



WorkKeys® Solutions

ACT® WORKKEYS® NCRC®  
CROSSWALK<sub>to</sub>

**College and  
Career Readiness  
Standards for  
Adult Education**

# SYNOPSIS

The purpose of this study was to demonstrate the extent to which the three WorkKeys assessments making up the ACT® WorkKeys® National Career Readiness Certificate® (NCRC®) crosswalk to the College and Career Readiness Standards for Adult Education (CCRSAE), a subset of the Common Core State Standards. Since the National Reporting System's (NRS) Educational Functioning Levels (EFL) for Mathematics and Language Arts also use the CCRSAE as their foundation, the results of this study can be extended to demonstrate a crosswalk to the NRS EFLs. The ACT® WorkKeys® Curriculum is the only curriculum built from the ground up to align with the assessments. As a result, this crosswalk can also be used to demonstrate alignment between the WorkKeys Curriculum and the CCRSAE.

## Background on ACT WorkKeys National Career Readiness Certificate

In 1992, ACT introduced the first assessments in a system called ACT WorkKeys. ACT® WorkKeys® Assessments are research-based and criterion-referenced measures of foundational work skills essential to career success. The assessments measure the career readiness skills most broadly relevant across industries and occupations. The information they produce provides information to examinees, employers, workforce development officials, and educators. With more than 5 million certificates being awarded since 2006, the WorkKeys NCRC has materially improved the lives of individuals in the labor force, the organizations that use them, and has the potential to strengthen the US economy. In the secondary and postsecondary education space, the WorkKeys NCRC serves the dual purpose of providing indication of curricular and instructional health while also providing students with a tangible credential to carry and use beyond high school graduation. Whether a student is planning to immediately enroll in college or enter the workforce, the WorkKeys NCRC has the potential to bolster their employability and earnings potential.

## Background on the College and Career Readiness Standards for Adult Education

In 2014, the Workforce Innovation and Opportunity Act (WIOA) was passed to improve coordination and alignment between the primary federal programs that support employment services, workforce development, adult education, and vocational rehabilitation activities. WIOA emphasized that adult education program learning goals should lead to participants successfully transitioning to postsecondary education programs and/or obtaining

employment. WIOA also promoted the integration of adult education with occupational education and training, and the development of career pathways including the authorization of funds for “integrated education and training” and “workforce preparation activities.” Starting in 2017, Adult Education Title II programs were required to be integrated into career pathways and education and training programs.

The National Reporting System (NRS) is the accountability system for the federally funded, State-administered adult education program. It embodies the accountability and reporting requirements under WIOA. Measurable Skill Gain (MSG) is a key indicator in the NRS and provides a measure of a participant’s interim progress towards a credential or employment. One-way adult education participants may complete an MSG is through Educational Functioning Level (EFL) gain. Adult Basic Education (ABE) has different descriptors for English language arts/literacy and mathematics and six levels in each area. The EFL descriptors are intended to guide both teaching and assessment for adult learners. While these EFL descriptors address the most critical concepts for adult learners, there are additional concepts found in the College and Career Readiness Standards for Adult Education (CCRSAE) standards that support the major work for each level, and that are included in these descriptors. The NRS Technical Bulletin recommends that lesson plans and assessment items for adult learners be based on the full text of the CCR standards for each level, using these critical concepts as the foundation for lesson development and assessment. It is important to note that the CCRSAE consist of the most relevant Common Core State Standards (CCSS) to adult education and the CCSS have been adopted by 41 states, the District of Columbia, four territories, and the Department of Defense Education Activity (DoDEA). Therefore, it was decided that a crosswalk of the three WorkKeys NCRC assessments to the CCRSAE would be the most useful to adult education educators and administrators.

## **WorkKeys NCRC Assessments and CCRSAE**

The WorkKeys NCRC skill areas, item types, and skill domains include the following:

- The ACT® WorkKeys® Applied Math assessment measures the skill to apply mathematic principles to math-related problems encountered in the workplace. The assessment consists of a total of 34 five-foil multiple-choice items (31 operational items and three pretest items). Items are presented as scenarios based on authentic workplace stimuli.
- The ACT® WorkKeys® Graphic Literacy assessment measures the skill to interpret and apply information presented in workplace graphics. The assessment consists of 38 items (32 operational items and six pretest items) four-foil multiple-choice items. Items are presented as scenarios based on authentic workplace stimuli.

- The ACT® WorkKeys® Workplace Documents assessment measures the skill to find, interpret, and apply information presented in workplace documents. The assessment consists of a total of 35 items (30 operational items and five pretest items) five-foil multiple choice items. Items are presented as scenarios based on authentic workplace stimuli.

## WorkKeys Workplace Documents (formerly Reading for Information) and CCRSAE ELA/Literacy

WorkKeys Workplace Documents is designed to assess the extent to which individuals can read and comprehend written workplace documents and use that information to make decisions and solve problems. The documents—which include, but are not limited to, messages, emails, letters, directions, signs, notices, bulletins, policies, websites, contracts, and regulations—are based on materials that reflect the actual reading demands of the workplace. There are five levels of difficulty. Level 3 is the least complex and Level 7 is the most complex. The levels build on each other, each incorporating the skills assessed at the preceding levels. For example, at Level 5, readers need the skills from Levels 3, 4, and 5. The reading materials at Level 3 are short and direct. The material becomes longer, denser, and more difficult to use as readers move toward Level 7. The tasks also become more complex as readers move from Level 3 to Level 7. At Level 3, readers begin by finding obvious details and following short instructions. At the more complex levels, tasks can also involve more application and interpretation.

The ELA/Literacy CCRSAE standards include the domains of Reading, Writing, Speaking and Listening, Language, and the Reading Standards: Foundational Skills (K-5). However, only the Reading, Language and Reading Standards: Foundational Skills domains were crosswalked to WorkKeys Workplace Documents. The WorkKeys Workplace Documents skill does not address the skills of Writing, Speaking or Listening. As shown in the table below, the standards consist of five grade-level groupings (A through E) so they align more closely to the six EFL Math Levels.

**Table 1. CCRSAE EFL ELA/Literacy Grade-Level Groupings**

EFL ELA/Literacy Levels	CCR Standards Level	Grade-Level
Beginning Adult Basic Education Literacy	Level A	K-1
Beginning Basic Education	Level B	2-3
Low Intermediate Basic Education	Level C	4-5
High Intermediate Basic Education	Level D	6-8
Low Adult Secondary Education	Level E	9-10
High Adult Secondary Education	Level E	11-CCR

## *Text Complexity*

Document level complexity refers to the text complexity of the reading documents examinees are required to read in order to respond to the items. The Workplace Documents construct was defined through the interplay of document level complexity and reading tasks required of an examinee or student. Although each aspect is defined separately, collectively they interact to provide meaning and interpretability to test scores. For the Workplace Documents construct, reading and skill progressions are highly relevant.

Document (text) complexity for the Workplace Documents assessment is defined by the document's word count, reading level, clarity, amount of detail, and vocabulary level (including the use of technical terms, jargon, and acronyms). Additionally, different document types are permitted at specific levels (e.g., multiple-related and legal documents are allowed at the higher levels). These criteria are consistent with the research and resources supporting text complexity found in the Supplemental Information for Appendix A of the Common Core State Standards for English Language Arts and Literacy: New Research on Text Complexity (NGA n.d.). CCRSAE has also embraced a three-part model for determining text complexity as described in Appendix D of the College and Career Readiness Standards for Adult Education (CCRSAE) report by Susan Pimentel (2013).

1. **Quantitative:** The first part of the model addresses the quantitative dimensions of text complexity, such as those measured by computer software (e.g., academic vocabulary, sentence structure, word unfamiliarity, concreteness, degree of narrativity, word count, sentence count). The associated quantitative measures of text complexity for CCRSAE levels B-E are provided in ELA/Literacy Standard 10. At level A, students are just learning how to read, so it is not appropriate to focus on the complexity of the text until level B.
2. **Qualitative:** The second part of the model addresses the qualitative dimensions of text complexity and refers to levels of meaning or purpose, structure, language conventionality and clarity, and knowledge demands. These dimensions are usually measurable by a human reader.
3. **Reader and task considerations:** The third part of the model requires educators to use professional judgement to identify texts that are well-matched to specific tasks.

The CCRSAE standards recommend that quantitative tools be used with qualitative expert judgements. This is consistent with ACT's WorkKeys Workplace Documents complexity requirements and is a critical point when crosswalking the ELA/literacy standards to Workplace Documents. CCS and CCRSAE Standard 10 defines a staircase of increasing text complexity that rises from beginning reading to the college and career readiness level. The skills of reading outlined in Reading Anchor Standards 1-9 must be applied to level-appropriate complex text as described in Standard 10.

**CCR Anchor 10: Read and comprehend complex literary and informational texts independently and proficiently. Associated Quantitative Measures of Text Complexity to B-E Levels of Learning**

Therefore, establishing that the text complexity of the Workplace Document passages are level appropriate was critical. To address the quantitative part of the model, forty-six Workplace Documents items were evaluated using the six different computer programs used in the Supplemental Information for Appendix A of the Common Core State Standards for English Language Arts and Literacy study. For each Workplace Documents Level, eight to eleven items were analyzed. In general, the Workplace Documents passages showed a steady upward trajectory of reading comprehension development and were generally within the Standard 10 five text complexity grade bands B through E. The Lexile Framework provided level ratings that were the most consistent with the WorkKeys levels.

Workplace Documents items that appeared to be outside the expected grade band were examined by Dr. Hill for qualitative factors. Workplace Documents texts are required to be authentic workplace documents and as a result, the quantitative measures were inaccurate for some types of workplace documents. For example, one Workplace Documents Level 3 item was an out-of-office email providing the names and emails of contacts for various issues that might arise. The document was in a bullet format and it was extremely easy for the reader to locate the name and email of the person they needed to contact. However, the Lexile was 1010-1200, 5th-12th grade, and within the high C to 9/10 E bands rather than the Level B band.

The Standards acknowledge that certain quantitative measures are less valid or not applicable for specific kinds of texts. Both Standards also recommend that educators provide students with a broad range of high-quality, increasingly challenging literary and informational texts. In contrast, workplace reading materials are usually written by individuals more qualified by their content knowledge than their writing skills. The examinee results for the ACT<sup>®</sup> WorkKeys<sup>®</sup> Business Writing assessment support this statement. The WorkKeys Business Writing assessment measures the skill used when writing an original response to a work-related situation. The main requirement of workplace writing is clarity. Employers want their employees' written communications to be direct, grammatically correct, and easy to read. Since the WorkKeys Workplace Documents assessment uses authentic workplace documents for item passages, qualitative measures are even more important than quantitative measures when determining text complexity for workplace documents.

## **WorkKeys Applied Math and CCRSAE Mathematics**

In applying mathematical skills to workplace problems, employees must utilize their understanding of mathematics and quantitative reasoning to derive the process or procedure

for solving the problem. An employee may be expected to set up and solve the problem. In other cases, the employee will need to determine what data is relevant and pertinent to solving the problem. To be successful with applying math in the workplace, workers need to be able to blend the following:

- Apply and integrate mathematical concepts, procedures, and skills
- Understand the types of practical tasks that require mathematical solutions
- Identify the strategic mathematical process required to solve the specified problems
- Identify pertinent or relevant information or data for use in solving the problem

Each step in solving a workplace Applied Math problem—from defining the problem through evaluating the results—requires a comprehensive understanding of mathematics. In the workplace, context provides the purpose for doing the work and a practical need to know the result exists. Finding the best solution in the workplace can be the difference between an effective and efficient operation or one filled with problems, mistakes, and lost opportunities. Mathematical problem solving is often intertwined with other issues, where the mathematical result is linked to business success.

The CCSS for Mathematics takes a similar view as indicated by its two central parts: 1) the Standards for Mathematical Practice and 2) the Standards for Mathematical Content. According to Pimentel (2013), “the Standards for Mathematical Practice describe habits of mind that mathematics educators at all levels of learning should seek to develop in their students. These practices rest on “processes and proficiencies” with established significance in mathematics education...”. The Standards for Mathematical Content are a balanced combination of procedural fluency and conceptual understanding intended to be connected to the Practices across domains and at each level. The Practices define ways students are to engage with the subject matter as they grow in mathematical maturity and expertise across levels.

For the purposes of this study, the Standards for Mathematical Content were crosswalked to the WorkKeys Applied Math assessment. The NRS EFL mathematics descriptors are divided into six educational functioning levels that correspond to CCR levels as shown in the table below. Each of the levels correspond roughly to two grade levels, in K-12 terms, except for Level E, which combines the critical concepts of all of grades 9 through 12.

**Table 2. CCRSAE Math Grade-Level Groupings**

<b>EFL ELA/Literacy Levels</b>	<b>CCR Standards Level</b>	<b>Grade-Level</b>
<b>Beginning Literacy</b>	Level A	K-1
<b>Beginning Basic</b>	Level B	2-3
<b>Low Intermediate</b>	Level C	4-5, 6
<b>Middle Intermediate</b>	Part of Level D	6, 7-8
<b>High Intermediate</b>	Remainder of Level D	
<b>Adult Secondary</b>	Level E	High School

## **WorkKeys Graphic Literacy and CCRSAE Mathematics and ELA/Literacy**

The WorkKeys Graphic Literacy skill is the skill people use when they work with workplace graphics such as tables, graphs, charts, digital dashboards, flow charts, timelines, forms, maps, and blueprints. Employees use this skill when they find, summarize, compare, and analyze information to make decisions using workplace graphics to solve work-related problems. The development of the personal computer in the late 1970s and the subsequent development of office software packages designed to improve workplace communication and productivity has led to the development and use of more and more graphical representations in the workplace (Few, 2012). ACT further confirmed the importance of graphical literacy skills through the findings of the ACT National Curriculum Survey (NCS) (ACT, 2016). The NCS found that employers identify the ability to analyze and interpret data in graphs and tables as an important workplace skill. As a result, ACT has concluded that the ability to comprehend and accurately interpret graphic materials in the workplace has become as foundationally important to worker success as the ability to read written communications and solve mathematical problems.

The College and Career Readiness Reading Anchor 7 acknowledges how important it is for students to be able to integrate and evaluate content presented in diverse media and formats, including maps, charts, diagrams, flowcharts, models, graphs, and tables. The College and Career Readiness standards for Math repeatedly require students to use number line diagrams, coordinate axes, use addition and multiplication tables, interpret key features of graphs and tables, and use graphs to represent and compare data. For example, students will need to interpret unit rate as the slope of a graph.

Graphic Literacy has five levels of difficulty. Level 3 is the least complex and Level 7 is the most complex. At each new level, employees need more demanding skills in addition to the skills used at the previous levels. For example, Level 5 includes the skills used at Levels 3, 4, and 5. At the lower levels, employees may need to locate or find information in a simple graphic. At the higher levels, employees may use information in one or more difficult graphics to draw conclusions and make decisions. The complexity can also increase as the quantity and/or density of the information increases.

## **Methodology**

### **Development of Materials for Study**

Four spreadsheets were prepared using standards identified in the CCRSAE report by Pimentel (2013):

- A. English Language Arts and Literacy Standards for Reading, Reading Standards: Foundational Skills, and Language crosswalk to
  1. WorkKeys Workplace Documents assessment
  2. WorkKeys Graphic Literacy assessment



- B. Mathematics crosswalk to**
- 1. WorkKeys Applied Math assessment**
  - 2. WorkKeys Graphic Literacy assessment**

An initial crosswalk was completed by Dr. Cindy Hill, an Industrial/Organizational Psychologist with ACT for more than 25 years and who is a major contributor to the design and presentation of the WorkKeys Job Profiling Training Program. She also contributed to the updating of the WorkKeys assessments in 2017 to ensure ongoing relevance and alignment to today's jobs and conducted the standard setting study for the revised assessments. The WorkKeys skill level descriptors and technical manuals for each of the three WorkKeys skills were used as reference material during the crosswalk process. Dr. Hill also reviewed the CCRSAE report in order to understand the background, rationale and intent of their development.

During the initial crosswalk, Dr. Hill found that it was sometimes difficult to assign a specific WorkKeys level to a specific standard because one aspect of the standard might call for something that could not or should not be addressed in a WorkKeys assessment such as explaining why a particular strategy worked. As a result, Dr. Hill defined four levels of crosswalk strength.

