7th GRADE MATH

Curriculum Map 2016-2017

CANYONS
School District

MATH CURRICULUM MAP
CANYONS SCHOOL
DISTRICT 2016-2017

Curriculum Mapping Purpose

Canyons School District's curriculum math maps are standards-based maps driven by the Utah Core State Standards for Mathematics and implemented using Big Ideas. Student achievement is increased when both teachers and students know where they are going, why they are going there, and what is required of them to get there. Additional instructional days were intentionally built into the map to allow teachers to go into more depth on concepts. Supporting resources for these additional days can be found in the General Information section.

Curriculum Maps are a tool for:

- **ALIGNMENT:** Provides support and coordination between concepts, skills, standards, curriculum, and assessments
- **COMMUNICATION:** Articulates expectations and learning goals for students
- **PLANNING:** Focuses instruction and targets critical information
- **COLLABORATION:** Promotes professionalism and fosters dialogue between colleagues about best practices in both instruction and assessment.
- **SCAFFOLDED INSTRUCTION AND GROUPING STRUCTURES:** The organization of a scaffolded classroom includes whole group, small group (e.g., teacher-led skill-based, cooperative learning), partner, and independent work where students are provided support towards mastery. As students assume more responsibility for the learning, gradual support is decreased in order to shift the responsibility for learning from the teacher to the students.

General Information

Pacing

This curriculum map provides guidance for intertwining the Utah Core Math Standards and the Big Ideas curriculum. Following the map, allows students to access all core standards by the end of the year.

Homework

The struggle to develop new concepts should occur while the teacher is available to support and scaffold the learning and correct students' errors in thinking. Work that is sent home for students to complete should consist of concepts that have already been taught in class, been practiced, and the student can already do independently. Math homework should be used to build automaticity of skills already acquired and not for development of new skills without instruction. Practicing concepts incorrectly at home can reinforce errors in thinking and cause frustration for students and families. Practicing the skill to automaticity with homework assignments is appropriate after students have acquired the skill. *Reflex Math* is available for students in grades 2-5 and can be accessed at home as well as at school. *Reflex* Math *helps* students develop fluency with their basic facts in addition, subtraction multiplication and division and could be assigned as homework to support students' automaticity.

Online Supports for Unpacking the Core

For additional information about teaching math standards, please visit the following websites:

USOE Curriculum Guides *http://www.schools.utah.gov/CURR/mathsec/Core/Grade7.aspx*

EngageNY—Mathematics Modules--http://www.engageny.org/mathematics

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Canyons School District secondary math maps are created by CSD secondary teachers and published by the CSD Office of Instructional Supports.

Canyons School District Academic Framework to Support Effective Instruction

Multi-Tiered System of Supports (MTSS) for Academics and Behavior

RTI Multi-Tiered System of Support	(1) Providing high quality core instruction (and intervention) matched to students' needs	(2) using data over time (i.e. rate of learning, level of performance, fidelity of implementation)	(3) to make important educational decisions.
CANYONS School District **Student Achievement Principles**	• All CSD students and educators are part of ONE proactive educational system. • Evidence-based instruction and interventions are aligned with rigorous content standards.	• Data are used to guide instructional decisions, and allocate resources. • CSD educators use assessments that are reliable, valid, and connected to standards	• CSD educators problem solve collaboratively to meet student needs.
	• Culture centers around building positive relationships, setting high expectations, and committing to every student's success. • Ongoing, targeted, quality professional development and coaching supports effective instruction for ALL students. • Leadership at all levels is vital.		

Core Expectations for ALL Teachers in the Classrooms and Common Areas

Standards for Instruction	Evidence-based Instructional Priorities	Time Allocation for Instruction	Teacher Learning Data	Student Performance Data	Collaborative Problem Solving for Improvement
Standards clarify what we want students to learn and do.	Planning, instruction, and assessment techniques to increase student engagement and achievement.	School culture ensures that instructional time is maximized to increase student growth.	Teacher learning and professional growth fostered through public practice and ongoing feedback.	Student academic and behavioral performance is assessed using a variety of reliable and valid methods.	Use data to problem solve and make decisions
Curriculum maps with common pacing guides Instructional content aligned with the Utah Core Standards Scientifically research-based programs Standards-based grades and report cards Cognitive Rigor (Depth of Knowledge – DOK) International Society for Technology in Education Standards (ISTE) School-wide Positive Behavioral Interventions and Supports (PBIS) World-class Instructional Design and Assessment (WIDA) Federal and state requirements (IEP, 504, ELs)	Classroom Positive Behavioral Interventions and Supports (PBIS) Explicit Instruction (I, We, Y'all, You) Instructional Hierarchy: Acquisition, Automaticity, Application (AAA) Systematic Vocabulary Development Maximizing Opportunities to Respond (OTR) Feedback Cycle Scaffolded Instruction & Grouping (SIG) Structures	Master schedule takes into consideration the learning needs of the student population. Scheduling is ensured for: • Intervention and skill-based instruction • Special Education services • English Language Development (ELD) Classroom instructional time is prioritized for instruction of standards Individual and team planning time is used to intentionally increase the application of evidence-based instructional priorities and standards for instruction	Annual setting of goals and documentation of progress (e.g. CSIP, LANDTrust, CTESS) Supporting teacher growth Formalized protocols and checklists to monitor and support implementation Public practice applications: • Coaching cycles with peer coaches, teacher specialists, achievement coach, and/or new teacher coach • Instructional Professional Learning Communities (IPLCs) • Learning walkthroughs and targeted observations • Lesson Study • Video Analysis	Assessment practices: • Inform instruction • Provide feedback about learning to students, parents, and teachers • Build student efficacy • Monitor student achievement and behavioral growth • Celebrate teaching and learning successes Assessment Types: • Classroom Assessing • Teams and Schoolwide Assessment • Districtwide Standards-based Benchmarks • Comprehensive Assessments • Screening Assessments (DIBELS, SRI, SMI) • Specialized Assessments (WIDA, IDEA, eligibility assessment, Phonics surveys)	Problem solving process: identify, analyze, plan, and evaluate Early warning system for identification of risk (academic, behavior, and attendance) Timely and consistent review of relevant data by teams (e.g. BLT, IPLC, CST): • Evaluate effectiveness of academic and behavior instruction for all groups of students using valid and reliable data (student and teacher data) • Determine needs for academic and behavior intervention

Public Practice and Coaching Supports

INSTRUCTIONAL PRIORITIES

Techniques to Increase Student Achievement and Engagement

Classroom Positive Interventions & Supports (PBIS)

