09.
. = This item was not asked at this grade level.

Six-Point Holistic Scoring Rubric for the ACT Writing Test

Papers at each level exhibit *all* or *most* of the characteristics described at each score point.

Score = 6
Essays within this score range demonstrate effective skill in responding to the task.

The essay shows a clear understanding of the task. The essay takes a position on the issue and may offer a critical context for discussion. The essay addresses complexity by examining different perspectives on the issue, or by evaluating the implications and/or complications of the issue, or by fully responding to counterarguments to the writer's position. Development of ideas is ample, specific, and logical. Most ideas are fully elaborated. A clear focus on the specific issue in the prompt is maintained. The organization of the essay is clear: the organization may be somewhat predictable or it may grow from the writer's purpose. Ideas are logically sequenced. Most transitions reflect the writer's logic and are usually integrated into the essay. The introduction and conclusion are effective, clear, and well developed. The essay shows a good command of language. Sentences are varied and word choice is varied and precise. There are few, if any, errors to distract the reader.

Score = 5
Essays within this score range demonstrate competent skill in responding to the task.

The essay shows a clear understanding of the task. The essay takes a position on the issue and may offer a broad context for discussion. The essay shows recognition of complexity by partially evaluating the implications and/or complications of the issue, or by responding to counterarguments to the writer's position. Development of ideas is specific and logical. Most ideas are elaborated, with clear movement between general statements and specific reasons, examples, and details. Focus on the specific issue in the prompt is maintained. The organization of the essay is clear, although it may be predictable. Ideas are logically sequenced, although simple and obvious transitions may be used. The introduction and conclusion are clear and generally well developed. Language is competent. Sentences are somewhat varied and word choice is sometimes varied and precise. There may be a few errors, but they are rarely distracting.

Score = 4
Essays within this score range demonstrate adequate skill in responding to the task.

The essay shows an understanding of the task. The essay takes a position on the issue and may offer some context for discussion. The essay may show some recognition of complexity by providing some response to counterarguments to the writer's position. Development of ideas is adequate, with some movement between general statements and specific reasons, examples, and details. Focus on the specific issue in the prompt is maintained throughout most of the essay. The organization of the essay is apparent but predictable. Some evidence of logical sequencing of ideas is apparent, although most transitions are simple and obvious. The introduction and conclusion are clear and somewhat developed. Language is adequate, with some sentence variety and appropriate word choice. There may be some distracting errors, but they do not impede understanding.

Score = 3
Essays within this score range demonstrate some developing skill in responding to the task.

The essay shows some understanding of the task. The essay takes a position on the issue but does not offer a context for discussion. The essay may acknowledge a counterargument to the writer's position, but its development is brief or unclear. Development of ideas is limited and may be repetitious, with little, if any, movement between general statements and specific reasons, examples, and details. Focus on the general topic is maintained, but focus on the specific issue in the prompt may not be maintained. The organization of the essay is simple. Ideas are logically grouped within parts of the essay, but there is little or no evidence of logical sequencing of ideas. Transitions, if used, are simple and obvious. An introduction and conclusion are clearly discernible but underdeveloped. Language shows a basic control. Sentences show a little variety and word choice is appropriate. Errors may be distracting and may occasionally impede understanding.

Score = 2
Essays within this score range demonstrate inconsistent or weak skill in responding to the task.

The essay shows a weak understanding of the task. The essay may not take a position on the issue, or the essay may take a position but fail to convey reasons to support that position, or the essay may take a position but fail to maintain a stance. There is little or no recognition of a counterargument to the writer's position. The essay is thinly developed. If examples are given, they are general and may not be clearly relevant. The essay may include extensive repetition of the writer's ideas or of ideas in the prompt. Focus on the general topic is maintained, but focus on the specific issue in the prompt may not be maintained. There is some indication of an organizational structure, and some logical grouping of ideas within parts of the essay is apparent. Transitions, if used, are simple and obvious, and they may be inappropriate or misleading. An introduction and conclusion are discernible but minimal. Sentence structure and word choice are usually simple. Errors may be frequently distracting and may sometimes impede understanding.

Score = 1
Essays within this score range show little or no skill in responding to the task.

The essay shows little or no understanding of the task. If the essay takes a position, it fails to convey reasons to support that position. The essay is minimally developed. The essay may include excessive repetition of the writer's ideas or of ideas in the prompt. Focus on the general topic is usually maintained, but focus on the specific issue in the prompt may not be maintained. There is little or no evidence of an organizational structure or of the logical grouping of ideas. Transitions are rarely used. If present, an introduction and conclusion are minimal. Sentence structure and word choice are simple. Errors may be frequently distracting and may significantly impede understanding.

No Score
Blank, Off-Topic, Illegible, Not in English, or Void

To help schools derive maximum benefit from their participation in ACT programs and services, ACT maintains a staff of consultants in regional offices. If you need additional ACT information or assistance, please contact the ACT office that serves your state.

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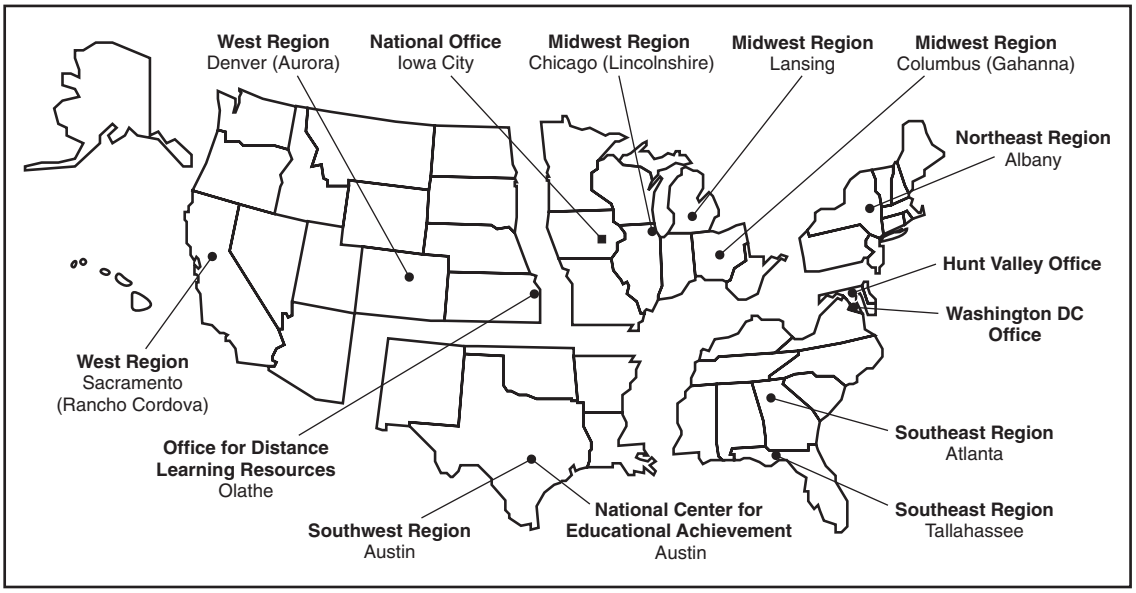


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