- High indicates that an examinee scoring at the specified WorkKeys level would more than likely be able to demonstrate the majority or main part of the standard.
- Medium indicates that an examinee scoring at the specified WorkKeys level would more than likely be able to demonstrate one or two aspects of the standard, but not the main part or the majority of the standard.
- Low indicates that an examinee scoring at the specified WorkKeys level would more than likely be able to demonstrate an aspect of the standard, but not the main part or the majority of the standard. For example, an examinee that scores at Level 3 could probably mentally find 10 more or 10 less than a two-digit number without having to count and explain the reasoning used, but examinees are provided with a calculator so this is not directly assessed.
- Supporting - If an examinee scores at the specified WorkKeys level, they would more than likely have met this standard even though it is below the level or not directly covered by WorkKeys (e.g., must understand place value to convert decimals to fractions.)

For example, CCRSAE Mathematics Standard 2.NBT.9 asks students to explain why addition and subtraction strategies work, using place value and the properties of operations. This standard was crosswalked as supporting WorkKeys Applied Math Level 3. In the workplace, an employee probably won't be asked to explain why they chose to add or subtract to find an answer, as long as they arrive at the correct answer. In fact, employees are usually told exactly what math to perform when they are in jobs that just require them to add and subtract (i.e., it isn't their decision or responsibility to decide).

## Panelist Selection and Training

Panelists were invited to participate based on their prior experience using the WorkKeys curriculum and/or assessments as part of an adult basic education program and to nominate additional panelists. In some instances, multiple staff from the same institution, but different areas volunteered to participate. Multiple participants from one institution were accepted if their roles in the adult basic education program differed (e.g., program administrators at different levels, instructors primarily in math or language). Twenty-three individuals volunteered or were nominated. Fourteen individuals returned the Memorandum of Understanding to ACT. Panelists were volunteers and did not receive an honorarium.

On March 3 and 5 in 2020, Dr. Hill conducted webcasts with panelists to review reference materials including the College and Career Readiness Standards for Adult Education (2013) and the ACT WorkKeys Skill Descriptions for the three skills that make up the WorkKeys NCRC. For each WorkKeys NCRC skill, the skill definition was provided and reviewed, as were the skill descriptions for each level of the skill, four sample items at each level, and a summary chart for easy reference. In addition, a table from the Workplace Documents Technical Manual outlining the criteria for documents included in the assessment was provided. Panelists were also walked through the layout of the spreadsheets and their task following the training. Specifically, panelists were asked to agree or disagree with the level Dr. Hill associated with each standard, the strength of the association, and/or her notes explaining the reason for the association. Panelists were also asked to provide an explanation for their decisions. Dr. Hill's definitions for strength of the link were also reviewed and discussed. Panelists were encouraged to contribute to the discussion and ask questions throughout the webcasts. The webcast closed by reviewing the timeline and procedure to return the spreadsheets. The webcast was also recorded and provided to panelists who could not attend the live webcast or wanted it for reference as they completed the activity.

Unfortunately, the Covid-19 pandemic disrupted the timeline and availability of the panelists. Adult basic education programs were forced to move to all on-line offerings very quickly and the panelists were often involved in this endeavor. As a result, two panelists were not able to participate at all. Some of the remaining panelists were only able to complete a subset of the spreadsheets, or if they were from the same organization provided input and then a representative submitted one response for the group. The list of panelists is provided in Table 3.

The panelist's responses were consolidated into one spreadsheet. The data consolidated included their agreement or disagreement with the WorkKeys Level, strength of the link, or the reason provided by Dr. Hill for the decisions she made. Dr. Hill reviewed the data and made modifications. A draft of this report and the updated appendices were provided to the panelists for review. The panelists provided edits to both the text of the report and to the appendices. Two panelists expressed concern about the following standards crosswalk to WorkKeys.

Reading Standard Anchor 5:C:RI.5.5 Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts.

**Table 3.** Panelists

Name	Job Title	Organization	State	Years of Experience
<b>Kenesha Barnes</b>	Instructor	Grenada Adult Education Center	MS	12
<b>Anne Bowman</b>	Adult Education Coordinator	Career & Technology Education Centers (C-TEC)	OH	9
<b>Rachel Embrey</b>	Adult Education Instructor	NEMCC-Corinth Adult Education	MS	9
<b>Lynda Geoffroy</b>	Instructional Specialist	Hagerstown Community College	MD	10
<b>Tammy Green</b>	Director of Workforce & IT Innovation	Metropolitan Community College	NE	26
<b>Cindy Heimbach</b>	Instructional Development Specialist	Grenada Adult Education Center	MS	26.5
<b>Chris Maul</b>	Adult Education Coordinator/Woodall Center Site Supervisor	Pearl River Community College	MS	15
<b>Bronwyn Robertson</b>	Program Specialist for Workforce & Employer Engagement	Mississippi Community College Board	MS	16
<b>Dawn Schoenenberger</b>	Director of Developmental Educational & Adult Literary Services	Hagerstown Community College	MD	16

When the Reading for Information assessment was updated to Workplace Documents, multiple related documents was added as a document type to give examinees the opportunity to demonstrate that they are able to read complex text materials, understand and apply differing perspectives, and utilize the information contained in these documents to complete workplace tasks. The definition of multiple related documents is that they consist of two or more documents that are related or cover a common topic and have two or more authors. At Workplace Documents Level 5, employees may be asked to apply information/instructions to a new situation that is similar to the one described in the material while considering changing conditions, or apply complex information/instructions that include conditionals to situations described in the materials. Examinees may be presented with two texts and asked to make a comparison, identify cause/effect, or identify a problem/solution at Level 5. Additional information is available in the ACT WorkKeys Workplace Documents Technical Manual. As a result, Reading Standard Anchor 5:C:RI.5.5 remained linked to Workplace Documents Level 5 with a medium strength.

Anchor 5:D:RI.6.5 Analyze how a particular sentence, paragraph, chapter, or section fits into the overall structure of a text and contributes to the development of the ideas.

Anchor 5:D:RI.7.5 Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to the development of the ideas.

The panelists did not believe these standards should be linked to Workplace Documents Level 5 with a low strength link because examinees will not be asked to analyze a text in this way. The link was changed to not applicable because while examinees may need to consider how major sections of a text contribute to the whole and to the development of ideas in order to perform their task, this isn't the main focus of what they are being asked to do on the assessment. The same is true for Anchor 5:D:RI.7.5.

Anchor 6:E:RL.11-12.6 Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).

The panelists did not believe this standard should be linked to Workplace Documents Level 6 with a high strength link because the stimulus for workplace document items will not contain satire, sarcasm, irony, or understatement. While examinees will need to infer the meaning of an words from context, apply principles inferred from the materials to a situation not directly described or to a completely new situation, identify the rationale behind an entire document or a section of a document, and infer implied details, they will not encounter satire, sarcasm, or irony. The link was changed to not applicable for this reason.

Language Standards Anchor 4:D:L.6.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from a range of strategies.

- a. Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
- b. Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., audience, auditory, audible).
- c. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

These standards were linked to Workplace Documents Level 5 with a high strength of link. The panelists pointed out that other assessments aligned to the CCRS asks examinees to pick the meaning of the word and recommended lowering the strength of the link to supporting. After reviewing the standards and the explanation for the link, Dr. Hill lowered the strength of the link to medium and clarified and expanded on the explanation regarding the link for Language Standards Anchor 4:D:L.6.4 and sub-standard a. The explanation now reads, "At Workplace Documents Level 5, examinees can be asked to figure out the appropriate meaning of a word based on how the word is used in a document and to identify the appropriate meaning of technical term, jargon, or an acronym that is defined in the document. The strength of the link is medium because the strategy used will not be assessed." The strength of the link for Language Standards Anchor 4:D:L.6.4 and sub-standard b was lowered to supporting based on advice from the two panelists and sub-

standard d changed to not applicable because examinees will never be asked to verify an answer on the assessment.

## Data Analysis

The panelist’s responses were consolidated into one spreadsheet. The data consolidated included their agreement or disagreement with the WorkKeys Level, strength of the link, or the reason provided by Dr. Hill for the decisions she made. Dr. Hill reviewed the data and made modifications. The final detailed tables for each of the four spreadsheets are provided in the Appendices.

### CCRSAE Mathematics Crosswalk to WorkKeys Applied Math

As shown in Table 4, everything the WorkKeys Applied Math assessment measures is covered by the CCRSAE standards. The WorkKeys Applied Math Skill levels crosswalk to all but 19 of the 263 CCRSAE standards. As expected, the majority of the CCRSAE Mathematics Level A and B standards crosswalk to WorkKeys Applied Math skill levels 3 and 4 (72.7%), and the majority of the CCRSAE Mathematics Level D and E standards crosswalk to WorkKeys Applied Math skill levels 5, 6, and 7 (76.4%). Slightly more CCRSAE Mathematics Level C standards crosswalk to WorkKeys Levels 3 and 4 (57.8%) than to Levels 5, 6, and 7 (42.2%).

**Table 4.** CCRSAE Mathematics Crosswalk to WorkKeys Applied Math Skill Levels

WorkKeys Skill Levels	CCRSAE Mathematics Levels					Total	
	A	B	C	D	E	Count	%
Level 3	12	22	18	1	0	53	20.15
Level 4	1	5	30	24	0	60	22.81
Level 5	2	11	21	14	8	56	21.29
Level 6	1	1	5	18	11	36	13.69
Level 7	0	0	9	10	20	39	14.83
Not Crosswalked	0	0	2	14	3		

Table 5 shows the strength of the crosswalk between the WorkKeys Applied Math skill levels and the CCRSAE Levels. Overall, 58.6% of the links were of high strength and 34.4% were supporting.

**Table 5. CCRSAE Mathematics Crosswalk to WorkKeys Applied Math Skill Levels with Strength of Link**

WorkKeys Skill Levels	CCRSAE Levels				
	A	B	C	D	E
<b>WorkKeys Level 3</b>	12	22	18	1	0
High	8	13	8	1	
Medium			3		
Low	1	3			
Supporting	3	6	7		
<b>WorkKeys Level 4</b>	1	5	30	24	0
High		2	25	13	
Medium			2	2	
Low				2	
Supporting	1	3	3	7	
<b>WorkKeys Level 5</b>	2	11	21	14	8
High			9	10	6
Medium			1	1	1
Supporting	2	11	11	3	1
<b>WorkKeys Level 6</b>	1	1	5	18	11
High			3	14	6
Low				1	
Supporting	1	1	2	3	5
<b>WorkKeys Level 7</b>	0	0	9	10	20
High			6	7	12
Supporting			3	3	8
N/A	0	0	2	14	3

As shown in Table 6, CCRSAE domains for K-8 crosswalked primarily to WorkKeys Applied Math Levels 3, 4 and 5, and CCRSAE high school domains crosswalked primarily to WorkKeys Applied Math Levels 6 and 7.

**Table 6. CCRSAE Mathematics Crosswalk to WorkKeys Applied Math Skill Levels by Domain**

CCRS AE Applied Mathematics Domains	WorkKeys Applied Math Skill Levels						Grand Total
	3	4	5	6	7	n/a	
<b>Domains for K-8</b>							
Number and Operations in Base Ten (K-5)	28	2	1				31
The Number System (6-8)	1	22	2	1			26
Number and Operations - Fractions (3-5)	1	17	5				23
Ratios and Proportional Relationships			8	3	1		12
Operations and Algebraic Thinking (K-5)	16	6	2			1	25
Expressions and Equations (6-8)	5	9	5	11			30
Functions (8)					3	1	4
Geometry (K-8)			7	5	5	1	18
Measurement and Data (K-5)	2	4	18	5	2	1	32
Statistics and Probability (6-8)					8	12	20
<b>Domains for High School</b>							
The Real Number System					1		1
Number and Quantity			2				2
Algebra: Seeing Structure in Expressions				5			5
Algebra: Arithmetic with Polynomials and Rational Expressions				2			2
Algebra: Creating Equations			1		3		4
Algebra: Reasoning with Equations and Inequalities			3	1	2		6
Functions: Interpreting Functions			2	3	3		8
Functions: Building Functions					1		1
Functions: Linear, Quadratic, and Exponential Models					4		4
Geometry: Congruence						1	1
Geometry: Similarity, Right Triangles, and Trigonometry					1		1
Geometry: Geometric Measurement and Dimension					1		1
Geometry: Modeling with Geometry					1		1
Statistics and Probability: Interpreting Categorical and Quantitative Data					3	2	5
<b>Grand Total</b>	<b>53</b>	<b>60</b>	<b>56</b>	<b>36</b>	<b>39</b>	<b>19</b>	<b>263</b>

## CCRS AE ELA/Literacy Standards and WorkKeys Workplace Documents

As mentioned previously, only the Reading, Language, and Reading Standards: Foundational Skills domains crosswalked to WorkKeys Workplace Documents. The Workplace Documents skill does not address the skills of Writing, Speaking or Listening. The Standards identify four types of reading material: 1) RI: Reading Informational Text, 2) RL: Reading Literature, 3) RH: Reading Historical/Social Studies Text, and 4) RST: Reading Scientific and Technical Text. Workplace Documents text passages will not include historical or social studies text or literature such as poems or stories. As a result, most of the standards that specifically require the reading of those types of texts were determined to be not applicable. Table 7 shows the strength of the crosswalk between the WorkKeys Workplace Documents skill levels and the CCRSAE Reading Levels. Overall, 27% of the links were of high strength, 16% were medium strength, 9% were low strength, 10% were supporting, and 38% were not applicable.

**Table 7. CCRSAE ELA/Literacy Reading Standards Crosswalk to WorkKeys Workplace Documents with Strength of Link**

WorkKeys Levels	CCRS AE Levels				
	A	B	C	D	E
Level 3	6	7	0	0	0
High		6			
Medium		1			
Low					
Supporting	6				
Level 4	0	0	6	3	0
High			5	1	
Medium				2	
Low			1		
Supporting					
Level 5	1	1	4	5	3
High			2	2	
Medium			2	2	2
Low				1	1
Supporting	1	1			
Level 6	0	0	0	1	10
High				1	3
Medium					3
Low					4
Supporting					
Level 7	0	0	0	0	0
N/A	1	4	5	7	12



As shown in Table 8, three of the CCRSAE ELA/Literacy Language Standards crosswalked to the WorkKeys Workplace Documents skill levels. Language Anchor 1 requires command of the conventions of standard English grammar and usage when writing or speaking. As a result, WorkKeys Workplace Documents could not be crosswalked to this anchor because it only addresses reading. Language Anchor 2 requires command of the conventions of standard English capitalization, punctuation, and spelling when writing. Again, WorkKeys Workplace Documents could not be crosswalked because it only addresses reading. Given that panelists are WorkKeys content experts, they did point out that WorkKeys Business Writing would crosswalk to this anchor, but that skill was not included in this study. Language Anchor 3 requires knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening. Dr. Hill and the panelists decided not to crosswalk Workplace Documents to this anchor since it does not include listening or choosing words for style.

**Table 8. CCRSAE ELA/Literacy Language Standards Crosswalk to WorkKeys Workplace Documents**

CCRS AE Language Standards	WorkKeys Workplace Document Range of Levels Crosswalked
CCR Anchor 1: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	N/A
CCR Anchor 2: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	N/A
CCR Anchor 3: Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.	N/A
CCR Anchor 4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.	Levels 3-7
CCR Anchor 5: Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.	Levels 3-5
CCR Anchor 6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering a word or phrase important to comprehension or expression.	Levels 3-6

Anchors 4 through 6 require determining or clarifying the meaning of unknown and multiple-meaning words and phrases, demonstrating an understanding of figurative language, word relationships, and nuances in word meanings, and the acquisition and accurate use of a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; and the demonstration of

independence in gathering vocabulary knowledge when encountering a word or phrase important to comprehension or expression. As shown in Table 9, 50% of the standards had a high strength link to Workplace Documents. Out of 46 standards, fourteen or 30% were not applicable.