Effect Size: .52

Explicit Instruction (I do, We do, Y'all Do, You do)

Effect Size: .57

Instructional Hierarchy (Acquisition, Automaticity, Application)

Effect Size: .57

Systematic Vocabulary Development

Effect Size: .67

Maximizing Opportunities to Respond (OTR)

Effect Size: .60

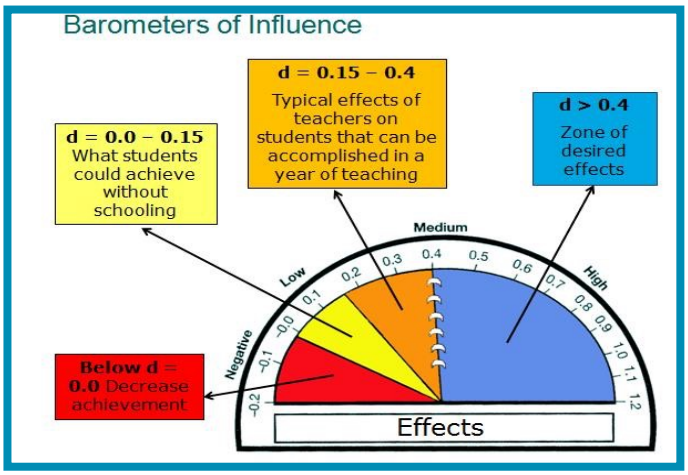
Feedback Cycle

Effect Size: .75

Scaffolded Instruction & Grouping

Effect Size: .49

Our time with students is limited and valuable. Every minute we spend with them should be spent using the practices that are most likely to be successful. This requires us to shift our perspective from looking at instructional practices that work to looking at what instructional practices work BEST.



Works Best?

Meta-analysis offer the strongest evidence base for determining what works best. "A Meta-analysis is a summary, or synthesis of relevant research findings. It looks at all of the individual studies done on a particular topic and summarizes them." (Marzano, 2000). A meta-analysis is simply, a study of studies. Meta-analysis explain the results across studies examined using effect size (ES). Average effects for instruction is 0.20 to 0.40 growth per year (Hattie, 2009). Thus the hinge point for determining what works best is 0.40. Instructional practices above the 0.40 have a high likelihood of increasing learning than those practices below the hinge-point (Hattie, 2009).

INSTRUCTIONAL PRIORITIES

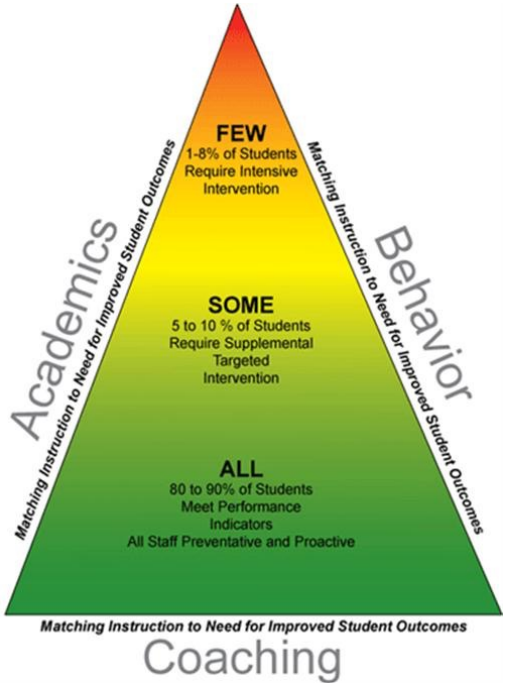
Techniques to increase Student Achievement and Engagement

Overview

Priority	Critical Actions for Educators
Classroom Positive Behavioral Interventions and Supports (PBIS)	*Clearly identify behavior expectations and explicitly teach them to your students. *Implement reinforcement system for appropriate behavior and routinely evaluate the system for effectiveness. *Recognize students for positive behavior. *Systematically correct problem behaviors.
Explicit Instruction (I do, We do, Y'all do, You do)	*Give clear, straightforward, and unequivocal directions. *Explain, demonstrate and model. Introduce skills in a specific and logical order. Support this sequence of instruction in your lesson plans. *Break skills down into manageable steps. Review frequently. *Demonstrate the skills for students and give opportunity to practice skills independently.
Instructional Hierarchy: Acquisition, Automaticity, then Application (AAA)	*Explicitly teach a skill to students by explaining, demonstrating, and modeling. *Build the skill through practice and use, to gain automaticity. *Provide students with multiple opportunities to apply the skill.
Systematic Vocabulary Development	*Explicitly teach critical vocabulary before students are expected to use it in context. *Teach students to say, define, and use critical vocabulary in discreet steps. *Explicitly teach common academic vocabulary across all content areas.
Maximizing Opportunities to Respond (OTR)	*Actively engage ALL students in learning; students are active when they are saying, writing, or doing. *Pace instruction to allow for frequent student responses. *Call on a wide variety of students throughout each period.
Feedback Cycle	*Provide timely prompts that indicate when students have done something correctly or incorrectly. *Give students the opportunity to use the feedback to continue their learning process. *End feedback with the student performing the skill correctly and receiving positive acknowledgement.
Scaffolded Instruction and Grouping Structures	*Present information at various levels of difficulty. *Use data to identify needs and create small groups to target specific skills. *Frequently analyze current data and move students within groups depending on their changing needs.

CLASSROOM PBIS

Effect Size: 0.52



Critical Actions for Educators

*Clearly identify behavior expectations and explicitly teach them to students.

*Implement reinforcement system for appropriate behavior and routinely evaluate the system for effectiveness.

*Recognize students for positive behavior.

*Systematically correct problem behaviors.

The heart of classroom management is developing routines and organizing environments that promote student success through the active teaching of positive social behaviors.

A well-implemented positive classroom management system will:

- Increase positive behavior in students
- Help students feel more positive towards their teacher, administrator and school
- Help students feel safer in school
- Increase time for academic instruction and decrease teacher time spent correcting problem behaviors

PBIS, or Positive Behavioral Interventions and Supports, is an evidence-based system that helps define the key components of a well-managed classroom. The key components include:

- Clearly establishing classroom rules
- Explicitly teaching rules
- Reinforcing positive behaviors and correcting negative behaviors
- Creating a supportive classroom

CLASSROOM PBIS

Effect Size: 0.52

Key Component	Definition

Clearly Establishing Student Rules	• Select 3-5 positively stated and easily remembered rules that align with the school- wide rules
	  • For example: If the school-wide rules are to Be Safe, Be Kind, Be Responsible. It is appropriate to adopt these same rules for your classroom, and add one or two additional rules that fit the needs of your setting if necessary. It is important to explicitly describe what these rules look like in your classroom.
	• Publicly post rules in the classroom in a prominent location.
	• Determine which routines are needed for your classroom (a routine is a set of skills explicitly taught to students to help them be successful with following the rules). Examples may include:
	  • Walking in the hallway
	  • Classroom exit
	  • Starting and ending class
	  • Sharpening pencils
	  • Going to the restroom
	  • Transitioning from one activity to the next
	  • Technology use in the classroom

Explicitly Teaching Rules	• Explicitly teach classroom rules and routines to students.
	  • Define and model positive examples and non-examples of what the rules look like in the classroom.
	  • Have students model and practice performing the desired behaviors.
	  • Provide positive feedback and corrective feedback as needed during practice of the desired behaviors.
	• Review and practice the rules with students throughout the school year.
	  • Rules should be reviewed more comprehensively at the beginning of each year, after significant breaks in the school schedule (e.g. Thanksgiving, Winter, Spring), and as needed.
	• Example Routine
	  • Classroom exit: Describe and model the routine to students, have students practice lining up, and going back to their seats. It is important that 100% of students demonstrate the behavior correctly. This may require multiple practice opportunities while providing positive and corrective feedback.

CLASSROOM PBIS

Effect Size: 0.52

Key Component	Definition

Reinforcing Positive Behaviors and Correcting Negative Behaviors	• It is important to publicly recognize positive behavior, while individually providing corrective feedback when needed. Students should be monitored closely while in the classroom and feedback should be given often. Public positive statements often prompt other students to exhibit the desired behavior.
	  • Example: "I really like the way Sarah is waiting for instructions. She has her materials ready, and she's sitting quietly at her desk."
	• When correcting negative behavior, provide a precision request to students (whole group) to describe desired behavior. Based on student response, provide positive feedback to the group. If undesired behaviors continue follow-up with a statement of the desired behavior directed to the target student in a private manner as needed. Give the student an opportunity to comply and perform the behavior correctly, and then reward the student with positive feedback.
	  • Example: "I need everyone to be in their seats, have materials ready, and wait quietly for instructions." Teacher observes Sarah talking during the transition, so he/she approaches Sarah quietly. "Sarah, the rule in our class is to wait quietly for instructions. I need you to show me how you sit quietly for instructions." While Sarah is performing the desired behavior, you might say, "Sarah, I appreciate how you are waiting quietly. Great job."

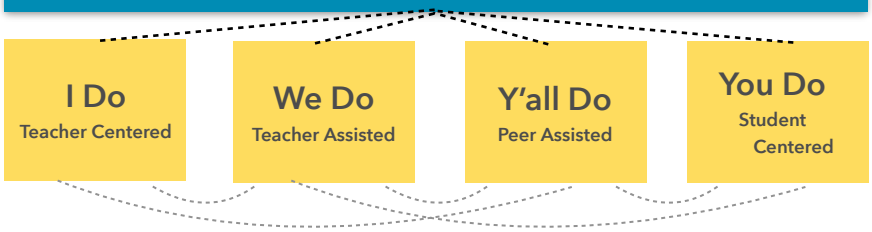
Creating a Supportive Classroom	Creating a safe and respectful learning environment allows students to feel supported while learning. It is necessary for teachers to find opportunities to establish positive connections with all students. A teacher's daily interactions influence the students' perception of safety and sense of trust. Considerations for creating a supportive classroom include: • Make personal connections with students • Help students feel like they belong • Establish clear classroom norms to demonstrate respect for others • Create consistent rules, routines, and arrangements (fosters predictability) • Weave positive feedback into daily interactions with students and parents • Be available for students (e.g. to ask questions, seek guidance) • Actively listen • Set a positive tone for learning and problem solving • Be aware of your personal emotions, assumptions, and biases and how they may impact your interactions with students

EXPLICIT INSTRUCTION

Effect Size: 0.57

Explicit instruction is a systematic method of teaching with emphasis on proceeding in small steps, checking for student understanding, and achieving active and successful participation by all students.

Student Feedback/Checks for Understanding



The model is generally characterized with the following components: I Do, We Do, Y'all Do, and You Do. Teachers use student feedback to determine how to progress through the model. For instance, if students are in the "We Do" phase, and the teacher has determined that students aren't understanding, they should move back to the "I Do" phase to provide more examples.

Explicit Instruction	
I Do (Modeling)	Demonstrate & Describe Use Think-Alouds Involve Students
We Do (Guided Practice)	Heavily Scaffolded with Prompts • Tell them what to do. • Ask them what to do. • Remind them what to do. Continual Checks for Understanding
Y'all Do (Group Practice)	Practice Skill in Small Groups/Partners Continual Checks for Understanding Use Precision Partnering
You Do (Individual Practice)	Monitored Individual Practice Show Mastery of Skill

Critical Actions for Educators

*Give clear, straightforward, and unequivocal directions.

*Explain, demonstrate and model. Introduce skills in a specific and logical order. Support this sequence of instruction in your lesson plans.

*Break skills down into manageable steps. Review frequently.

*Demonstrate the skills for students and then give the opportunity to practice skills independently.

* I do, We Do, Y'all Do, You Do.

INSTRUCTIONAL HIERARCHY

Effect Size: 0.57

Critical Actions for Educators

*Explicitly teach a skill to students by explaining, demonstrating, and modeling.
*Build the skill through practice and use, to gain automaticity.
*Provide students with multiple opportunities to apply the skill.

Learners follow predictable stages. To begin, the learner is usually halting and uncertain as she tries to use a new skill. With feedback and a lot of practice, the learner becomes increasingly accurate, then automatic (fluent), and confident in using the skill.

Acquisition, automaticity, and application are progressive stages of the instructional hierarchy. Each stage requires its own set of pedagogical approaches and assessment strategies.

The learning stages, along with the goal of each phase and the teacher and student actions present in each stage are listed in the table below.

Accurate at Skill

- If no, teach skill.
- If yes, move to automaticity.

Automatic at Skill

- If no, teach automaticity.
- If yes, move to application.

Able to Apply Skill

- If no, teach application.
- If yes, move to higher level/concept or repeat cycle with new knowledge.