**Table 9. CCRSAE ELA/Literacy Language Anchors Crosswalk to WorkKeys Workplace Documents with Strength of Link**

WorkKeys Levels	CCRS AE Language Anchors		
	4	5	6
Level 3	4	2	3
High	1	2	3
Medium			
Low			
Supporting	3		
Level 4	2	4	4
High	1	4	4
Medium	1		
Low			
Supporting			
Level 5	6	2	1
High	1	2	1
Medium	2		
Low			
Supporting	3		
Level 6	0	0	1
High			1
Level 7	3	0	0
High	3		
N/A	9	5	0

***Reading Standards: Foundational Skills K-5.***

The CCRSAE only includes Common Core State Standards for Reading Foundational Skill standards for RF.2, RF.3, and RF.4. Anchor RF.2 focuses on demonstrating understanding of spoken words, syllables, and sounds (phonemes). Since Workplace Documents focuses on reading and not speaking, Dr. Hill and the panelists agreed that it could not be crosswalked. Anchor RF.3 focuses on knowing and applying grade-level phonics and word analysis skills in decoding words, and RF.4 focuses on reading with sufficient accuracy and fluency to support comprehension. As shown in Table 10, both RF.3 and RF.4 crosswalked to Workplace Documents Levels 3 and 4 with the exception of standards that required oral production of sounds.



**Table 10. CCRSAE ELA/Literacy Reading Standards: Foundational Skills K-5 Crosswalk to WorkKeys Workplace Documents with Strength of Link**

WorkKeys Levels	CCRSAE Reading Standards: Foundational Skills	
	3	4
Level 3	18	6
High	9	3
Supporting	9	3
Level 4	2	3
High	2	3
N/A	3	3

### CCRSAE Math and ELA/Literacy and WorkKeys Graphic Literacy

As shown in Table 11, fifty-three out of 263 math standards or 20% of the CCRSAE standards for Math at levels B, C, D and E crosswalked to the WorkKeys Graphic Literacy skill. The standards repeatedly require students to use number line diagrams, coordinate axes, use addition and multiplication tables, interpret key features of graphs and tables, and use graphs to represent and compare data. For example, students will need to interpret unit rate as the slope of a graph.

**Table 11. CCRSAE Mathematics Levels Crosswalk to WorkKeys Graphic Literacy Skill Levels**

WorkKeys Levels	CCRSAE Language Standards			
	B	C	D	E
Level 3	3	6	11	0
High	1	4	10	
Medium		1		
Supporting	2	1	1	
Level 4	3	1	7	1
High	1	1	4	1
Supporting	2	3		
Level 5	0	1	12	7
High		1	9	7
Supporting			3	
Level 6	0	0	1	0
High			1	
Level 7	0	0	0	0

As shown in Table 12, all of the K-8 domains with the exception of Number and Operations in Base Ten (K-5) and three out of 14 High School domains crosswalked to the WorkKeys Graphic Literacy Skill. One standard crosswalked to WorkKeys Graphic Literacy skill Level 6 and none to Level 7.

**Table 12. CCRSAE Mathematics Crosswalk to WorkKeys Graphic Literacy Skill Levels by Domain**

CCRS AE Applied Mathematics Domains	WorkKeys Graphic Literacy Levels					Grand
	3	4	5	6	7	Total
<b>Domains for K-8</b>						
The Number System (6-8)	10					10
Number and Operations - Fractions (3-5)	1					1
Ratios and Proportional Relationships		5				5
Operations and Algebraic Thinking (K-5)		1				1
Expressions and Equations (6-8)	1	2	4			7
Functions (8)			4			4
Geometry (K-8)	2					2
Measurement and Data (K-5)	5	2				7
Statistics and Probability (6-8)	1	1	5	1		8
<b>Domains for High School</b>						
Number and Quantity			1			1
Functions: Interpreting Functions		1	3			4
Statistics and Probability: ICQD			3			3
<b>Grand Total</b>	<b>20</b>	<b>12</b>	<b>20</b>	<b>1</b>	<b>0</b>	<b>53</b>

## Conclusions and Recommendations

The results of this study demonstrate that the three WorkKeys assessments making up the WorkKeys NCRC crosswalk to the CCRSAE, a subset of the Common Core State Standards. Since the National Reporting System's (NRS) Educational Functioning Levels (EFL) for Mathematics and Language Arts also use the CCRSAE as their foundation, the results of this study can be extended to demonstrate a crosswalk to the NRS EFLs.

The WorkKeys Curriculum is the only curriculum built from the ground up to align with the assessments. As a result, this crosswalk can also be used to demonstrate alignment between the WorkKeys Curriculum and the CCRSAE. The WorkKeys Curriculum covers Levels 1 through 7 for all three skills that make up the WorkKeys NCRC while the WorkKeys Assessments only cover Levels 3-7. A future study should examine the crosswalk between the WorkKeys Curriculum and the CCRSAE. The extent of the crosswalk of the CCRSAE by the WorkKeys NCRC skills may be greater and the links may be stronger at the lower CCRSAE levels.

Three panelists provided a description of how their organization has incorporated WorkKeys into their ABE programs.

Tammy Green, Director of Workforce & IT Innovation-Career Skills & Adult Education at Metropolitan Community College (MCC) in Omaha, Nebraska explained how they use the WorkKeys Curriculum with ABE NRS Level 4, 5, and 6 classes. This program aligns specifically with Integrated Education and Training (IET). IET is a service approach that provides adult education and literacy activities concurrently and contextually with workforce preparation activities and workforce training for a specific occupation or occupational cluster for the purpose of educational and career advancement (§463.35). Integrated Education and Training is the core educational strategy for career pathways developed between WIOA partners. The academic component of IET must be aligned with a state's content standards, and the IET program must be part of a career pathway. Therefore, an IET program must include the following three components: (1) adult education and literacy activities, (2) workforce preparation activities, and (3) workforce training (§463.36). In addition, as part of a career pathway (§463.37), the design of an IET program should support the local and state workforce development board plans as required under WIOA. With this alignment, WorkKeys Curriculum has solid application and will address activities 1 and 2.

1. WorkKeys Curriculum addresses skills gaps and provides adult education and literacy activities.
2. Since the WorkKeys Curriculum aligns with the WorkKeys NCRC that also aligns with a specific job, the WorkKeys Curriculum will prepare students for the workforce. Students will complete the WorkKeys NCRC as they enter into the IET programs and also at the conclusion of the technical training program.

Lynda Geoffroy, Instructional Specialist and Dawn Schoenenberger, Director of the Program of Adult Literacy Services (PALS) at Hagerstown Community College (HCC) in Hagerstown, Maryland shared that they have implemented the WorkKeys Curriculum into their Program of

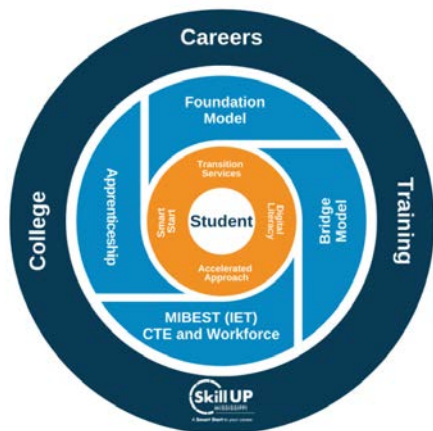
Adult Literacy Services, more specifically, through their Integrated English Language and Civics Education (IELCE) Bridge course in preparation for students' eligibility into an Integrated Education and Training (IET) program that uses the curriculum with ESL NRS Levels 3, 4, 5 and 6. The IELCE portion provides English Language Learners (ELL) the opportunity to receive instruction in literacy, English language acquisition and instruction on the rights and responsibilities of citizenship and civic participation (§463.33) for ELLs who are adults, including professionals with degrees and credentials in their native countries (§463.70). The expanded use of up to 30% of IELCE/IET, WIOA 243, funding to support ESL NRS Level 3 learners provides support by offering bridge classes that prepare students to enter the combined IELCE and IET in future sessions. In addition, to become eligible for the IETP at Hagerstown Community College, the career training programs require completion of the WorkKeys NCRC. The WorkKeys Curriculum component provides ELLs with workforce preparation activities. As referenced above in the example of Metropolitan Community College, it is the same alignment that Hagerstown Community College's PALS seek as a WIOA partner with an IET program as part of a career pathway and we have come to the same conclusion in understanding that the solid application does address the following activities:

1. WorkKeys Curriculum addresses skill gaps and provides adult education and literacy activities and includes the Essential Skills Module providing personal development and promotes effective job performance.
2. The alignment of the WorkKeys Curriculum to the WorkKeys NCRC and to a specific career, the WorkKeys Curriculum will prepare learners for the workforce.
3. Learners will complete the WorkKeys NCRC upon completion of the IELCE/IET Bridge course in preparation for entry into the IET.

Bronwyn Robertson, Program Specialist for Workforce & Employer Engagement in the Mississippi Community College Board's Office of Adult Education (OAE), explained how OAE partners with adult education programs and community colleges across Mississippi to develop and establish a career pathway system inclusive of all eligible students and populations. The development and implementation of career pathways programming is an integral part of the initiatives set forth by the Workforce Innovation and Opportunity Act of 2014 (WIOA) and is even codified as one of the thirteen program considerations (WIOA Sec. 231 (e)(10)). The entire model is student-centered and based on the needs, goals, aptitude, and interests of the individual. Components of the model:

- Smart Start Pathway Course
  - Career Exploration
    - Specific to State Job Sector
    - ACT WorkKeys Curriculum
  - Financial Literacy
  - Essential Workplace Skills
- WorkKeys National Career Readiness Certificate (NCRC)
- Digital Literacy
- Transition Services

The goal of Career Pathways for Adult Education is to offer multi-level career pathway options with multiple entry points into postsecondary education and/or workforce training programs for students of all educational levels: Bridge, Foundation, and Mississippi Integrated Basic Education and Skills Training (MIBEST).



MIBEST is an accelerated service approach delivering adult education activities, workforce preparation (Smart Start), and occupational skills training concurrently and contextually. The adult education component of MIBEST is aligned with the College and Career Readiness Standards and workforce preparation is specifically designed to meet the vision of Mississippi’s WIOA Combined State Plan.

Career pathways in adult education, developed with the guidance from the State Workforce Investment Board and Local Workforce Investment Boards, align with state strategies and local/regional plans. Currently, with over 2,600 employers recognizing the WorkKeys NCRC in hiring practices, not to mention all community colleges requiring the WorkKeys NCRC as a prerequisite for a majority of CTE and/or workforce programs, the OAE believes it’s a key foundation to provide students not only with a marketable workplace credential, but it connects them to other credentials on their pathway.

The Smart Start Pathway Course is a 45-hour course of study focusing on essential skills needed to become work-ready. All students are enrolled in the online WorkKeys Curriculum aligned to the WorkKeys NCRC.

Participants who meet the minimum requirements of the course receiving both the Smart Start Credential and the WorkKeys NCRC, can earn up to three hours of college credit from participating community colleges. The community college admission office determines issuing of prior learning assessment or college credit as well as creating articulation agreements with the local adult education program.

The WorkKeys Curriculum serves many purposes in adult education:

- Identify and analyze competency skills gaps in order to inform instructional practices (MS WIOA State Plan Goals)
- Promote transition options for college, training, and careers within the community (MS WIOA Combined Plan Goals and NRS reporting)
- Address the components of the IET/MIBEST program (WIOA §463.35, MS WIOA Combined Plan Goals, and NRS reporting)
- Workforce and/or CTE training competencies for purposes of educational and career advancement (WIOA §463.37 and MS WIOA Combined Plan Goals)
- Supports students’ development of workplace skills - IET Single Set of Learning Objectives (WIOA §463.37)

- Assist with career exploration/development – a) workplace and b) workforce activities – (MS WIOA Combined Plan Goals, NRS Reporting, and WIOA §463.34)
- Assist with contextualized instruction and occupational relevant instructional materials (WIOA §463.37 and MS WIOA Combined State Plan Goals)
- Proven tool for helping individuals acquire skills critical to workplace success, increase measurable skill gains, and improve test scores on the WorkKeys Assessments leading to the WorkKeys NCRC.
  - The WorkKeys NCRC’s role in adult education:
    - Requirement of the state issued credential, MS Smart Start
    - One of the requirements to enroll in MIBEST
    - One of the three (3) ways an individual can demonstrate eligibility for Ability to Benefit.
      - Through the OAE’s efforts, Mississippi became the fourth state in the nation to allow students without a high school diploma to potentially receive Federal student financial aid for enrolling in a MIBEST program at a Mississippi community college.



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## Appendix A. CCRSAE ELA/Literacy Crosswalk to ACT WorkKeys Workplace Documents

### Reading Standards

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
<b>Anchor 1: Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.</b>					
<b>A</b>	RI/RL.1.1	Ask and answer questions about key details in a text.	3	Supporting	Find the main ideas and clearly stated details. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
<b>B</b>	RI/RL.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.	3	Medium	Find the main ideas and clearly stated details.
<b>C</b>	RI/RL.4.1	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.	4	High	Identify main Ideas and details that may not be clearly stated and conditions that require the reader to decide what action should be taken in a specific situation.
<b>C</b>	RI/RL.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.	N/A		WorkKeys Workplace Documents is a multiple-choice test, so quoting is not possible.
<b>D</b>	RI/RL.7.1	Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.	5	Medium	Identify the main idea and details that may not be clearly stated because there are so many details, and some may not be needed for the task being performed (extraneous information). They may need to make inferences to accomplish their goal.
<b>D</b>	RH.6-8.1	Application: cite specific textual evidence to support analysis of primary and secondary sources.	N/A		Not applicable because WorkKeys Workplace Documents will not include historical texts.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
D	RST.6-8.1	Application: cite specific textual evidence to support analysis of science and technical texts.	5	Medium	Identify the main idea and details that may not be clearly stated because there are so many details, and some may not be needed for the task being performed (extraneous information). They may need to make inferences to accomplish their goal.
E	RI/RL.9-10.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.	6	Medium	The information that employees need is not stated clearly. They may need to make some inferences to accomplish their goal. Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.
E	RH.9-10.1	Application: cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.	N/A		WorkKeys Workplace Documents does not include historical texts.
E	RST.9-10.1	Application: cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.	6	Medium	The information that employees need is not stated clearly. They may need to make some inferences to accomplish their goal. Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.

Anchor 2: Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
A	RI.1.2	Identify the main topic and retell key details of a text.	3	Supporting	Find the main ideas and clearly stated details. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
B	RI.3.2	Determine the main idea of a text; recount the key details and explain how they support the main idea.	3	High	Find the main ideas and clearly stated details.
C	RI.4.2	Determine the main idea of a text and explain how it is supported by key details; summarize the text.	4	High	They are straightforward with some long sentences and contain a number of details. Identify the main idea and details that may not be clearly stated.
C	RL.4.2	Determine a theme of a story, drama, or poem from details in the text; summarize the text.	N/A		WorkKeys Workplace Documents text does not include stories, dramas, or poems.
D	RI/RL.6.2	Determine a theme or central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.	4	High	They are straightforward with some long sentences and contain a number of details. Identify the main idea and details that may not be clearly stated.
D	RST.6-8.2	Application: determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.	4	Medium	They are straightforward with some long sentences and contain a number of details. Identify the main idea and details that may not be clearly stated.
E	RI/RL.9-10.2	Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.	5	Medium	The information that employees need is generally stated directly, but it is hard to find because there are so many details, and some may not be needed for the task being performed (extraneous information). They may need to make some inferences to accomplish their goal.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
E	RST.11-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.	N/A		WorkKeys Workplace Documents is a multiple-choice test, so paraphrasing isn't possible.
<b>Anchor 3: Analyze how and why individuals, events, and ideas develop and interact over the course of a text.</b>					
A	RI.1.3	Describe the connection between two individuals, events, ideas, or pieces of information in a text.	3	Supporting	Apply information/instructions to a situation that is the same as the one they are reading about. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
B	RI.3.3	Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.	3	High	Apply information/instructions to a situation that is the same as the one they are reading about.
C	RI.4.3	Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.	4	High	They are straightforward with some long sentences and contain a number of details. Identify the main idea and details that may not be clearly stated.
D	RI.8.3	Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories).	4	Medium	When following the procedures, employees must think about changing conditions that affect what they should do. For example, they can follow directions that include "if/then" statements. When employees use Level 4 skills, they apply information/instructions to a situation that is the same as the situation in the reading materials.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
D	RH.6-8.3	Application: identify key steps in a text's description of a process related to history/social studies (e.g., how a bill becomes law, how interest rates are raised or lowered).	N/A		WorkKeys Workplace Documents does not include historical texts
D	RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	5	High	Apply information/instructions to a new situation that is similar to the one described in the material while considering changing conditions. Apply complex information/instructions that include conditionals to situations described in the materials.
E	RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.	6	Medium	Documents may be long and/or complex and/or contain conditional situations. Apply information/instructions to a situation not directly described or to a completely new situation. Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.
E	RH.9-10.3	Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.	N/A		WorkKeys Workplace Documents text does not include historical texts
E	RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.	6	High	Documents may be long and/or complex and/or contain conditional situations. Apply information/instructions to a situation not directly described or to a completely new situation.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
<b>Anchor 4: Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.</b>					
A	RI.1.4	Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.	3	Supporting	WorkKeys Workplace Documents is a multiple-choice test, so it is not possible to ask questions. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
B	RI.3.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a topic or subject area.	3	High	Short sentences and common, everyday, and workplace words (such as employee, timecard, office) are used.
C	RI.5.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a topic or subject area.	4	High	These materials use common words, but do have some harder words, too. Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms).
C	RL.5.4	Determine the meaning of words and phrases as they are used in a text, including figurative language such as metaphors and similes.	5	High	The materials include technical terms, jargon, and acronyms, or words that have several meanings. Figure out the appropriate meaning of a word based on how the word is used. Identify the appropriate meaning of technical term, jargon, or an acronym that is defined in the document. Apply technical terms and jargon to stated situations
D	RI/RL.6.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of a specific word choice on meaning and tone.	5	High	See note for standard RL5.4

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
E	RI/RL.9-10.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).	5	Medium	See note for standard RL5.4
E	RST.9-10.4	Application: determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.	6	High	There are implied and/or extraneous details with difficult words, jargon, and technical terms. Most of the information is not clearly stated. Meanings may need to be determined from context. Infer the meaning of an acronym, jargon, or technical term from context
<b>Anchor 5: Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.</b>					
A	RI.1.5	Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.	3	Supporting	Identify main ideas and details. Policies, procedures, and announcements often have headings and other text features that can help the reader to locate key fact or information. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
B	RI.2.5	Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.	3	High	Identify main Ideas and details. Policies, procedures, and announcements often have headings and other text features that can help the reader to locate key fact or information.



Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
B	RI.3.5	Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.	N/A		Since WorkKeys Workplace Documents is a multiple-choice test there aren't any text features and search tools.
C	RI.4.5	Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.	4	High	When following the procedures, employees must think about changing conditions that affect what they should do. For example, they can follow directions that include “if-then” statements.
C	RI.5.5	Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts.	5	Medium	When the Reading for Information assessment was updated to Workplace Documents, multiple related documents was added as a document type to give examinees the opportunity to demonstrate that they are able to read complex text materials, understand and apply differing perspectives, and utilize the information contained in these documents to complete workplace tasks. The definition of multiple related documents is that they consist of two or more documents that are related or cover a common topic and have two or more authors. Additional information is available in the ACT WorkKeys Workplace Documents Technical Manual at: <a href="https://www.act.org/content/dam/act/unsecured/documents/WorkKeys-Workplace-Documents-Technical-Manual.pdf">https://www.act.org/content/dam/act/unsecured/documents/WorkKeys-Workplace-Documents-Technical-Manual.pdf</a>

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
D	RI.6.5	Analyze how a particular sentence, paragraph, chapter, or section fits into the overall structure of a text and contributes to the development of the ideas.	N/A		
D	RI.7.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to the development of the ideas.	N/A		
E	RI.9-10.5	Analyze in detail how an author's ideas or claims are developed and refined by particular sentences, paragraphs, or larger portions of a text (e.g., a section or chapter).	6	Low	Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.
E	RI.11-12.5	Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.	6	Low	See note for standard RI.9-10.5
<b>Anchor 6: Assess how point of view or purpose shapes the content and style of a text.</b>					
B	RI.2.6	Identify the main purpose of a text, including what the author wants to answer, explain, or describe.	3	High	Find the main ideas and clearly stated details.
B	RI.3.6	Distinguish their own point of view from that of the author of a text.	N/A		WorkKeys Workplace Documents is a multiple-choice test so it isn't possible to distinguish the examinees point of view from that of the author of a text.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
C	RI.5.6	Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.	5	Medium	At Level 5, workplace documents include policies, procedures, announcements, legal and <i>multiple related documents</i> that have many details They may need to make some inferences to accomplish their goal.
C	RL.5.6	Describe how a narrator’s or speaker’s point of view influences how events are described.	N/A		WorkKeys Workplace Documents is a multiple- choice test so it isn’t possible for an examinee to provide this level of detail
D	RI.8.6	Determine an author’s point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.	6	High	Identify the rationale behind a procedure, policy, or communication.
D	RH.6-8.6	Identify aspects of a text that reveal an author’s point of view or purpose (e.g., loaded language, inclusion or avoidance of particular facts).	N/A		WorkKeys Workplace Documents does not include historical texts
E	RI.9-10.6	Determine an author’s point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose.	6	High	Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.
E	RL.9-10.6	Application: analyze a particular point of view or cultural experience reflected in a work of literature from outside the United States, drawing on a wide reading of world literature.	N/A		WorkKeys Workplace Documents does not include work of literature from outside the US or world literature.
E	RL.11-12.6	Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).	6	High	Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
E	RH.9-10.6	Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.	N/A		WorkKeys Workplace Documents does not include historical texts.
<b>Anchor 7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.</b>					
A	RI.1.7	Use the illustrations and details in a text to describe its key ideas (e.g., maps, charts, photographs, political cartoons, etc.).	N/A		See crosswalk for WorkKeys Graphic Literacy skill
B	RI.3.7	Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).	N/A		See crosswalk for WorkKeys Graphic Literacy skill
B	RL.3.7	Explain how specific aspects of a text's illustrations contribute to what is conveyed by the words in a story (e.g., create mood, emphasize aspects of a character or setting).	N/A		WorkKeys Workplace Documents will not include text with illustrations.
C	RI.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.	N/A		WorkKeys Workplace Documents will not include text with illustrations.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
C	RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.	5	High	At Level 5, workplace documents include policies, procedures, announcements, legal and multiple related documents that have many details They may need to make some inferences to accomplish their goal.
D	RI.6.7	Integrate information presented in different media or formats (e.g., in charts, graphs, photographs, videos, or maps) as well as in words to develop a coherent understanding of a topic or issue.	N/A		See crosswalk for WorkKeys Graphic Literacy skill.
D	RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	N/A		
E	RH.9-10.7	Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.	N/A		See crosswalk for WorkKeys Graphic Literacy skill.
E	RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	N/A		
E	RI.11.12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.	N/A		See crosswalk for WorkKeys Graphic Literacy skill.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
<b>Anchor 8: Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.</b>					
<b>A</b>	RI.1.8	Identify the reasons an author gives to support points in a text.	3	Supporting	Find the main ideas and clearly stated details. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
<b>B</b>	RI.2.8	Describe how reasons support specific points the author makes in a text.	3	High	Find the main ideas and clearly stated details.
<b>C</b>	RI.5.8	Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).	4	Low	Find the main ideas and clearly stated details. When following the procedures, employees must think about changing conditions that affect what they should do. For example, they can follow directions that include “if-then” statements. Choose what to do when changing conditions call for a different action.
<b>D</b>	RI.8.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.	5	Low	The information that employees need is generally stated directly, but it is hard to find because there are so many details, and some may not be needed for the task being performed (extraneous information). They may need to make some inferences to accomplish their goal.
<b>E</b>	RI.9-10.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.	6	Low	Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.
<b>Anchor 9: Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.</b>					

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
A	RI.1.9	Identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).	5	Supporting	Multiple documents won't be shown until Level 5. Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
B	RI.3.9	Compare and contrast the most important points and key details presented in two texts on the same topic.	5	Supporting	Multiple documents won't be shown until Level 5.
C	RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.	N/A		WorkKeys Workplace Documents is a multiple-choice test so examinees can't write or speak.
E	RI.8.9	Analyze a case in which two or more texts provide conflicting information on the same topic and identify where the texts disagree on matters of fact or interpretation.	5	Low	At Level 5, workplace documents include policies, procedures, announcements, legal and multiple related documents that have many details They may need to make some inferences to accomplish their goal.
E	RI.9-10.9	Analyze seminal U.S. documents of historical and literary significance (e.g., Washington's Farewell Address, the Gettysburg Address, Roosevelt's Four Freedoms speech, King's "Letter from Birmingham Jail"), including how they address related themes and concepts.	N/A		WorkKeys Workplace Documents text does not include historical text of this nature.
E	RI.11-12.9	Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.	N/A		WorkKeys Workplace Documents text does not include historical text of this nature.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Note
E	RST.9-10.9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	6	Low	Apply information/instructions to a situation not directly described or to a completely new situation. Apply principles inferred in a passage to a situation not directly described or to a completely new situation. Identify the rationale behind a procedure, policy, or communication.
E	RH.9-10.9	Application: compare and contrast treatments of the same topic in several primary and secondary sources.	N/A		WorkKeys Workplace Documents text does not include historical texts



## Language Standards 4 through 6

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
<b>Anchor 4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.</b>					
A	L.1.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from an array of strategies.	5	Supporting	Identify meanings and definitions of words and phrases. Figure out the appropriate meaning of a word based on how the word is used. Identify the appropriate meaning of technical term, jargon, or an acronym that is defined in the document. Apply technical terms and jargon to stated situations Supporting since text will be simpler than WorkKeys Workplace Documents Level 3 text.
A	L.1.4	a. Use sentence-level context as a clue to the meaning of a word or phrase.	3	Supporting	See note for standard L.1.4.
A	L.1.4	b. Use frequently occurring affixes as a clue to the meaning of a word.	3	Supporting	See note for standard L.1.4.
A	L.1.4	c. Identify frequently occurring root words (e.g., look) and their inflectional forms (e.g., looks, looked, looking).	3	Supporting	See note for standard L.1.4.
B	L.2.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from an array of strategies.	5	Supporting	See note for standard L.1.4.
B	L.2.4	a. Use sentence-level context as a clue to the meaning of a word or phrase.	4	Medium	Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms).

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
B	L.2.4	b. Determine the meaning of the new word formed when a known prefix is added to a known word (e.g., happy/unhappy, tell/retell).	N/A		
B	L.2.4	c. Use a known root word as a clue to the meaning of an unknown word with the same root (e.g., addition, additional).	N/A		
B	L.2.4	d. Use knowledge of the meaning of individual words to predict the meaning of compound words (e.g., birdhouse, lighthouse, housefly; bookshelf, notebook, bookmark).	3	High	Level 3 will include short sentences and common, everyday, and workplace words (such as cleanroom, fingernail, fingertips, and inside).
B	L.2.4	e. Use glossaries and beginning dictionaries, both print and digital, to determine or clarify the meaning of words and phrases.	N/A		
C	L.4.4 and 5.4 merge	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from a range of strategies.	5	High	The materials include technical terms, jargon, and acronyms, or words that have several meanings.
C	L.4.4 and 5.4 merge	a. Use context (e.g., definitions, examples, restatements, cause/effect relationships and comparisons in text) as a clue to the meaning of a word or phrase.	4	High	The materials include technical terms, jargon, and acronyms, or words that have several meanings. Apply information/instructions to a new situation that is similar to the one described in the material while considering changing conditions. Apply complex information/instructions that include conditionals to situations described in the materials.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
C	L.4.4 and 5.4 merge	b. Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., telegraph, autograph, photograph, photosynthesis).	N/A		
C	L.4.4 and 5.4 merge	c. Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.	N/A		
D	L.6.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from a range of strategies.	5	Medium	At Workplace Documents Level 5, examinees can be asked to figure out the appropriate meaning of a word based on how the word is used in a document and to identify the appropriate meaning of technical term, jargon, or an acronym that is defined in the document. The strength of the link is medium because the strategy used will not be assessed.
D	L.6.4	a. Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.	5	Medium	See note for standard L.6.4.
D	L.6.4	b. Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., audience, auditory, audible).	5	Supporting	See note for standard L.6.4.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
D	L.6.4	c. Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.	N/A		
D	L.6.4	d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).	N/A		
E	L.11-12.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from a range of strategies.	7	H	The documents contain a lot of details, and the concepts are complicated. May cover uncommon topics (concepts) and/or contain conditional situations. There are implied and extraneous details. Advanced, unfamiliar, and/or uncommon words, technical terms, and jargon; meanings must be determined from context.
E	L.11-12.4	a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.	7	H	See note for standard L.11-12.4.
E	L.11-12.4	b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).	7	H	See note for standard L.11-12.4.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
E	L.11-12.4	c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, or its etymology or its standard usage.	N/A		Examinee will not have access to reference material
E	L.11-12.4	d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).	N/A		Examinee will not be able to verify
<b>Anchor 5: Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.</b>					
A	L.1.5	With guidance and support, demonstrate understanding of word relationships and nuances in word meanings.	N/A		
A	L.1.5	a. Sort words into categories (e.g., colors, clothing) to gain a sense of the concepts the categories represent.	N/A		
A	L.1.5	b. Define words by category and by one or more key attributes (e.g., a duck is a bird that swims; a tiger is a large cat with stripes).	N/A		
A	L.1.5	c. Identify real-life connections between words and their use (e.g., note places at home that are cozy).	3	High	Employees read the materials to find out what they should do. All the information within the document is stated clearly and directly. Short sentences and common, everyday, and workplace words (such as employee, timecard, office) are used.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
A	L.1.5	d. Distinguish shades of meaning among verbs differing in manner (e.g., look, peek, glance, stare, glare, scowl) and adjectives differing in intensity (e.g., large, gigantic) by defining or choosing them or by acting out the meanings.	3	High	See note for standard L.1.5.
B	L.3.5	Demonstrate understanding of word relationships and nuances in word meanings.	4	High	Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms). For example, the standard is met through understanding word relationships in a context such as the word "basket" in reference to the coffee pot.
B	L.3.5	a. Distinguish the literal and non-literal meanings of words and phrases in context (e.g., take steps).	4	High	Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms) such as "people come first" when explaining steps to be taken during a disaster.
B	L.3.5	b. Identify real-life connections between words and their use (e.g., describe people who are friendly or helpful).	4	High	Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms).
B	L.3.5	c. Distinguish shades of meaning among related words that describe states of mind or degrees of certainty (e.g., knew, believed, suspected, heard, wondered).	4	High	See note for standard L.3.5.
C	L.5.5	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.	5	High	Identify meanings and definitions of words and phrases. Figure out the appropriate meaning of a word based on how the word is used.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
C	L.5.5	a. Interpret figurative language, including similes and metaphors, in context.	N/A		Using these as part of the item stimulus could result in a fairness issue.
C	L.5.5	b. Recognize and explain the meaning of common idioms, adages, and proverbs.	N/A		Using these as part of the item stimulus could result in a fairness issue.
C	L.5.5	c. Use the relationship between particular words (e.g., synonyms, antonyms, homographs) to better understand each of the words.	5	High	Identify meanings and definitions of words and phrases. Figure out the appropriate meaning of a word based on how the word is used.
<b>Anchor 6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering a word or phrase important to comprehension or expression.</b>					
A	L.1.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).	3	High	Choose when to perform each step in a series of short steps. Apply information/instructions to a situation that is the same as the one they are reading about (such as knowing what button to push first after reading instructions on how to run a copy machine).
B	L.2.6	Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe (e.g., When other people are happy that makes me happy).	3	High	See note for standard L.1.6.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
B	L.3.6	Acquire and use accurately level-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships (e.g., After dinner that night we went looking for them).	3	High	See note for standard L.1.6.
C	L.4.6 and 5.6 merge	Acquire and use accurately level-appropriate general academic and domain-specific words and phrases, including those that:	4	High	Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms).
C	L.4.6 and 5.6 merge	Signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered).	4	High	See note for standard L.4.6 and 5.6 merge.
C	L.4.6 and 5.6 merge	Are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation).	4	High	See note for standard L.4.6 and 5.6 merge.
C	L.4.6 and 5.6 merge	Signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition).	4	High	When following the procedures, employees must think about changing conditions that affect what they should do. For example, they can follow directions that include “if-then” statements.



Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
D	L.8.6	Acquire and use accurately level-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	5	High	The reader must know and apply domain-specific words and phrases to understand the context and implications of workplace documents in order to draw conclusions. Standard is looking for use and comprehension of "domain-specific words and phrases". At Level 5 technical terms are used that may not be understood by a reader unfamiliar with the industry including: "valve bodies", "valve bonnets", "pistons", "risers", "castings", "molten", "pouring", casting", and "stress".
E	L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	6	High	Infer implied details to situations not directly described to new situations (e.g., Employees may make arrangements if unforeseen changes are needed during the trip, on an actual-cost basis to employees who are away from their home locale, and meals that are extravagant or excessive because of the location selected).
<b>RF.3. Know and apply grade-level phonics and word analysis skills in decoding words. (Phonics and Word Recognition)</b>					
A	RF.2.3 and 3.3 merge	Know and apply grade-level phonics and word analysis skills in decoding words.	3	Supporting	Employees read the materials to find out what they should do. Short sentences and common, everyday, and workplace words (such as employee, timecard, office) are used.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
A	RF.2.3 and 3.3 merge	Demonstrate basic knowledge of one-to-one letter-sound correspondences by producing the primary sound or many of the most frequent sounds for each consonant.	N/A		The WorkKeys Workplace Documents assessment is a multiple-choice test so examinees will not be asked to produce sounds.
A	RF.2.3 and 3.3 merge	Associate the long and short sounds with common spellings (graphemes) for the five major vowels.	N/A		See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Know the spelling-sound correspondences for common consonant digraphs.	N/A		See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Decode regularly spelled one-syllable words.	3	Supporting	Short sentences and common, everyday, and workplace words (such as employee, timecard, office) are used.
A	RF.2.3 and 3.3 merge	Distinguish between similarly spelled words by identifying the sounds of the letters that differ.	3	Supporting	See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Know final -e and common vowel team conventions for representing long vowel sounds.	3	Supporting	See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Use knowledge that every syllable must have a vowel sound to determine the number of syllables in a printed word.	3	Supporting	See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Decode two-syllable words following basic patterns by breaking the words into syllables.	3	Supporting	See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Read words with inflectional endings.	3	Supporting	See note for standard RF.2.3 and 3.3 merge.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
A	RF.2.3 and 3.3 merge	Read common high-frequency words by sight (e.g., the, of, to, you, she, my, is, are, do, does).	3	Supporting	See note for standard RF.2.3 and 3.3 merge.
A	RF.2.3 and 3.3 merge	Recognize and read grade-appropriate irregularly spelled words.	3	Supporting	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Know and apply grade-level phonics and word analysis skills in decoding words.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Distinguish long and short vowels when reading regularly spelled one-syllable words.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Know spelling-sound correspondences for additional common vowel teams.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Identify and know the meaning of the most common prefixes and derivational suffixes.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Identify words with inconsistent but common spelling-sound correspondences.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Identify words with inconsistent but common spelling-sound correspondences.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Decode words with common Latin suffixes.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Decode multisyllable words.	3	High	See note for standard RF.2.3 and 3.3 merge.
B	RF.2.3 and 3.3 merge	Recognize and read grade-appropriate irregularly spelled words.	3	High	See note for standard RF.2.3 and 3.3 merge.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
C	RF.4.3 and 5.3 merge	Know and apply grade-level phonics and word analysis skills in decoding words.	4	High	These materials use common words, but do have some harder words, too. Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms).
C	RF.4.3 and 5.3 merge	Use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.	4	High	These materials use common words, but do have some harder words, too. Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms).
<b>RF.4 Read with sufficient accuracy and fluency to support comprehension. (Fluency)</b>					
A	RF.K.4 and 1.4 merge	Read with sufficient accuracy and fluency to support comprehension.	3	Supporting	Find the main ideas and clearly stated details. Choose when to perform each step in a series of short steps. Apply information/instructions to a situation that is the same as the one they are reading about
A	RF.K.4 and 1.4 merge	Read grade-level text with purpose and understanding.	3	Supporting	See note for standard RF.K.4 and 1.4 merge.
A	RF.K.4 and 1.4 merge	Read grade-level text orally with accuracy, appropriate rate, and expression on successive readings.	N/A		The WorkKeys Workplace Documents assessment is a multiple-choice test so examinees will not be asked to read orally.
A	RF.K.4 and 1.4 merge	Use context to confirm or self-correct word recognition and understanding, rereading as necessary.	3	Supporting	See note for standard RF.K.4 and 1.4 merge.
B	RF.2.4 and 3.4 merge	Read with sufficient accuracy and fluency to support comprehension.	3	High	See note for standard RF.K.4 and 1.4 merge.

Anchor 10	CCRS-AE Code	CCRS-AE Standard	WorkKeys Level	Strength of Link	Notes
B	RF.2.4 and 3.4 merge	Read grade-level text with purpose and understanding.	3	High	See note for standard RF.K.4 and 1.4 merge.
B	RF.2.4 and 3.4 merge	Read grade-level prose and poetry orally with accuracy, appropriate rate, and expression on successive readings.	N/A		The WorkKeys Workplace Documents assessment is a multiple-choice test so examinees will not be asked to read orally.
B	RF.2.4 and 3.4 merge	Use context to confirm or self-correct word recognition and understanding, rereading as necessary.	3	High	See note for standard RF.K.4 and 1.4 merge.
C	RF.4.4 and 5.4 merge	Read with sufficient accuracy and fluency to support comprehension.	4	High	Identify the main idea and details that may not be clearly stated. Use the reading material to figure out the meaning of words that are not defined for them (not jargon or technical terms). Apply information/instructions to a situation that is the same as the situation in the reading materials. Choose what to do when changing conditions call for a different action.
C	RF.4.4 and 5.4 merge	Read grade-level text with purpose and understanding.	4	High	See note for standard RF.4.4 and 5.4 merge.
C	RF.4.4 and 5.4 merge	Read grade-level prose and poetry orally with accuracy, appropriate rate, and expression on successive readings.	N/A		The WorkKeys Workplace Documents assessment is a multiple-choice test so examinees will not be asked to read orally.
C	RF.4.4 and 5.4 merge	Use context to confirm or self-correct word recognition and understanding, rereading as necessary.	4	High	See note for standard RF.4.4 and 5.4 merge.

## Appendix B. CCRSAE Mathematics Crosswalk to ACT WorkKeys Applied Math

Mathematics Standards Level A	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
<b>Numbers and Operations: Base Ten</b>				
<b>Understand place value</b>				
Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand special cases a, b, and c.	1.NBT.2	3	Supporting	Supporting because an examinee must understand place value to perform Level 3 skills of adding, subtracting, multiplying, and dividing, converting fractions and units of money.
Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols $>$ , $=$ , and $<$ .	1.NBT.3	3	Supporting	Supporting because examinees will not be required to use the symbols.
<b>Use place value understanding and the properties of operations to add and subtract</b>				
Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.	1.NBT.4	3	High	Overall Note Reminders: 1) Examinee will not be asked to relate the strategy to a written method and explain the reasoning used. 2) Examinees will be allowed to use a calculator but will have to set-up the problem.
Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	1.NBT.5	3	Low	Low because examinees do have access to a calculator and will not have to explain the reasoning used.

Mathematics Standards Level A	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	1.NBT.6	3	High	Overall Note Reminders: 1) Examinee will not be asked to relate the strategy to a written method and explain the reasoning used. 2) Examinees will be allowed to use a calculator but will have to set-up the problem.
<b>Operations and Algebraic Thinking</b>				
Represent and solve problems involving addition and subtraction				
Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	1.OA.2	3	High	Solve problems that require one type of mathematical operation. They add or subtract either positive or negative numbers such as (10 or -2).
Understand and apply properties of operations and the relationship between addition and subtraction				
Apply properties of operations as strategies to add and subtract.	1.OA.3	3	High	Examinee must understand subtraction as an unknown-addend problem to perform Level 3 skills.
Understand subtraction as an unknown-addend problem.	1.OA.4	3	High	Examinee must understand subtraction as an unknown-addend problem to perform Level 3 skills.
Add and subtract with 20				
Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	1.OA.5	3	Supporting	Supporting because an examinee must be able to relate counting to addition and subtraction to perform Level 3 skills.

Mathematics Standards Level A	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$ ); decomposing a number leading to a ten (e.g., $13 - 4 = 13 - 3 - 1 = 10 - 1 = 9$ ); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$ , one knows $12 - 8 = 4$ ); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$ ).	1.OA.6	3	High	At Level 3, examinees will need to choose the correct answer to an addition or subtraction problem.
Work with addition and subtraction				
Understand the meaning of the equal sign and determine if equations involving addition and subtraction are true or false.	1.OA.7	3	High	At Level 3, examinees will need to choose the correct answer to an addition or subtraction problem.
Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.	1.OA.8	3	High	At Level 3, examinees will be asked to solve for one unknown.
<b>Geometry</b>				
Analyze, compare, create, compose shapes				
Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/ "corners") and other attributes (e.g., having sides of equal length).	K.G.4	5	Supporting	At Level 5, the examinee will need to calculate the perimeter or circumference of a basic shape or calculate the area.
Reason with shapes and their attributes				



Mathematics Standards Level A	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape and compose new shapes from the composite shape.	1.G.2	6	Supporting	At Level 6, the examinee will need to find the area of basic shapes when it may be necessary to rearrange a formula, convert units of measurement in the calculations, or use the result in further calculations. They will also need to calculate the volume of rectangular solids (e.g., cubes).
<b>Measurement and Data</b>				
<b>Measure lengths indirectly and by iterating length units</b>				
Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.	1.MD.2	5	Supporting	At Level 5, the examinee will need to calculate the perimeter or circumference of a basic shape or calculate the area. These problems may provide a shape with measurements.
<b>Represent and interpret data</b>				
Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.	1.MD.4	4	Supporting	At level 4, the examinee may be presented with a chart, diagram or graph and they may need to put information in the right order before they perform calculations. The Graphic Literacy skill would also be required.

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Number and Operations: Base 10</b>				
<b>Understand place value</b>				
Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases a and b	2.NBT.1	3	Supporting	Supporting because an examinee must understand place value to perform Level 3 skills of adding, subtracting, multiplying, and dividing, and converting fractions and units of money.
Count within 1000; skip-count by 5s, 10s, and 100s.	2.NBT.2	3	Supporting	Supporting because examinees will not be asked to count but do need to understand this concept to add and multiply.
Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.	2.NBT.3	3	Supporting	Supporting because examinees will not be asked to read or write numbers but will need to read them within word problems.
Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.	2.NBT.4	3	Supporting	Supporting because examinees will not be required to use the symbols.
<b>Use place value understanding and properties of operations to add and subtract</b>				
Add up to four two-digit numbers using strategies based on place value and properties of operations.	2.NBT.6	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.	2.NBT.7	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.	2.NBT.8	3	Low	Low because examinees do have access to a calculator.
Explain why addition and subtraction strategies work, using place value and the properties of operations.	2.NBT.9	3	Supporting	Supporting because examinees won't have to explain, but they will have to perform.
Use place value understanding and properties of operations to perform multi-digit arithmetic				
Use place value understanding to round whole numbers to the nearest 10 or 100.	3.NBT.1	3	High	Examinees will need to understand when rounding is appropriate in the workplace (e.g., a partial box of tile can't be purchased so the examinee would need to round up).
Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	3.NBT.2	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., $9 \times 80$ , $5 \times 60$ ) using based on place value and properties of strategies operations.	3.NBT.3	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
<b>Operations and Algebraic Thinking</b>				
Represent and solve problems involving addition and subtraction				
Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	2.OA.1	4	High	Two-step addition and subtraction is Level 4.
Add and subtract with 20				
Fluently add and subtract within 20 using mental strategies. Know from memory all sums of two one-digit numbers.	2.OA.2	3	Low	Examinees do have access to a calculator.
Represent and solve problems involving multiplication and division				
Interpret products of whole numbers, e.g., interpret $5 \times 7$ as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as $5 \times 7$ .	3.OA.1	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.	3.OA.2	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	3.OA.3	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
Determine the unknown whole number in a multiplication or division equation relating three whole numbers.	3.OA.4	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
Understand properties of multiplication and the relationship between multiplication and division				
Apply properties of operations as strategies to multiply and divide.[3] Examples: If $6 \times 4 = 24$ is known, then $4 \times 6 = 24$ is also known. (Commutative property of multiplication.) $3 \times 5 \times 2$ can be found by $3 \times 5 = 15$ , then $15 \times 2 = 30$ , or by $5 \times 2 = 10$ , then $3 \times 10 = 30$ . (Associative property of multiplication.) Knowing that $8 \times 5 = 40$ and $8 \times 2 = 16$ , one can find $8 \times 7$ as $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$ . (Distributive property.)	3.OA.5	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Understand division as an unknown-factor problem. For example, find $32 \div 8$ by finding the number that makes 32 when multiplied by 8.	3.OA.6	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
<b>Multiply and divide within 100</b>				
Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$ , one knows $40 \div 5 = 8$ ) or properties of operations. Know from memory all products of two one-digit numbers.	3.OA.7	3	Low	Examinees will have access to a calculator because employees will have access to a calculator.
<b>Solve problems involving the four operations, and identify and explain patterns in arithmetic</b>				
Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	3.OA.8	4	High	At Level 4, examinees are required to solve problems requiring two or more basic operations and solve for one or two unknowns.
Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.	3.OA.9	3	Supporting	Supporting because at Level 4, examinees are required to solve problems requiring two or more basic operations and solve for one or two unknowns, but they will not be asked to identify arithmetic patterns.
<b>Measurement and Data</b>				
Measure and estimate lengths in standard units				

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.	2.MD.2	5	Supporting	Measurement is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. At Level 5, examinees will need to calculate perimeters, circumference, and areas of basic shapes like rectangles and circles.
Estimate lengths using units of inches, feet, centimeters, and meters.	2.MD.3	5	Supporting	At Level 5, examinees will convert units within or between systems of measurement (e.g., time, measurement, and quantity) where the formula is provided such as converting from ounces to pounds or from centimeters to inches. Examinees will also solve problems that require mathematical operations using mixed units.
Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.	2.MD.4	5	Supporting	Measurement is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. At Level 5, examinees will need to calculate perimeters, circumference, and areas of basic shapes like rectangles and circles.
Relate addition and subtraction to length				
Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.	2.MD.6	5	Supporting	Measurement is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. At Level 5, examinees will need to calculate perimeters, circumference, and areas of basic shapes like rectangles and circles.
Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects				

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.	3.MD.1	3	High	Time is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. At Level 3, examinees may be asked to convert between familiar units such as hours and minutes. At Level 5, examinees may be asked to perform operations with mixed units such as 3.5 hours + 4 hours and 30 minutes. Examinees will not be asked to tell or write time.
Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.	3.MD.2	3	High	Quantity is an Applied Math Application on the WorkKeys Applied math assessment and may appear at all levels. Examinees may be asked to add, subtract, multiply or divide to solve one-step word problems at Level 3.
<b>Represent and interpret data</b>				
Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	2.MD.10	4	Supporting	Examinees will not be asked to draw on assessment. Graphic Literacy is used here. Examinees may be presented with a graphic of this nature at Applied Math level 4.



Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.	3.MD.3	4	Supporting	Examinees will not be asked to draw on the assessment. Graphic Literacy is used here. Examinees may be presented with a graphic of this nature at Applied Math level 4.
Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	3.MD.4	4	Supporting	Examinees will not be asked to draw on the assessment. Graphic Literacy is used here. Examinees may be presented with a graphic of this nature at Applied Math level 4.
Geometric measurement: understand concepts of area and relate to area of multiplication and addition				
Recognize area as an attribute of plane figures and understand concepts of area measurement. - A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. - A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.	3.MD.5	5	Supporting	Measurement is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. At Level 5, examinees will need to calculate perimeters, circumference, and areas of basic shapes like rectangles and circles.
Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).	3.MD.6	5	Supporting	See note for standard 3.MD.5.
Relate area to the operations of multiplication and addition.	3.MD.7	5	Supporting	See note for standard 3.MD.5.