INSTRUCTIONAL HIERARCHY

Effect Size: 0.57

Learning Stage	Goal	Teacher and Student Actions
Acquisition • First learning stage • Teacher feedback to increase accuracy • Typically associated with DOK 1	The student can perform the skill accurately with little adult support. If goal met proceed to automaticity stage; if not teach skill.	• Teacher actively demonstrates target skill • Teacher uses 'think-aloud' strategy-- especially for thinking skills that are otherwise covert • Student has models of correct performance to consult as needed (e.g., correctly completed math problems on board) • Student gets feedback about correct performance • Student receives praise, encouragement for effort • Students take notes, outlines, points
Automaticity • Builds habits and fluent skills through repetition and deliberate practice with timely and descriptive feedback • Typically associated with DOK 2	The student has learned skill well enough to retain, to combine with other skills, and is as fluent as peers. If observed proceed to application; if not continue or move back to acquisition.	• Teacher structures learning activities to give student opportunity for active (observable) responding • Student has frequent opportunities to drill (direct repetition of target skill) and practice (blending target skill with other skills to solve problems) • Student gets feedback on fluency and accuracy of performance • Student receives praise, encouragement for increased fluency
Application • Applying knowledge or skills to relevant application • Typically associated with DOK 3 & 4	The student uses the skill across situations and settings solving real life problems. If observed, move to new skills and knowledge or move to a higher level concept; if not observed try again or go back to building automaticity.	• Teacher structures academic tasks to require that the student use the target skill regularly in assignments • Student receives encouragement, praise for using skill in new settings, situations • Teacher works with parents to identify tasks that the student can do outside of school to practice target skill • Teacher helps student to articulate the 'big ideas' or core element(s) of target skill that the student can modify to face novel tasks, situations • Encourage student to set own goals for adapting skill to new and challenging situations.

EXPLICIT VOCABULARY

Effect Size: 0.57

Explicit vocabulary instruction is clear, concise vocabulary instruction presenting the meaning and contextual examples of a word through multiple exposures. It is not the traditional procedure of having students copy a list of words, looking up words, copying definitions, or memorizing definitions.

Systematic vocabulary instruction increases reading comprehension, allows for greater access to content material, increases growth in vocabulary knowledge, and supports struggling readers.

Effective vocabulary/academic language instruction comes down to:

- Connection: Connect the new word to what the student knows, which helps to build the "semantic network" in the brain.
- Use: Academic speaking and writing is constructed as we apply it, not by simply memorizing.

Teacher should explicitly teach worlds that are:

- Based on essential concepts
- Unknown
- Critical to the future
- Difficult to obtain independently (or through context)

Critical Actions for Educators

*Explicitly teach critical vocabulary before students are expected to use it in context.
*Teach students to say, define, and use critical vocabulary in discreet steps.
*Explicitly teach common academic vocabulary across all content areas.

Basic Instructional Protocol	
1. Introduce the word 2. Provide student friendly definition of the word 3. Identify word parts, families, and origin 4. Illustrate word with examples	5. Check students' understanding 6. Deepen students' understanding 7. Check students' understanding 8. Review and coach use (possible extensions)

OPPORTUNITIES TO RESPOND

Effect Size: 0.57

Critical Actions for Educators

*Actively engage ALL students in learning; students are active if they are saying, writing, or doing.
*Pace instruction to allow for frequent student responses.
*Call on a wide variety of students throughout each period.

Maximizing the opportunities to respond in a classroom increases students engagements. Engagement allows for positive interactions between teacher and student, creates opportunities for teachers to provide authentic feedback on learning, and decreases inappropriate student behavior.

Students are engaged through opportunities to respond when they are saying, writing, or doing (Feldman). When tied to learning objectives, these opportunities give the teacher and students feedback on their learning and understanding.

Engagement opportunities can be focused on an individual student or a group of students. Each of these approaches has different purposes. The teacher may choose to use a group OTR to minimize the risk the student feels in responding and to increase engagement for all students. Through group OTRs, students not only receive feedback from the teacher, but their peers as well as they hear and see other student responses. When seeking individual student understanding, teachers may choose to use individual OTRs.

Opportunities to respond can be verbal or non-verbal. Verbal responses help students to summarize and share their thoughts with others while non-verbal responses can increase writing skills or give students the opportunity to move around the room.

Structured Non-Verbal	Structured Verbal	Structured Writing	Structured Reading
• Cold Calling (Teacher Chosen) • Cold Calling (Random) • Choral Response • Think Pair Share • Precision Partner • Small Group Discussion	• Hand Signals • Point at Something • 4 Corners • Response Cards • White Boards • Student Response System	• Note-Taking: Cloze, Cornell • Graphic Organizer • Sentence Starter/ Quick Write • White Boards • Summarizing • Technology	• Partner Reading w/ Comprehension Strategy • Choral Reading • Cloze Reading Guide • Model Reading Strategies • Task for each Reading Segment

FEEDBACK

BETWEEN TEACHERS & STUDENTS

Effect Size: 0.75

Feedback lets the learner know whether or not a task was performed correctly, and how it might be improved. Feedback is most effective when it is clear, purposeful, compatible with prior knowledge, immediate, and non-threatening.

Feedback from Students:
Educational research indicates that feedback is one of the most powerful drivers of student achievement. John Hattie's synthesis of the overall effect size of feedback is very high (ES = .75). He states that feedback from students as to what they understand, when they are not engaged, where they make errors, and when they have misconceptions helps make student learning visible to the teacher.

Feedback to Students:
Positive academic and behavioral feedback, or teacher praise has been statistically correlated with student on-task behavior (Apter, Arnold & Stinson, 2010) and has strong empirical support for both increasing academic and behavioral performance and decreasing problem behaviors (Gable, Hester, Rock & Hughes, 2009). With regard to reprimands and corrective feedback, there is a continued assertion that teachers maintain a ratio of praise to correction at 3:1 or 4:1 (Gable, Hester, Rock, & Hughes, 2009; Stichter, Lewis, & Wittaker, 2009).

Critical Actions for Educators

*Provide timely prompts that indicate when students have done something correctly or incorrectly.
*Give students the opportunity to use the feedback to continue their learning process.
*End feedback with the student performing the skill correctly and receiving positive acknowledgement.

Feedback Types:

Type	Description	Example	Non-Example
Positive	Teacher indicates that a target academic or social behavior is correct.	"Correct! 7 X 4 is 28"	"Johnny, pick up your pencil off the floor please
Corrective	Teacher indicates that a behavior is incorrect.	"That's not quite right, let me give you another clue . . . "	"Try harder on your math worksheet; I know you can do better."
Harsh	Teacher shows frustration or is critical of the student.	I can't believe you **still** can't figure this out!	"Let me give you another clue . . . "
Neutral	Teacher redirects the student or describes what she would like the student to do.	"Johnny, turn to page 4 and start reading."	"Nice work! You really showed justification for your reasons."

FEEDBACK CYCLE

Effect Size: 0.75

	Example	Non-Example
Corrective Sequence	• Teacher provides an opportunity to respond • Student responds incorrectly • Teacher indicates that the response was not correct and provides an opportunity for correction • Student gives correct response • Teacher affirms that response was correct	• Teacher provides an opportunity to respond • Student responds incorrectly • Teacher indicates that the response was not correct but does not provide an opportunity for the student to answer correctly
Expansive Sequence	• Teacher provides an opportunity to respond • Student response is a partial response or could be expanded into a higher quality response • Teacher affirms response and provides guidance for expansion/refinement • Student revises or elaborates upon previous response • Teacher acknowledges response as an improvement	• Teacher provides an opportunity to respond • Student response is a partial response or could be expanded into a higher quality response • Teacher affirms response but does not provide guidance for expansion/refinement
Challenge Sequence	• Teacher provides an opportunity to respond • Student response is fully correct • Teacher affirms student response and asks a more difficult question on the same topic as a follow up • Student answers • Teacher responds with positive or corrective feedback	• Teacher provides an opportunity to respond • Student response is fully correct • Teacher affirms student response but does not ask a more difficult question on the same topic as a follow up

SCAFFOLDING & GROUPING

Effect Size: 0.57

Scaffolding is a process in which students are given support until they can apply new skills and strategies independently (Rosenshine & Meister, 1992). When students are learning new or challenging task, they are given more assistance. As they begin to demonstrate task mastery, the assistance or support is decreased gradually in order to shift the responsibility for learning from the teacher to the students. Thus, as the students assume more responsibility for learning, the teacher provides less support.

Structure of the Scaffolded Classroom:
The organization of the scaffolded classroom includes whole group, small group (skill-based or station teaching), partners, and independent work. The scaffolding supports that will be put in place for diverse learners should include interventions for striving and accelerated learners. When using small groups, identify the groups as skill-based or station teaching. Skill-based groups are organized homogeneously based upon the needs of students. Station teaching groups are organized heterogeneously to create diverse groups.

Critical Actions for Educators

*Present information at various levels of difficulty.
*Use data to identify needs and create small groups to target specific skills.
*Frequently analyze current data and move students within groups depending on their changing needs.

Types of Scaffolds

Scaffold	Ways to use Scaffolds in an Instructional Setting
Advance Organizers	Tools used to introduce new content and tasks to help student learn about the topic: Venn diagrams to compare and contrast information; flow charts to illustrate processes; organizational charts to illustrate hierarchies; outlines that represent content; mnemonics to assist recall; statements to situate the task or content; rubrics that provide task expectations.
Checklists	Prepare a list of items required, things to be done, or points to be considered; used as a reminder as the student proceeds through the learning task.
Collaborative Grouping	Having students work in partners or small groups with students who can support/model students who may struggle with content.
Concept and Mind Maps	Maps that show relationships: Partially or completed maps for students to complete; students create their own maps based on their current knowledge of the task or concept.
Cue Cards	Prepared cards given to individual groups of students to assist in their discussion about a particular topic or content area: Vocabulary words to prepare for exams; content-specific stem sentences to complete; formula to associate with a problem; concepts to define.
Examples	Samples, specimens, illustrations, problems, modeling: Real objects; illustrative problems used to represent something. Demonstrate and model how to do something, giving an example of what it should look like.
Explanations	More detailed information to move students along on a task or in their thinking of a concept: Written instructions for a task; verbal explanation of how a process works.

Scaffold	Ways to use Scaffolds in an Instructional Setting
Handouts	Prepared handouts that contain task and content-related information, but with less detail and room for student note taking.
Images and Multimedia	Providing an image or other graphic representation, such as a video, that represents the word(s)/concept(s) being taught in conjunction with the explicit vocabulary routine can help to support students in learning new vocabulary and concepts. Images help provide a non-linguistic representation and allow students to recall the term more readily. This technique can be used with any Reading Street Vocabulary (Amazing Words, Story/Lesson Vocabulary), Math Vocabulary, or Content Vocabulary or concepts.
Manipulatives	Manipulatives, such as markers, toothpicks, blocks, or coins, are used to support hands-on learning and provide concrete models to help students solve problems and develop concepts. The students can manipulate the items to increase their understanding and come to accurate conclusions. May also include virtual manipulatives.
Pair-Share	Pose a problem, students have time to think about it individually, and then they work in pairs to solve the problem and share their ideas with the class. Providing think time increase the quality of the response.
Precision Partnering	Strategically appointed partners with assigned roles.
Previewing Text	Before reading a text, preview the text by providing students with an overview/synopsis of the text. This will allow students to know what to expect when they are reading and give them background knowledge to help them understand the text.
Prompts	A physical or verbal cue to remind–to aid in recall of prior or assumed knowledge. Physical: Body movements such as pointing, nodding the head, eye blinking, foot tapping. Verbal: Words, statements and questions such as "Go," "Stop," "It's right there," "Tell me now," "What toolbar menu item would you press to insert an image?" "Tell me why the character acted that way."
Question Cards	Prepared cards with content and task-specific *questions* given to individuals or groups of students to ask each other pertinent questions about a particular topic or content area.
Question Stems	Incomplete sentences which students complete: Encourages deep thinking by using higher order "What if" questions.
Realia	Anytime the real object, concept, or phenomena can be presented with the actual object helps to support learners in acquiring new ideas and concepts. For example, when teaching about the three types of rocks, having examples of those types for students to see and touch can help them to make deeper connections.
Rubrics	A rubric is an easily applicable form of authentic assessment. A rubric simply lists a set of criteria, which defines and describes the important components of the work being planned or evaluated.
Sentence Frames	Sentence frames provide an opportunity for students to use key vocabulary while providing a structure that may be higher than what they could produce on their own. For example, if students are to compare two ocean creatures, they might say something like "Whales have lungs, but fish have gills." In the preceding sentence, the simple frame is "_____ have _____, but _____ have _____. Note the sentence can be filled in with any content; this differs from cloze sentences that often have only a few possibilities.
Setting & Reviewing Objectives	Providing students with a purpose and intended outcome will help students to know what to focus their attention on and what they should be learning. Having student self-assess their progress towards the objectives at the end of the lesson will provide the teacher with information on their current levels of understanding.
Socratic Seminar	The purpose of a Socratic Seminar is to achieve a deeper understanding about the ideas and values in a text. In the Seminar, participants systematically question and examine issues and principles related to a particular content, and articulate different points-of-view. The group conversation assists participants in constructing meaning through disciplined analysis, interpretation, listening, and participation. Prepare several questions in advance in addition to questions that students may bring to class. Questions should lead participants into the core ideas and values and to the use of the text in their answers. Questions must be open-ended, reflect genuine curiosity, and have no "one-right answer."
Stories	Stories relate complex and abstract material to situations more familiar with students: Recite stories to inspire and motivate learners.
Student Work Exemplars	Providing students with example student work samples can provide models for students to use to support their development of the skill. For example, an anchor paper for a writing assignment of how a sample student responded to the assignment previously will provide an example of what the assignment looks like.
Visual Scaffolds	Pointing to call attention to an object; representational gestures (holding cured hands apart to illustrate roundness; moving rigid hands diagonally upward to illustrate steps or process), diagrams such as charts and graphs; methods of highlighting visual information.