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength	Note
Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.	3.MD.7a	5	Supporting	See note for standard 3.MD.5.
Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.	3.MD.7b	5	Supporting	See note for standard 3.MD.5. All Applied Math items are based on real world context.
Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths $a$ and $b + c$ is the sum of $a \times b$ and $a \times c$ . Use area models to represent the distributive property in mathematical reasoning.	3.MD.7c	5	Supporting	See note for standard 3.MD.5.
Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.	3.MD.7d	6	Supporting	See note for standard 3.MD.5. All Applied Math items are based on real world context.
<b>Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures</b>				
Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	3.MD.8	5	Supporting	See note for standard 3.MD.5. All Applied Math items are based on real world context.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Number and Operations: Base Ten (+ The Number System)</b>				
<b>Generalize place value understanding for multi-digit whole numbers</b>				
Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that $700 \div 70 = 10$ by applying concepts of place value and division.	4.NBT.1	3	Supporting	Supporting because an examinee must understand place value to perform Level 3 skills of adding, subtracting, multiplying, and dividing, and converting fractions and units of money.
Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.	4.NBT.2	3	Supporting	Supporting because examinee will not be asked to write numbers or use symbols.
Use place value understanding to round multi-digit whole numbers to any place.	4.NBT.3	4	High	Examinees will need to understand when rounding is appropriate in the workplace (e.g., a partial box of tile can't be purchased so the examinee would need to round up).
<b>Use place value understanding and properties of operations to perform multi-digit arithmetic</b>				
Fluently add and subtract multi-digit whole numbers using the standard algorithm.	4.NBT.4	3	High	At level 3, Examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	4.NBT.5	3	Medium	At level 3, Examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide). They will be allowed to use a calculator on the assessment and will not be required to illustrate and explain the calculation.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	4.NBT.6	3	Medium	At level 3, Examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide). They will be allowed to use a calculator on the assessment and will not be required to illustrate and explain the calculation.
Understand the place value system				
Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.	5.NBT.1	3	Supporting	Supporting because an examinee must understand place value to perform Level 3 and higher skills.
Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.	5.NBT.2	5	Supporting	At this point, students are taught to move the decimal by the number of 0s. This is supporting because the formulas used at Level 5 will require an understanding of exponents. Supporting because they won't need to explain patterns.
Read, write, and compare decimals to thousandths.	5.NBT.3	3	Supporting	Will not be asked to read or write decimals but will need to understand them for money problems that do begin at Level 3.
Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$ .	5.NBT.3a	3	Supporting	Will not be asked to read or write decimals but will need to understand them for money problems that do begin at Level 3.
Compare two decimals to thousandths based on meanings of the digits in each place, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.	5.NBT.3b	3	Supporting	Will not be asked to read or write decimals or use symbols but will need to understand them for money problems that do begin at Level 3.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Use place value understanding to round decimals to any place.	5.NBT.4	3	High	Examinees will need to understand when rounding is appropriate in the workplace (e.g., a partial box of tile can't be purchased so the examinee would need to round up ).
<b>Perform operations with multi-digit whole numbers and with decimals to hundredths</b>				
Fluently multiply multi-digit whole numbers using the standard algorithm.	5.NBT.5	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).
Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	5.NBT.6	3	Medium	Will not be asked to explain or illustrate the calculation, but will have to set it up
Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. [Note from panel: Applications involving financial literacy should be used.	5.NBT.7	4	High	At level 4, add commonly known fractions, decimals, or percentages. Examinees may divide using negative numbers and this is more likely when dealing with finances.
<b>The Number System</b>				
<b>Compute fluently with multi-digit numbers and find common factors and multiples</b>				
Fluently divide multi-digit numbers using the standard algorithm.	6.NS.2	3	High	At level 3, examinees are required to solve problems that require one type of mathematical operation (add, subtract, multiply and divide).

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.	6.NS.3	4	High	At level 4, examinees are required to solve problems that require one or two operations; add, subtract, or multiply using positive or negative numbers; divide positive numbers; and add commonly known fractions, decimals, or percentages.
Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express $36 + 8$ as $4(9 + 2)$ .	6.NS.4	5	Supporting	At level 5, examinees need to be able to build the least common denominator using factoring.
<b>The Number System</b>				
Apply and extend previous understandings of multiplication and division to divide fractions by fractions				
Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$ . (In general, $(a/b) \div (c/d) = ad/bc$ .) How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$ -cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?	6.NS.1	5	Medium	At level 5, examinees are required to calculate perimeters, circumference, and areas of basic shapes like rectangles and circles; and add and subtract fractions with unlike denominators.
<b>Number and Operations: Fractions</b>				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Extend understanding of fraction equivalence and ordering				
Explain why a fraction $a/b$ is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.	4.NF.1	5	Supporting	At level 5, examinees will add and subtract fractions with unlike denominators, but will not be asked to explain.
Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as $1/2$ . Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols $>$ , $=$ , or $<$ , and justify the conclusions, e.g., by using a visual fraction model.	4.NF.2	5	High	At level 5, examinees will add and subtract fractions with unlike denominators, but will not be asked to justify the conclusion.
Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers				
Understand a fraction $a/b$ with $a > 1$ as a sum of fractions $1/b$ .	4.NF.3	4	Supporting	Examinees will not be asked to use symbols.
Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.	4.NF.3a	4	High	At level 4, examinees will add and subtract fractions with a common denominator.
Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. Examples: $3/8 = 1/8 + 1/8 + 1/8$ ; $3/8 = 1/8 + 2/8$ ; $2\ 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8$ .	4.NF.3b	4	High	At level 4, examinees will add and subtract fractions with a common denominator.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.	4.NF.3c	4	High	At level 4, examinees will multiply a mixed number by a whole number or a decimal.
Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.	4.NF.3d	4	High	At level 4, examinees will add and subtract fractions with a common denominator.
Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.	4.NF.4	4	High	At level 4, examinees will multiply a mixed number by a whole number or a decimal.
Understand a fraction $a/b$ as a multiple of $1/b$ . For example, use a visual fraction model to represent $5/4$ as the product $5 \times (1/4)$ , recording the conclusion by the equation $5/4 = 5 \times (1/4)$ .	4.NF.4a	4	High	At level 4, examinees will multiply a mixed number by a whole number or a decimal.
Understand a multiple of $a/b$ as a multiple of $1/b$ , and use this understanding to multiply a fraction by a whole number. For example, use a visual fraction model to express $3 \times (2/5)$ as $6 \times (1/5)$ , recognizing this product as $6/5$ . (In general, $n \times (a/b) = (n \times a)/b$ .)	4.NF.4b	4	High	At level 4, examinees will multiply a mixed number by a whole number or a decimal.
Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. For example, if each person at a party will eat $3/8$ of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?	4.NF.4c	4	High	At level 4, examinees will multiply a mixed number by a whole number or a decimal.
Understand decimal notation for fractions, and compare decimal fractions				



Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	4.NF.6	3	High	At level 3, examinees will change between familiar decimals and fractions.
Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols $>$ , $=$ , or $<$ , and justify the conclusions, e.g., by using a visual model.	4.NF.7	4	High	At level 4, examinees will change between decimals and fractions.
Use equivalent fractions as strategy to add and subtract fractions				
Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$ . (In general, $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$ .)	5.NF.1	5	High	At level 5, examinees will add and subtract fractions with uncommon denominators.
Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$ , by observing that $\frac{3}{7} < \frac{1}{2}$ .	5.NF.2	5	High	At level 5, examinees will add and subtract fractions with uncommon denominator.
Apply and extend previous understanding of multiplication and division to multiply and divide fractions				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Interpret a fraction as division of the numerator by the denominator ( $a/b = a \div b$ ). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret $3/4$ as the result of dividing 3 by 4, noting that $3/4$ multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size $3/4$ . If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?	5.NF.3	5	High	At level 5, examinees will be presented with word problems that require mathematical operations using mixed units (e.g., adding 3.50 hours and 4 hours 30 minutes or subtracting 3 feet and 10 inches from 6 feet and 4 inches), to multiply a mixed number by a whole number, and to add and subtract fractions with unlike denominators (such as $1/2 - 1/4$ ).
Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.	5.NF.4	4	High	At level 4, examinees will multiply a mixed number by a whole number or decimal.
Interpret multiplication as scaling (resizing), by: a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying $a/b$ by 1.	5.NF.5	4	Supporting	At level 4, examinees will multiply a mixed number by a whole number or decimal. Supporting because they will not be asked to interpret.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.	5.NF.6	4	High	At level 4, examinees will multiply a mixed number by a whole number or decimal.
Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.	5.NF.7	4	High	At level 4, examinees will multiply a mixed number by a whole number. To divide a whole number by a fraction, the examinee will need to understand that the whole number can be placed over one to represent a fraction and then they take the reciprocal and multiply.
Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for $(1/3) \div 4$ , and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $(1/3) \div 4 = 1/12$ because $(1/12) \times 4 = 1/3$ .	5.NF.7a	4	Medium	See note for standard 5.NF.7. All WorkKeys Applied Math problems consist of a word problem or story context and are application items (quantity, money, time, or measurement). Medium strength because examinees will not be asked to interpret or create a story context.
Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for $4 \div (1/5)$ , and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $4 \div (1/5) = 20$ because $20 \times (1/5) = 4$ .	5.NF.7b	4	Medium	See note for standard 5.NF.7a.
Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $1/3$ -cup servings are in 2 cups of raisins?	5.NF.7c	4	High	See note for standard 5.NF.7a. except the link to this standard is of high strength because the examinee is not required to create or interpret.
<b>Operations and Algebraic Thinking</b>				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Use the four operations with whole numbers to solve problems				
Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.	4.OA.1	4	High	All WorkKeys Applied Math problems consist of a word problem and the examinee is required to translate it into a math equation.
Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.	4.OA.2	4	High	All WorkKeys Applied Math problems consist of a word problem and the examinee is required to translate it into a math equation.
Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	4.OA.3	5	High	At Level 5, examinees may need to perform multiple operations and solve for one or two unknowns or solve for one unknown and then use to solve the problem to answer the question.
Gain familiarity with factors and multiples				
Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.	4.OA.4	5	Supporting	This prepares examinees for reducing fractions and creating common denominators. At level 5, examinees will add and subtract fractions with unlike denominators (such as $\frac{1}{2} - \frac{1}{4}$ ).
Generate and analyze patterns				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.	4.OA.5	N/A		
<b>Write and interpret numerical expressions</b>				
Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	5.OA.1	4	High	Word problems at Level 4 require some translation to a math equation and the information may not be presented in a logical order. They may also be solving for one or two unknowns.
Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as $2 \times (8 + 7)$ . Recognize that $3 \times (2100 + 425)$ is three times as large as the $2100 + 425$ , without having to calculate the indicated sum or product.	5.OA.2	4	High	Word problems at Level 4 require some translation to a math equation and the information may not be presented in a logical order. They may also be solving for one or two unknowns.
<b>Expressions and Equations</b>				
<b>Apply and extend previous understandings of arithmetic to algebraic expressions</b>				
Write and evaluate numerical expressions involving whole-number exponents.	6.EE.1	5	High	For example, area of a circle.
Write, read, and evaluate expressions in which letters stand for numbers.	6.EE.2	4	High	Word problems at Level 4 require some translation to a math equation and the information may not be presented in a logical order. They may also be solving for one or two unknowns.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as $5 - y$ .	6.EE.2a	4	High	See note for standard 6.EE.2a.
Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression $2(8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms.	6.EE.2b	4	Supporting	Word problems at Level 4 require some translation to a math equation and the information may not be presented in a logical order.
Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$ .	6.EE.2c	6	High	At level 6, examinees will find the volume of rectangular solids (e.g., cubes).
Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$ ; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$ ; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$ .	6.EE.3	4	High	At level 4, examinees will set-up equations and solve for one or two unknowns.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number $y$ stands for.	6.EE.4	4	High	At level 4, examinees will set-up equations and solve for one or two unknowns.
Reason about and solve one-variable equations and inequalities				
Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	6.EE.5	3	High	At level 3, examinees will set-up equations and solve for one unknown.
Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.	6.EE.6	3	High	At level 3, examinees will set-up equations and solve for one unknown.
Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which $p$ , $q$ and $x$ are all nonnegative rational numbers.	6.EE.7	3	High	At level 3, examinees will set-up equations and solve for one unknown.
Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.	6.EE.8	3	Supporting	At level 3, examinees will set-up equations and solve for one unknown, but will not be asked to write an inequality.
Represent and analyze quantitative relationships between dependent and independent variables				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.	6.EE.9	4	High	At level 3, examinees will solve for one or two unknowns and may include a graph.
<b>Geometry</b>				
Draw and identify lines and angles, and classify shapes by properties of their lines and angles				
Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	4.G.1	5	Supporting	WorkKeys Applied Math examinees will not be asked to graph, but will need this understanding when performing Level 5 and higher items.
Graph points on the coordinate plane to solve real-world and mathematical problems				
Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	5.G.1	5	Supporting	WorkKeys Applied Math examinees will not be asked to graph, but will need this understanding when performing Level 5 and higher items.



Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.	5.G.2	5	Supporting	WorkKeys Applied Math examinees will not be asked to graph, but will need this understanding when performing Level 5 and higher items.
<b>Classify two-dimensional figures into categories based on their properties</b>				
Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.	5.G.3	5	Supporting	Examinees will need this understanding to perform Level 5 and higher items.
<b>Solve real-world and mathematical problems involving area, surface area, and volume</b>				
Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.	6.G.1	7	High	At level 7, examinees will find the area of composite shapes.
Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	6.G.3	7	Supporting	Examinees will not be asked to draw, but will need this understanding when performing Level 5 and higher items.
Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	6.G.4	7	Supporting	While examinees will be expected to solve real-world and mathematical problems, they can use any method to solve the problem.
<b>Measurement and Data</b>				
Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.	4.MD.2	5	High	At level 5, examinee will need to perform multiple operations, and convert between and within systems of measurement (e.g., time, measurement, and quantity).
Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.	4.MD.3	5	High	At level 5, examinees will calculate perimeter and area using the formulas provided.
<b>Geometric measurement: understand concepts of angle and measure angles</b>				
Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: - An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through $1/360$ of a circle is called a "one-degree angle," and can be used to measure angles. - An angle that turns through $n$ one-degree angles is said to have an angle measure of $n$ degrees.	4.MD.5	5	Supporting	Measurement is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. Examinees are provided with the sum of angles for a triangle = $180^\circ$ and number of degrees in a circle = 360.
Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	4.MD.6	5	Supporting	Examinees will not be asked to sketch angles or use a protractor.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.	4.MD.7	5	Supporting	Measurement is an Applied Math Application on the WorkKeys Applied Math assessment and may appear at all levels. Examinees are provided with the sum of angles for a triangle = $180^\circ$ and number of degrees in a circle = 360.
Convert like measurement units within a given measurement system				
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.	5.MD.1	5	High	At level 5, examinees will convert units within or between systems of measurement (e.g., time, measurement, and quantity) where the formula is provided such as converting from ounces to pounds or from centimeters to inches.
Represent and interpret data				
Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{1}{8}$ ). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally. [Note from panel: Plots of numbers other than measurements also should be encouraged.]	5.MD.2	N/A		Examinees will not be asked to make a line plot.
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a) A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. b) A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.	5.MD.3	6	High	At level 6, examinees will find the volume of rectangular solids.
Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	5.MD.4	6	Supporting	At level 6, examinees will find the volume of rectangular solids.
Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.	5.MD.5	6	Supporting	At level 6, examinees will find the volume of rectangular solids.
Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.	5.MD.5a	6	High	At level 6, examinees will find the volume of rectangular solids.
Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.	5.MD.5b	7	High	At level 6, examinees will find the volume of rectangular solids. At level 7, examinees will calculate volumes of spheres, cylinders, or cones and it may be necessary to rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength	Note
Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.	5.MD.5c	7	High	See note for standard 5.MD.5b.
<b>Statistics and Probability</b>				
Develop understanding of statistical variability				
Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.	6.SP.1	7	High	At level 7, examinees will apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).
Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	6.SP.2	7	High	See note for standard 6.SP.1.
Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.	6.SP.3	7	High	See note for standard 6.SP.1.
Summarize and describe distributions				
Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	6.SP.4	7	Supporting	At level 7, examinees will determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>The Number System</b>				
Apply and extend previous understandings of numbers to the system of rational numbers				
Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.	6.NS.5	4	High	At level 4, examinees can add, subtract, or multiply using positive or negative numbers.
Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.	6.NS.6	4	Medium	At level 4, examinees can add, subtract, or multiply using positive or negative numbers. A chart, diagram, or graph may be included.
Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$ , and that 0 is its own opposite.	6.NS.6a	4	High	At level 4, examinees can add, subtract, or multiply using positive or negative numbers. A chart, diagram, or graph may be included.
Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.	6.NS.6b	4	Low	At level 4, examinees can add, subtract, or multiply using positive or negative numbers. Low because they won't see ordered pairs.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	6.NS.6c	4	Supporting	At level 4, examinees can add, subtract, or multiply using positive or negative numbers. A chart, diagram, or graph may be included. Supporting because examinees will not be positioning pairs of integers, etc.
Understand ordering and absolute value of rational numbers.	6.NS.7	4	Supporting	At level 4, examinees can add, subtract, or multiply using positive or negative numbers, and they can figure out simple ratios, simple proportions, or rates.
Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret $-3 > -7$ as a statement that $-3$ is located to the right of $-7$ on a number line oriented from left to right.	6.NS.7a	4	Supporting	See note for standard 6.NS.7.
Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write $-3^{\circ}\text{C} > -7^{\circ}\text{C}$ to express the fact that $-3^{\circ}\text{C}$ is warmer than $-7^{\circ}\text{C}$ .	6.NS.7b	4	Supporting	See note for standard 6.NS.7.
Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of $-30$ dollars, write $ -30  = 30$ to describe the size of the debt in dollars.	6.NS.7c	4	Supporting	At level 4, examinees can add, subtract, or multiply using positive or negative numbers. For example, at this level, employees can figure out sales tax or a sales commission on a previously calculated total, and they can find out rates of use or business flow.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.	6.NS.7d	4	Supporting	See note for standard 6.NS.7c.
Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	6.NS.8	4	Low	At level 4, examinees can add, subtract, or multiply using positive or negative numbers when solving real-world math problems, but will not be required to graph.
Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers				
Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.	7.NS.1	4	High	At level 4, examinees will add commonly known fractions, decimals or percentages and add or subtract fractions with a common denominator.
Describe situations in which opposite quantities combine to make 0. For example, if a check is written for the same amount as a deposit, made to the same checking account, the result is a zero increase or decrease in the account balance.	7.NS.1a	4	High	At level 4, examinees can add, subtract, or multiply using positive or negative numbers. WorkKeys Applied Math applications can include money, time, quantity, and measurement.



Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Understand $p + q$ as the number located a distance $ q $ from $p$ , in the positive or negative direction depending on whether $q$ is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.	7.NS.1b	4	High	See note for standard 7.NS.1a.
Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.	7.NS.1c	4	High	See note for standard 7.NS.1a.
Apply properties of operations as strategies to add and subtract rational numbers.	7.NS.1d	4	High	See note for standard 7.NS.1a.
Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. 7.NS.2				
Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.	7.NS.2a	4	High	At level 4, examinees can add, subtract, or multiply using positive or negative numbers and they may divide positive numbers. Examinees will also multiply a mixed number by a whole number. WorkKeys Applied Math applications can include money, time, quantity, and measurement. Word problems are presented in a real-world context.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If $p$ and $q$ are integers, then $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.	7.NS.2b	4	High	See note for standard 7.NS.2a.
Apply properties of operations as strategies to multiply and divide rational numbers.	7.NS.2c	4	High	See note for standard 7.NS.2a.
Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.	7.NS.2d	4	High	At level 3, examinees will setup and/or manipulate simple ratios/ proportions/rates and convert a familiar fraction to a decimal.
Solve real-world and mathematical problems involving the four operations with rational numbers.	7.NS.3	4	High	At level 4, examinees can add, subtract, or multiply using positive or negative numbers and they may divide positive numbers.
Know that there are numbers that are not rational, and approximate them by rational numbers				
Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., $\sqrt{2}$ ). For example, by truncating the decimal expansion of $\sqrt{2}$ , show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.	8.NS.2	6	Supporting	At level 6, examinees will calculate rates, production rates, rate by time (such as, production rate is 59 cups produced per hour, how many will be produced in an 8-hour shift).
<b>Ratios and Proportional Relationships</b>				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Understand ratio concepts and use ratio reasoning to solve problems				
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	6.RP.3	6	High	At level 6, examinees will calculate rates, production rates, rate by time (such as, production rate is 59 cups produced per hour, how many will be produced in an 8-hour shift).
Make tables of equivalent ratios relating quantities with whole- number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.	6.RP.3a	6	Supporting	See note for standard 6.RP.3. Examinees will not be asked to make tables on a multiple-choice test.
Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?	6.RP.3b	6	High	See note for standard 6.RP.3.
Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.	6.RP.3c	5	High	At level 5, examinees will calculate a given percentage of a given number and then use that percentage to determine the solution (e.g., find the total cost of a product after calculating discount, markup, or tax).
Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	6.RP.3d	5	High	At level 5, examinees will convert units within or between systems of measurement (e.g., time, measurement, and quantity) where the formula is provided such as converting from ounces to pounds or from centimeters to inches.
Analyze proportional relationships and use them to solve real-world and mathematical problems				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour.	7.RP.1	7	High	At level 7, examinees will solve problems that include ratios, rates, or proportions with at least one of the quantities related to a fraction.
Recognize and represent proportional relationships between quantities.	7.RP.2	5	High	At level 5, examinees will convert units within or between systems of measurement where the formula is provided, solve problems that require mathematical operations using mixed units, and identify the best deal by doing one- and two-step calculations and then comparing the results to determine the solution that meets the stated conditions.
Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.	7.RP.2a	5	Supporting	See note for standard 7.RP.2.
Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	7.RP.2b	5	Supporting	See note for standard 7.RP.2.
Represent proportional relationships by equations. For example, if total cost $t$ is proportional to the number $n$ of items purchased at a constant price $p$ , the relationship between the total cost and the number of items can be expressed as $t = pn$ .	7.RP.2c	5	High	At level 5, examinees will identify the best deal by doing one- and two-step calculations and then comparing the results to determine the solution that meets the stated conditions.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.	7.RP.2d	5	Supporting	Examinees will not be asked to graph or use graphs to explain proportional relationships, but they will need to understand them to perform at Level 5.
Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.	7.RP.3	5	High	At level 5, examinees will calculate a given percentage of a given number and then use that percentage to find the solution to a problem (e.g., find the percentage and then use it to find the discount, markup, or tax).
<b>Expressions and Equations</b>				
Use properties of operations to generate equivalent expressions				
Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	7.EE.1	4	High	At Level 4, examinees may need to put information in the right order before they perform one or two operations to solve the problem.
Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, $a + 0.05a = 1.05a$ means that "increase by 5%" is the same as "multiply by 1.05."	7.EE.2	4	Supporting	At Level 4, examinees may need to put information in the right order before they perform one or two operations to solve the problem. However, they aren't required to rewrite expressions in different forms.
Solve real-life and mathematical problems using numerical and algebraic expressions and equations				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar $9\frac{3}{4}$ inches long in the center of a door that is $27\frac{1}{2}$ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.	7.EE.3	5	High	At level 5, examinees will be presented with multi-step real-life word problems that require mathematical operations using positive and negative numbers, and mixed units, and may be required to multiply a mixed number by a whole number, to add and subtract fractions with unlike denominators, and convert units.
Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	7.EE.4	3	High	Quantity is an Applied Math Application on the WorkKeys Applied math assessment and may appear at all levels. Examinees may be asked to set-up and add, subtract, multiply or divide to solve one-step word problems at Level 3.
Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?	7.EE.4a	5	High	At level 5, examinees will calculate perimeters, circumference, and areas of basic shapes like rectangles and circles.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.	7.EE.4b	4	Medium	At level 4, examinees will solve word problems with one or two unknowns, but will not be required to graph the solution.
<b>Work with radicals and integer exponents</b>				
Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{(-3)} = (1/3)^3 = 1/27$ .	8.EE.1	5	High	At level 5, examinees will be required to apply the properties of integer exponents when using formulas for geometric measurement.
Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$ , where $p$ is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.	8.EE.2	6	High	At level 6, examinees will be required to use square root and cube root symbols when using formulas for geometric measurement.
Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as $3 \times 10^8$ and the population of the world as $7 \times 10^9$ , and determine that the world population is more than 20 times larger.	8.EE.3	6	High	At level 6, examinees will be required to use square root and cube root symbols when using formulas for geometric measurement.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	8.EE.4	5	High	At level 5, examinees will perform operations with numbers expressed in scientific notation including formulas for geometric measurement.
Understand the connections between proportional relationships, lines, and linear equations				
Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	8.EE.5	6	Supporting	At level 6, examinees will calculate rates, production rates, rate by time (such as, production rate is 59 cups produced per hour, how many will be produced in an 8-hour shift), but will not be asked to graph.
Analyze and solve linear equations and pairs of simultaneous linear equations				
Solve linear equations in one variable.	8.EE.7	6	High	At level 6, examinees will be presented with a word problem and the information may not be presented in logical order and the mathematical set-up may be complicated. In solving, the examinee may need to perform multiple operations including finding one value and then using it to find another value to answer the question. They will also be expected to select the correct equation.



Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$ , $a = a$ , or $a = b$ results (where $a$ and $b$ are different numbers).	8.EE.7a	6	High	See note for standard 8.EE.7.
Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	8.EE.7b	6	High	See note for standard 8.EE.7.
Analyze and solve pairs of simultaneous linear equations.	8.EE.8	6	High	See note for standard 8.EE.7.
Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.	8.EE.8a	6	High	See note for standard 8.EE.7.
Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.	8.EE.8b	6	High	See note for standard 8.EE.7.
Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.	8.EE.8c	6	High	See note for standard 8.EE.7.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Functions</b>				
Define, evaluate, and compare functions				
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	8.F.1	7	Supporting	At level 7, examinees will set up and manipulate ratios, rates or proportions where at least one of the quantities is a fraction, and determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.
Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.	8.F.3	7	High	See note for standard 8.F.1.
Use functions to model relationships between quantities				
Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	8.F.4	7	High	See note for standard 8.F.1.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	8.F.5	N/A		WorkKeys Applied Math will not include nonlinear functions.
<b>Geometry</b>				
Draw, construct, and describe geometrical figures and describe the relationships between them				
Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	7.G.1	5	High	At level 5, examinees will be asked to compute areas, but not to draw.
Solve real-life and mathematical problems involving angle, measure, area, surface area, and volume				
Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.	7.G.4	5	Medium	At level 5, examinees will be provided with a sheet of formulas and will need to identify the correct formula.
Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	7.G.5	7	Supporting	At level 7, examinees may be asked to do this as part of other calculations.
Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	7.G.6	7	High	At level 7, examinees will be asked to calculate area of polygons and the volume of a rectangular solid, spheres, cylinders, and cones.
Understand congruence and similarity using physical models, transparencies, or geometry software				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	8.G.2	6	High	At level 6, examinees will find the area of basic shapes when it may be necessary to rearrange the formula, convert units of measurement in the calculations or use the result in further calculations or when finding the area of composite shapes.
Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	8.G.4	6	High	See note for standard 8.G.4.
Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.	8.G.5	6	Low	See note for standard 8.G.4.
Understand and apply the Pythagorean Theorem				
Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	8.G.7	6	High	At level 6, examinees are expected to solve real-world word problems, but the specific way they solve it is not specified.
Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	8.G.8	N/A		

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Statistics and Probability</b>				
<b>Summarize and describe distributions.</b>				
<p>Summarize numerical data sets in relation to their context, such as by:</p> <ul style="list-style-type: none"> <li>-Reporting the number of observations.</li> <li>- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>- Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> <li>- Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</li> </ul>	6.SP.5	7	High	At level 7, examinees will determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost, and apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).
<b>Use random sampling to draw inferences about a population</b>				
<p>Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.</p>	7.SP.1	7	Supporting	At level 7, examinees will apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.	7.SP.2	N/A		
<b>Draw informal comparative inferences about two populations</b>				
Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.	7.SP.3	7	High	At level 7, examinees will apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).
Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in one chapter of a science book are generally longer or shorter than the words in another chapter of a lower level science book.	7.SP.4	7	High	At level 7, examinees will apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Investigate chance processes and develop, use, and evaluate probability models				
Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	7.SP.5	N/A		
Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.	7.SP.6	N/A		
Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.	7.SP.7	N/A		
Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.	7.SP.7a	N/A		

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?	7.SP.7b	N/A		
Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.	7.SP.8a	N/A		
Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.	7.SP.8b	N/A		
Investigate patterns of association in bivariate data				
Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	8.SP.1	N/A		



Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength	Note
Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	8.SP.2	N/A		
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.	8.SP.3	N/A		
Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they like to cook and whether they participate actively in a sport. Is there evidence that those who like to cook also tend to play sports?	8.SP.4	N/A		

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Number and Quantity: The Real Number System</b>				
Extend the properties of exponents to rational exponents				
Rewrite expressions involving radicals and rational exponents using the properties of exponents.	N.RN.2	7	Supporting	At level 7, examinees will be expected to solve expressions using the properties of exponents, but will not be asked to rewrite expressions.
<b>Number and Quantity: Quantities</b>				
Reason quantitatively and use units to solve problems				
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	N.Q.1	5	High	At level 5, examinees will be presented with real-world word problems that may require mathematical set-up and require them to perform multiple operations.
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	N.Q.3	5	High	Quantity is an Applied Math application on the WorkKeys Applied Math assessment and examinees are presented with real-world word problems that require the appropriate level of accuracy. For example, you can't purchase half box of tiles.
<b>Algebra: Seeing Structure in Expressions</b>				
Interpret the structure of expressions				
Interpret expressions that represent a quantity in terms of its context.	A.SSE.1	6	High	Quantity is an Applied Math application on the WorkKeys Applied Math assessment. At level 6, examinees will solve problems may require considerable translation from verbal form to mathematical expression.
Interpret parts of an expression, such as terms, factors, and coefficients.	A.SSE.1a	6	High	At level 6, examinees will identify the correct equation for solving a problem.

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$ .	A.SSE.2	6	High	At level 6, examinees will find the area of basic shapes when it may be necessary to rearrange a formula, convert units of measurement in the calculations, or use the result in further calculations.
Write expressions in equivalent forms to solve problems				
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	A.SSE.3	6	Supporting	Quantity is an Applied Math application on the WorkKeys Applied Math assessment. At level 6, examinees will solve problems may require considerable translation from verbal form to mathematical expression.
Factor a quadratic expression to reveal the zeros of the function it defines.	A.SSE.3a	6	Supporting	See note for standard A.SSE.3.
<b>Algebra: Arithmetic with Polynomials and Rational Numbers</b>				
Perform arithmetic operations on polynomials				
Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	A.APR.1	6	Supporting	At level 6, examinees will calculate rates, production rates, rate by time and find the best deal and use the result for another calculation.
Rewrite rational expressions				
Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.	A.APR.6	6	Supporting	At level 6, examinees will be presented with real-world word problems that may require considerable translation from verbal form to mathematical expression and involve multiple-step calculations rearrange the formula, convert units of measurement in the calculations, or use the result in further calculations.

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Algebra: Creating Equations</b>				
Create equations that describe numbers or relationships				
Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	A.CED.1	5	High	At level 5, examinees will calculate the given percentage of a given number and then use that percentage to find the solution to a problem(e.g., find the percentage and then use it to find the discount, markup, or tax).
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	A.CED.2	7	Supporting	At level 7, examinees will determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.
Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.	A.CED.3	7	Supporting	At level 7, examinees will calculate the volume when it may be necessary to rearrange the formula, convert units of measurement in calculations, or use the result in further calculations.
Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance $R$ .	A.CED.4	7	Supporting	At level 7, examinees will find the area of basic shapes when it may be necessary to rearrange a formula, convert units of measurement in the calculations, or use the result in further calculations.
<b>Algebra: Reasoning with Equations and Inequalities</b>				
Understand solving equations as a process of reasoning and explain the reasoning				
Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	A.REI.1	5	Medium	At level 5, examinees will solve for one unknown and then use to solve problem to answer the question. Examinees will not be asked to explain each step.

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	A.REI.2	5	High	See note for standard A.REI.1.
Solve equations and inequalities in one equation				
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	A.REI.3	5	High	See note for standard A.REI.1.
Solve quadratic equations in one variable.	A.REI.4	6	Supporting	At level 5, examinees will calculate the given percentage of a given number and then use that percentage to find the solution to a problem (e.g., find the percentage and then use it to find the discount, markup, or tax).
Solve systems of equations				
Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	A.REI.6	7	Supporting	At level 7, examinees will determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.
Represent and solve equations and inequalities graphically				
Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	A.REI.10	7	Supporting	At level 7, examinees will determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.
<b>Functions: Interpreting Functions</b>				
Understand the concept of a function and use function notation				

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .	F.IF.1	5	Supporting	At level 5, examinees will identify the best deal using one-or two-step calculations that meet the stated conditions.
Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	F.IF.2	5	High	At level 5, examinees will identify the best deal using one-or two-step calculations that meet the stated conditions.
Interpret functions that arise in applications in terms of the context				
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. For example, for a quadratic function modeling a projectile in motion, interpret the intercepts and the vertex of the function in the context of the problem. [Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.]	F.IF.4	6	High	At level 6, examinees will calculate rates, production rates, rate by time.