Hess' Cognitive Rigor Matrix & Curricular Examples: Applying Webb's Depth-of-Knowledge Levels to Bloom's Cognitive Process Dimensions – *M-Sci*

Revised Bloom's Taxonomy	Webb's DOK Level 1 Recall & Reproduction	Webb's DOK Level 2 Skills & Concepts	Webb's DOK Level 3 Strategic Thinking/ Reasoning	Webb's DOK Level 4 Extended Thinking
Remember Retrieve knowledge from long-term memory, recognize, recall, locate, identify	○ Recall, observe, & recognize facts, principles, properties ○ Recall/ identify conversions among representations or numbers (e.g., customary and metric measures)			
Understand Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion (such as from examples given), predict, compare/contrast, match like ideas, explain, construct models	○ Evaluate an expression ○ Locate points on a grid or number on number line ○ Solve a one-step problem ○ Represent math relationships in words, pictures, or symbols ○ Read, write, compare decimals in scientific notation	○ Specify and explain relationships (e.g., non-examples/examples; cause-effect) ○ Make and record observations ○ Explain steps followed ○ Summarize results or concepts ○ Make basic inferences or logical predictions from data/observations ○ Use models /diagrams to represent or explain mathematical concepts ○ Make and explain estimates	○ Use concepts to solve non-routine problems ○ Explain, generalize, or connect ideas using supporting evidence ○ Make and justify conjectures ○ Explain thinking when more than one response is possible ○ Explain phenomena in terms of concepts	○ Relate mathematical or scientific concepts to other content areas, other domains, or other concepts ○ Develop generalizations of the results obtained and the strategies used (from investigation or readings) and apply them to new problem situations
Apply Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task	○ Follow simple procedures (recipe-type directions) ○ Calculate, measure, apply a rule (e.g., rounding) ○ Apply algorithm or formula (e.g., area, perimeter) ○ Solve linear equations ○ Make conversions among representations or numbers, or within and between customary and metric measures	○ Select a procedure according to criteria and perform it ○ Solve routine problem applying multiple concepts or decision points ○ Retrieve information from a table, graph, or figure and use it solve a problem requiring multiple steps ○ Translate between tables, graphs, words, and symbolic notations (e.g., graph data from a table) ○ Construct models given criteria	○ Design investigation for a specific purpose or research question ○ Conduct a designed investigation ○ Use concepts to solve non-routine problems ○ Use & show reasoning, planning, and evidence ○ Translate between problem & symbolic notation when not a direct translation	○ Select or devise approach among many alternatives to solve a problem ○ Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results
Analyze Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct	○ Retrieve information from a table or graph to answer a question ○ Identify whether specific information is contained in graphic representations (e.g., table, graph, T-chart, diagram) ○ Identify a pattern/trend	○ Categorize, classify materials, data, figures based on characteristics ○ Organize or order data ○ Compare/ contrast figures or data ○ Select appropriate graph and organize & display data ○ Interpret data from a simple graph ○ Extend a pattern	○ Compare information within or across data sets or texts ○ Analyze and draw conclusions from data, citing evidence ○ Generalize a pattern ○ Interpret data from complex graph ○ Analyze similarities/differences between procedures or solutions	○ Analyze multiple sources of evidence ○ analyze complex/abstract themes ○ Gather, analyze, and evaluate information
Evaluate Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique			○ Cite evidence and develop a logical argument for concepts or solutions ○ Describe, compare, and contrast solution methods ○ Verify reasonableness of results	○ Gather, analyze, & evaluate information to draw conclusions ○ Apply understanding in a novel way, provide argument or justification for the application
Create Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, construct, produce	○ Brainstorm ideas, concepts, or perspectives related to a topic	○ Generate conjectures or hypotheses based on observations or prior knowledge and experience	○ Synthesize information within one data set, source, or text ○ Formulate an original problem given a situation ○ Develop a scientific/mathematical model for a complex situation	○ Synthesize information across multiple sources or texts ○ Design a mathematical model to inform and solve a practical or abstract situation

	DOK Level Descriptions	Teacher's Role	Student's Role	Sample Tasks
Level 1	**Recall & Reproduction** requires recognition of information, such as a fact, definition, term, principle, or performance of a simple process or procedure. Responding to a Level 1 task or question involves following a well-known rule, procedure, or formula. You either know it, or you don't know it.	• Questions to direct or focus attention *(Who? What? Where? How? When?)* • Directs, leads, demonstrates, defines • Examines, breaks down • Uses concrete objects, nonverbal and visual cues to teach concepts, procedures, and vocabulary • Builds background knowledge to build upon later • Provides resources and procedures • Uses mentor texts as unambiguous models	• Learns rules (spells, decodes, edits for grammar, usage, mechanics, principles of design) • Learns processes (order of operations, evaluates expression, measures, key word searches) • Acquires vocabulary, facts • Memorizes, recites, quotes • Practices, restates • Locates/retrieves information • Identifies/names parts • Reports/shares solutions /findings	- Reads orally, reads fluently - Draws/labels/acts to illustrate an event, parts of the whole, phases in a cycle - Writes a variety of sentences - Represents math/fine arts relationships with words, symbols, objects, visuals - Recalls math facts, terms, dates, formulas, rules - Calculates, measures, follows steps - Uses tools, records data - Reads or reproduces maps, diagrams - Highlights key words
Level 2	**Basic Application of Skills/Concepts** requires engagement of some mental processing beyond recall or reproduction - basic comprehension and subsequent processing of content. Students apply more than one concept and make some decisions about how to approach the question or problem, what tools to use, and how ideas relate.	• Questions to differentiate/classify, draw out inferences, check conceptual understanding (*Why? What conditions? Give example?)* • Provides examples and non-examples to build conceptual understanding • Provides graphic organizers to show relationships or organizational schemas • Matches readers with texts • "Thinks aloud" to explore possible options or connections	• Explains relationships, sorts, classifies, compares • Makes predictions based on observations, estimates, proposes • Compiles and organizes information • Distinguishes relevant-irrelevant, fact-opinion, example-non-example • Selects appropriate strategy and applies it • Explains steps taken to complete a task	- Solves routine, multi-step math word problems - Makes science observations, organizes data (graph, table, spreadsheet, etc.) - Writes a caption, paragraph, summary - Creates a timeline of events - Makes and uses models - Interprets simple graphics, tables, etc. - Retrieves information and uses it to answer a question or solve a problem - Creates survey to research a topic
Level 3	**Strategic Thinking/Reasoning** gets at deeper understanding of concepts within novel or new contexts. Students develop their reasoning underlying an interpretation, generalization, or connection, and provide supporting evidence for judgments made. Cognitive demands are more complex and abstract, often with more than one possible answer or approach.	• Questions to probe reasoning and underlying thinking *(How do you know? What is the evidence? But what if? Is this supported by the facts?)* • Asks open-ended questions • Encourages varied approaches • Acts as a resource, coach, mentor • Provides criteria for making judgments • Guides how and what materials encourage in-depth explorations • Models and scaffolds complex thinking	• Uncovers relevant, accurate, and credible information • Uncovers flaws in a design • Develops supporting evidence for conclusions or claims • Tests ideas, predictions, hypotheses • Transfers knowledge to solve non-routine problems • Revises work to establish a progression of ideas or chain of reasoning	- Interprets complex graphics, tables, etc. - Sets up a data base - Conducts a designed investigation - Develops both sides of a fact-based argument for debate or speech - Creates a website, podcast, multi-media presentation matched to purpose - Critiques an essay, performance , or novel, using discipline-based criteria - Analyzes theme, perspective, author's craft in a piece of work
Level 4	**Extended Thinking** requires complex reasoning, planning, and designing own research focus, probably over an extended time. Tasks require significant conceptual understanding and application of skills across disciplines, using multiple sources or resources.	• Questions to extend thinking, explore sources, broaden perspectives *(What are the potential biases? Can you propose an alternative? Can you design a model? What is the importance/value?)* • Facilitates teaming, collaboration, self-monitoring • Models and scaffolds integrating sources	• Initiates learning focus and structures tasks needed to complete complex projects • Locates relevant and credible mentors and resources • Transfers and constructs knowledge • Modifies, creates, elaborates • Investigates real-world problems and issues • Revises work to establish a progression of ideas or chain of reasoning	- Produces a short film, play, or short story based on a theme or issue - Designs own research or investigation as an extension of concepts or issues studied - Critiques importance of policies or events from different perspectives (e.g., historical, social, economic, cultural) - Analyzes theme, perspectives, authors' craft across multiple pieces of work

Table 1: *Math Descriptors* – Applying Depth of Knowledge Levels for Mathematics (Webb, 2002) & NAEP 2002 Mathematics Levels of Complexity (M. Petit, Center for Assessment 2003, K. Hess, Center for Assessment, updated 2006)

Level 1 **Recall**	Level 2 **Skills/Concepts**	Level 3 **Strategic Thinking**	Level 4 **Extended Thinking**
a. Recall, observe, or recognize a fact, definition, term, or property b. Apply/compute a well-known algorithm (e.g., sum, quotient) c. Apply a formula d. Determine the area or perimeter of rectangles or triangles given a drawing and labels e. Identify a plane or three dimensional figure f. Measure g. Perform a specified or routine procedure (e.g., apply rules for rounding) h. Evaluate an expression i. Solve a one-step word problem j. Retrieve information from a table or graph k. Recall, identify, or make conversions between and among representations or numbers (fractions, decimals, and percents), or within and between customary and metric measures l. Locate numbers on a number line, or points on a coordinate grid m. Solve linear equations n. Represent math relationships in words, pictures, or symbols o. Read, write, and compare decimals in scientific notation	a. Classify plane and three dimensional figures b. Interpret information from a simple graph c. Use models to represent mathematical concepts d. **Solve a routine problem** requiring multiple steps/decision points, or the application of multiple concepts e. Compare and/or contrast figures or statements f. Construct 2-dimensional patterns for 3-dimensional models, such as cylinders and cones g. Provide justifications for steps in a solution process h. Extend a pattern i. Retrieve information from a table, graph, or figure and use it solve a problem requiring multiple steps j. Translate between tables, graphs, words and symbolic notation k. Make direct translations between problem situations and symbolic notation l. Select a procedure according to criteria and perform it m. Specify and explain relationships between facts, terms, properties, or operations n. Compare, classify, organize, estimate, or order data	a) Interpret information from a complex graph b) Explain thinking when more than one response is possible c) Make and/or justify conjectures d) Use evidence to develop logical arguments for a concept e) Use concepts to solve non-routine problems f) Perform procedure with multiple steps and multiple decision points g) Generalize a pattern h) Describe, compare, and contrast solution methods i) Formulate a mathematical model for a complex situation j) Provide mathematical justifications k) Solve a multiple- step problem and provide support with a mathematical explanation that justifies the answer l) Solve 2-step linear equations/inequalities in one variable over the rational numbers, interpret solution(s) in the original context, and verify reasonableness of results m) Translate between a problem situation and symbolic notation that is not a direct translation n) Formulate an original problem, given a situation o) Analyze the similarities and differences between procedures p) Draw conclusion from observations or data, citing evidence	a) Relate mathematical concepts to other content areas b) Relate mathematical concepts to real-world applications in new situations c) Apply a mathematical model to illuminate a problem, situation d) Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results e) Design a mathematical model to inform and solve a practical or abstract situation f) Develop generalizations of the results obtained and the strategies used and apply them to new problem situations g) Apply one approach among many to solve problems h) Apply understanding in a novel way, providing an argument/justification for the application ***NOTE**: Level 4 involves such things as complex restructuring of data or establishing and evaluating criteria to solve problems.*

Elements of Rigor

Conceptual Understanding:

Conceptual understanding refers to the kind of thinking that demonstrates understanding of the underlying mathematics in a situation and is an important part of learning mathematics deeply. Conceptual understanding provides flexibility in thinking about mathematics. It can be assessed at a variety of DOK levels. For example, a DOK 1 conceptual question might have a student provide a basic definition of a word. A higher level DOK question would require students to engage in mathematical practices such as making conjectures based on their understanding of mathematics or constructing an argument. Conceptual understanding can be seen when students connect different representations of mathematical ideas, such as graphs, tables, and equations or when they answer questions such as "why?" or "under what conditions?" Standards that begin with verbs such as understand, explain, or identify most likely fall into the conceptual category.