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function $h(n)$ gives the number of person-hours it takes to assemble $n$ engines in a factory, then the positive integers would be an appropriate domain for the function.	F.IF.5	6	High	At level 6, examinees will calculate rates, production rates, rate by time.
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	F.IF.6	6	High	At level 6, examinees will calculate rates, production rates, rate by time.
<b>Analyze functions using different representations</b>				
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	F.IF.7	7	Supporting	Examinees won't be asked to graph but may be provided with one.
Use properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in an exponential function and then classify it as representing exponential growth or decay.	F.IF.8b	7	High	At level 7, examinees may need to set up and manipulate ratios, rates, or proportions where at least one of the quantities is a fraction.
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.	F.IF.9	7	High	At level 7, examinees will need to determine the better economic value of several alternatives by using graphics, or determining the percentage difference, or by determining unit cost.
<b>Functions: Building Functions</b>				

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
<b>Build a function that models a relationship between two quantities</b>				
Write a function that describes a relationship between two quantities.	F.BF.1	7	High	At level 7, examinees will need to determine the better economic value of several alternatives by using graphics, or determining the percentage difference, or by determining unit cost.
<b>Functions: Linear, Quadratic, and Exponential Models</b>				
<b>Construct and compare linear, quadratic, and exponential models and solve problems</b>				
Distinguish between situations that can be modeled with linear functions and with exponential functions.	F.LE.1	7	High	At level 7, examinees will set up and manipulate ratios, rates or proportions where at least one of the quantities is a fraction, and determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost.
Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	F.LE.1b	7	High	See note for standard F.LE.1.
Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	F.LE.1c	7	High	See note for standard F.LE.1.
<b>Interpret expressions for functions in terms of the situation they model</b>				
Interpret the parameters in a linear or exponential function in terms of a context.	F.LE.5	7	High	See note for standard F.LE.1.
<b>Geometry: Congruence</b>				
<b>Experiment with transformations in the plane</b>				



Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	G.CO.1	N/A		Examinees will not be asked to identify or provide definitions on the exam but will need to understand them.
<b>Geometry: Similarity, Right Triangles, and Trigonometry</b>				
Prove theorems involving similarity				
Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	G.SRT.5	7	High	At level 7, examinees will need this understanding when finding the area of a composite shape.
<b>Geometry: Geometric Measurement and Dimension</b>				
Explain volume formulas and use them to solve problems				
Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	G.GMD.3	7	High	Beginning at level 6, examinees may be asked to calculate volume. At Level 7, examinees may be asked to calculate the volume of spheres, cylinders, and cones.
<b>Geometry: Modeling with Geometry</b>				
Apply geometric concepts in modeling situations				
Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	G.MG.2	7	High	At Level 7, examinees may be asked to calculate the volume of spheres, cylinders, and cones, and will apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).
<b>Statistics and Probability: Interpreting Categorical and Quantitative Data</b>				
Summarize, represent, and interpret data on a single count or measurable variable				

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength	Note
Represent data with plots on the real number line (dot plots, histograms, and box plots).	S.ID.1	7	Supporting	At level 7, examinees will apply basic statistical concepts (e.g., weighted mean, interpret measures of central tendency, or interpret measure of spread and tolerance).
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	S.ID.3	7	High	See note for standard S.ID.3.
Summarize, represent, and interpret data on two categorical and quantitative variables				
Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	S.ID.5	N/A		
Interpret linear models				
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	S.ID.7	7	High	At level 7, examinees will set up and manipulate ratios, rates or proportions where at least one of the quantities is a fraction, determine the better economic value of several alternatives by using graphics or by finding a percentage difference or a unit cost, and apply basic statistical concepts.
Distinguish between correlation and causation.	S.ID.9	N/A		

**Appendix C. CCRSAE Mathematics Crosswalk to ACT WorkKeys Graphic Literacy**

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
<b>Operations and Algebraic Thinking</b>				
Solve problems involving the four operations and identify and explain patterns in arithmetic.				
Identify arithmetic patterns (including patterns in the addition table or multiplication table) and explain them using properties of operations. For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.	3.OA.9	4	High	At Level 4, examinees will identify patterns in graphics of low moderate difficulty such as a multiplication table.
<b>Measurement and Data</b>				
Relate addition and subtraction to length.				
Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.	2.MD.6	3	High	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points) . An axis can be a horizontal or vertical number line.
Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.				
Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.	3.MD.1	3	Supporting	See note for standard 2.MD.6. Supporting because examinees will not be asked to write time.
Represent and interpret data.				

Mathematics Standards Level B	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	2.MD.10	4	Supporting	At Level 4, examinees will use workplace graphics that are common with familiar content and have one or two variables (such as day of the week and number of items in inventory) and compare two or more pieces of information. Supporting because they will not be asked to draw.
Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.	3.MD.3	4	Supporting	See note for standard 2.MD.10.
Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	3.MD.4	3	Supporting	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points) . An axis can be a horizontal or vertical number line. Supporting because they will not be asked to draw.

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
<b>Number and Operations: Fractions</b>				
Understand decimal notation for fractions and compare decimal fractions.				
Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	4.NF.6	3	High	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points). An axis can be a horizontal or vertical number line.
<b>Expressions and Equations</b>				
Reason about and solve one-variable equations and inequalities.				
Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.	6.EE.8	3	High	See note for standard 4.NF.6.
Represent and analyze quantitative relationships between dependent and independent variables.				
Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation.	6.EE.9	4	High	At level 4, examinees will be shown familiar graphics such as tables and number line diagrams demonstrating ratios and rates (e.g., Cost and Revenue per 1,000 Units Produced) and asked to compare information, and/or identify trends, relationships, or patterns.
<b>Geometry</b>				
Graph points on the coordinate plane to solve real-world and mathematical problems				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	5.G.1	3	High	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points) . An axis can be a horizontal or vertical number line.
Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.	5.G.2	3	Medium	See note for standard 5.G.1. Medium because examinees will not be expected to graph but will be expected to interpret.
<b>Measurement and Data</b>				
Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit				
Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.	4.MD.2	3	High	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points). An axis can be a horizontal or vertical number line.
Represent and interpret data				

Mathematics Standards Level C	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{1}{8}$ ). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally. [Note from panel: Plots of numbers other than measurements also should be encouraged.]	5.MD.2	3	Supporting	See note for standard 4.MD.2. Supporting because they will not be asked to draw.
<b>Statistics and Probability</b>				
Summarize and describe distributions.				
Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	6.SP.4	5	High	At level 5, examinees will be presented with less common graphics.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
<b>The Number System</b>				
Apply and extend previous understandings of numbers to the system of rational numbers				
Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.	6.NS.6	3	High	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points) . An axis can be a horizontal or vertical number line.
Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$ , and that 0 is its own opposite.	6.NS.6a	3	High	See note for standard 6.NS.6.
Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.	6.NS.6b	3	High	See note for standard 6.NS.6.
Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	6.NS.6c	3	High	See note for standard 6.NS.6.
Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret $-3 > -7$ as a statement that $-3$ is located to the right of $-7$ on a number line oriented from left to right.	6.NS.7a	3	High	See note for standard 6.NS.6.



Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of -30 dollars, write $ -30  = 30$ to describe the size of the debt in dollars.	6.NS.7c	3	High	See note for standard 6.NS.6.
Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	6.NS.8	3	Supporting	See note for standard 6.NS.6. Supporting strength because examinee will not be required to graph the points.
Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers				
Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.	7.NS.1	3	High	See note for standard 6.NS.6.
Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.	7.NS.1c	3	High	See note for standard 6.NS.6.
Know that there are numbers that are not rational, and approximate them by rational numbers				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., $\sqrt{2}$ ). For example, by truncating the decimal expansion of $\sqrt{2}$ , show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.	8.NS.2	3	High	See note for standard 6.NS.6.
<b>Ratios and Proportional Relationships (Grades 6-7)</b>				
Understand ratio concepts and use ratio reasoning to solve problems				
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	6.RP.3	4	High	At level 4, examinees will be shown familiar graphics such as tables and number line diagrams demonstrating ratios and rates (e.g., Cost and Revenue per 1,000 Units Produced) and asked to compare information, and/or identify trends, relationships, or patterns.
Make tables of equivalent ratios relating quantities with whole- number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.	6.RP.3a	4	Supporting	See note for standard 6.RP.3. Supporting strength because examinee will not be required to make tables.
Analyze proportional relationships and use them to solve real-world and mathematical problems				
Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.	7.RP.2a	4	Supporting	See note for standard 6.RP.3a. Supporting strength because examinee will not be required to graph.
Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	7.RP.2b	4	High	At level 4, examinees will be shown familiar graphics such as tables and number line diagrams demonstrating ratios and rates (e.g., Cost and Revenue per 1,000 Units Produced) and asked to compare information, and/or identify trends, relationships, or patterns.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.	7.RP.2d	4	High	See note for standard 6.RP.3a.
<b>Expressions and Equations</b>				
Solve real-life and mathematical problems using numerical and algebraic expressions and equations				
Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$ , where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.	7.EE.4b	5	High	At level 5, examinees will interpret a trend, relationship, or a pattern in a graphic.
Understand the connections between proportional relationships, lines, and linear equations				
Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	8.EE.5	4	Supporting	At level 4, examinees will be shown familiar graphics such as tables and number line diagrams demonstrating ratios and rates (e.g., Cost and Revenue per 1,000 Units Produced) and asked to compare information, and/or identify trends, relationships, or patterns.
Analyze and solve linear equations and pairs of simultaneous linear equations				
Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.	8.EE.8a	5	Supporting	At Level 5, examinees will compare two or more trends/patterns/relationships using graphics with an x and y axis and several variables.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.	8.EE.8b	5	Supporting	See note for standard 8.EE.8a.
Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.	8.EE.8c	5	Supporting	See note for standard 8.EE.8a.
Functions				
Define, evaluate, and compare functions				
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	8.F.1	5	High	At level 5, examinees will interpret a trend, relationship, or a pattern in a graphic and make a decision.
Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.	8.F.3	5	High	At level 5, examinees will interpret a trend, relationship, or a pattern in a graphic and make a decision. For example, an employee must determine when the greatest difference between revenue and cost occurs in order to decide how many units to produce.
Use functions to model relationships between quantities.				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	8.F.4	5	High	See note for standard 8.F.3.
Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	8.F.5	5	High	See note for standard 8.F.3.
<b>Statistics and Probability</b>				
<b>Summarize and describe distributions</b>				
Summarize numerical data sets in relation to their context, such as by: <ul style="list-style-type: none"> <li>-Reporting the number of observations.</li> <li>- Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>- Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> <li>- Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</li> </ul>	6.SP.5	5	High	At level 5, examinees will compare two or more trends/patterns/relationships, interpret a trend, relationship, or a pattern in a graphic, make a reasonable inference or decision based on one graphic after finding information in another graphic, justify an inference or decision based on information, identify and/or justify the most effective graphic for a task.
<b>Draw informal comparative inferences about two populations</b>				

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.	7.SP.3	5	High	See note for standard 6.SP.5.
Investigate chance processes and develop, use, and evaluate probability models				
Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.	7.SP.8b	3	High	At Level 3, examinees can locate information on one or two (such as an x and/or y axis), there is usually more than one level of data, and there is a moderate amount of data (more than 20 data points)
Investigate patterns of association in bivariate data				
Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	8.SP.1	5	High	At level 5, examinees will compare two or more trends/patterns/relationships, interpret a trend, relationship, or a pattern in a graphic, make a reasonable inference or decision based on one graphic after finding information in another graphic, justify an inference or decision based on information, identify and/or justify the most effective graphic for a task.
Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	8.SP.2	5	High	See note for standard 8.SP.1.

Mathematics Standards Level D	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.	8.SP.3	6	High	At Level 6, examinees will work with difficult graphics that are likely to be less common or a composite of graphics with less familiar content, many variables, two or more axis. Examinees will compare two or more pieces of information, identify a trend/pattern/relationship, make an inference or decision, or identify the graphic that accurately represents the data.
Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they like to cook and whether they participate actively in a sport. Is there evidence that those who like to cook also tend to play sports?	8.SP.4	4	High	At level 4, examinees will be shown familiar graphics such as tables and number line diagrams demonstrating ratios and rates (e.g., Cost and Revenue per 1,000 Units Produced) and asked to compare information, and/or identify trends, relationships, or patterns.

Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
<b>Number and Quantity</b>				
Reason quantitatively and use units to solve problems				
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	N.Q.1	5	High	At level 5, examinees will interpret a trend, relationship, or a pattern in a graphic.
<b>Functions</b>				
Understand the concept of a function and use function notation				
Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .	F.IF.1	4	High	At level 4, examinees will be shown familiar graphics such as tables and number line diagrams demonstrating ratios and rates (e.g., Cost and Revenue per 1,000 Units Produced) and asked to compare information, and/or identify trends, relationships, or patterns.
Interpret functions that arise in applications in terms of the context				
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. For example, for a quadratic function modeling a projectile in motion, interpret the intercepts and the vertex of the function in the context of the problem. [Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.]	F.IF.4	5	High	At level 5, examinees will interpret a trend, relationship, or a pattern in a graphic, and make a decision. For example, an employee must determine when the greatest difference between revenue and cost occurs in order to decide how many units to produce.



Mathematics Standards Level E	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	F.IF.6	5	High	See note for standard F.IF.4.
<b>Analyze functions using different representations</b>				
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.	F.IF.9	5	High	See note for standard F.IF.4.
<b>Statistics and Probability: Interpreting Categorical and Quantitative Data</b>				
<b>Summarize, represent, and interpret data on a single count or measurable variable</b>				
Represent data with plots on the real number line (dot plots, histograms, and box plots).	S.ID.1	5	High	See note for standard F.IF.4.
<b>Summarize, represent, and interpret data on two categorical and quantitative variables</b>				
Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	S.ID.5	5	High	See note for standard F.IF.4.
<b>Interpret linear models</b>				
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	S.ID.7	5	High	See note for standard F.IF.4.



Appendix D. CCRSAE ELA/Literacy Crosswalk to ACT WorkKeys Graphic Literacy

Anchor 10	CCRS-AE Standard	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
<b>CCR Anchor 5: Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.</b>					
A	Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.	RI.1.5	3	Low	Graphic Literacy includes working with graphics such as tables and charts and could include the use of electronic menus, tables of contents, and icons.
B	Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.	RI.2.5	3	Low	GL specifically relevant for glossaries, indexes, and electronic menus.
B	Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.	RI.3.5	3	Low	GL specifically relevant for glossaries, indexes, and electronic menus.
<b>CCR Anchor 7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.</b>					
A	Use the illustrations and details in a text to describe its key ideas (e.g., maps, charts, photographs, political cartoons, etc.).	RI.1.7	3	High	Since Band A is for K-1, it is assumed that any maps or charts will be extremely common, familiar, and simple.
B	Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).	RI.3.7	3	High	Since Band B is for 2-3 grades, it is assumed that any maps will be extremely common, familiar, and simple.

Anchor 10	CCRS-AE Standard	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
C	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.	RI.4.7	5	High	Since C is for 4-5 grades and they are being asked to interpret information, it is assumed that any graphics will be common and familiar, but may have more than one level of data, several variables, and a moderate number of data points or fields.
C	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.	RI.5.7	5	High	Since C is for 4-5 grades and they are being asked to interpret information, it is assumed that any graphics will be common and familiar, but may have more than one level of data, several variables, and a moderate number of data points or fields.
D	Integrate information presented in different media or formats (e.g., in charts, graphs, photographs, videos, or maps) as well as in words to develop a coherent understanding of a topic or issue.	RI.6.7	Level 5-6	High	Since D is for 6-8 grades and they are being asked to integrate information, it is assumed that at least some of the graphics may be of high moderate difficulty (more than one level of data with nesting, less common graphic types and a moderate number of data points or fields).
D	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	RST.6-8.7	Level 5-6	High	See note for Standard RI.6.7.
E	Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.	RH.9-10.7	Level 6-7	High	Since E is for high school and they are being asked to integrate information, it is assumed that at least some of the graphics may be difficult.

Anchor 10	CCRS-AE Standard	CCRS-AE Code	WorkKeys Level	Strength of Link	Note
E	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	RST.9-10.7	Levels 6-7	High	See note for Standard RH.9-10.7.
E	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.	RI.11.12.7	Levels 6-7	High	See note for Standard RH.9-10.7.