Procedural Skill and Fluency:

Procedural skill and fluency refer to demonstrations of completing mathematical processes such as solving arithmetic problems or manipulating algebraic expressions. Procedures are often rooted in algorithms, but may also be evident where students use repeated reasoning to solve problems. Procedural skill and fluency include efficiency and accuracy. Standards that begin with verbs such as solve, calculate, or construct most likely fall into the procedural skill and fluency category.

Applications and Modeling:

Applications and modeling are student demonstrations of applying mathematics to contextual problems. These problems engage students in problem solving and often include multiple steps and complex thinking. Applications come from a variety of academic subject areas such as science or social studies and can also be rooted in real life scenarios. Standards that begin with verbs such as use, apply, or model most likely fall into the applications and modeling category.

Utah SAGE Secondary Mathematics Blueprints

Grade 7		
50 Operational Items		
Reporting Category/Domain	**Min.**	**Max.**
Ratio and Proportions	22%	26%
Expressions and Equations	16%	20%
The Number System	18%	22%
Geometry	18%	22%
Statistics and Probability	18%	22%
DOK 1	12%	24%
DOK 2	48%	60%
DOK 3	20%	26%

Disclaimer: The percentages shown represent target aggregate values; individual student experiences will vary based on the adaptive algorithm.

Purpose: The purpose of test blueprints is to make sure that the intended breadth and depth of the curriculum is represented on the CRTS.

DOK Blueprint Disclosure: Depth of Knowledge (DOK) is an essential component of the Secondary Math instruction. As such, DOK is integrated in all mathematics items throughout the Student Assessment of Growth and
Excellence (SAGE) and their respective blueprints. All students will see a variety of DOK and item difficulty on the summative SAGE. For more information about DOK please see: http://www.schools.utah.gov/assessment/Adaptive-Assessement-System/Math.aspx

Acronym and Key Term Glossary for Secondary Teachers

- **ACT:** The ACT was designed to measure academic skills required for success in college and university settings. College and universities commonly use results to help determine which students to admit. There are four college readiness benchmark areas: 1) English, 2) Mathematics, 3) Reading, and 4) Science. Student's reaching ACT benchmarks have a 75% or better chance of getting a "C" or higher and a 50% chance or better of getting a "B" or higher in a college course in that subject. The ACT is administered to all 11th graders within the Canyons School District in the spring.

- **BLT:** Building leadership teams are comprised of key members of the school staff and an external coach. Each school's BLT is charged with the following tasks:
    - To identify, plan, and develop the instruction, intervention, and supports for all students to be successful
    - To sustain improvement over time
    - To develop collective capacity for quality instruction (e.g. support all teachers in professional learning and growth)

- **Canvas:** Canvas is a LMS, Learning Management System, (i.e. a software application for the administration, documentation, tracking, reporting and delivery of online learning). Canvas was selected as the LMS for Canyons schools because of its extensive use in Utah institutes of higher learning, along with its ability to increase collaboration among students, teachers, and parents.

- **CBM:** Curriculum-Based Measurement – a brief standardized measurement procedure designed to ascertain a student's overall academic performance in a basic subject area: e.g. reading, spelling, or writing. CBMs were designed to help teachers monitor academic growth over time, so that instruction could be modified and learning rates accelerated.

- **CFA:** Common Formative Assessment – An assessment typically created collaboratively by a team of teachers responsible for the same grade level or course, in order to improve instruction with a current group of students. Common formative assessments are frequently administered throughout the year to identify:
    - Individual students who need additional time and support for learning
    - The teaching strategies most effective in helping students acquire the intended knowledge and skills
    - Program concerns – areas in which students generally are having difficulty achieving the intended standard, and
    - Improvement goals for individual teachers and the team
    - *Dufour (2004). *Learning by Doing*, p. 214

- **CSA:** Common Summative Assessment – An assessment typically created collaboratively by a team of teachers responsible for the same grade level or course in order to evaluate whether or not students reached common standards at the completion of an instruction cycle.

- **CTESS:** Canyons Teacher Effectiveness Support System- In compliance with Senate Bill 64, this is Canyons School District teacher evaluation system that includes documentation of student growth, evidence of instructional quality, and response to stakeholder input.

- **District-Wide Standards-Based Assessment**: These assessments are given in all content areas at key times during the school year. Data from these benchmarks will be used for student growth in compliance with House Bill 201.

- **DLT:** The District Leadership Team supports implementation of the CSD Academic Framework and is comprised of representatives from school and district administration. The DLT is charged with the following:
    - Develop tools necessary for successful scaling-up of CSD Framework (i.e. evidence-based practices)
    - Provide a consistent feedback loop between school leaders and district leaders
    - Provide cascading levels of support to building leaders
    - Implement the district academic plan

- **HMH Math Inventory:** Houghton Mifflin Harcourt math inventory is a research-based, adaptive assessment that measures math abilities and longitudinal progress from Kindergarten through Algebra II

- **IPLC:** Instructional Professional Learning Communities meet regularly to focus on data and instruction to improve student achievement.

- **IPOP**: Instructional Priorities Observation Protocol – The classroom observation tool used for evidence of instructional quality.

- **ISD:** The Instructional Supports Department (commonly known as the curriculum department). This is where you will find the content leads and support for the curriculum.

- **LMS: Learning Management System -** A software application for the administration, documentation, tracking, reporting and delivery of online learning. **Canvas** was selected as the LMS for Canyons schools because of its extensive use in Utah institutes of higher learning, along with its ability to increase collaboration among students, teachers, and parents.

- **MTSS:** Multi-tiered Systems of Support (see RtI) is practice of providing high quality instruction, using data to make decisions about instruction and intervention for students that is based upon the students' performance, and providing multiple levels of support for both academic and behavioral standards.

- **PBIS:** Positive Behavioral Intervention and Supports is an evidence-based system that helps define the key components of a well-managed classroom.

- **Progress Monitoring:** A procedure that involves frequent measurement of student performance for the purpose of evaluating a student's growth toward a targeted objective. For example, the trajectory of reading growth can be measured with weekly administration of R-CBM.

- **Lexile Scores:** Lexiles can be a measure of text difficulty or of reading proficiency. They range from 0 to 1700. Below is a list of descriptors of Lexile scores by grade level. Students reading in the Proficient and Advanced levels are on track to graduate college and career ready.

- **SEM:** Standard error of measurement is one standard deviation of error around a student's true score.

- **SRI:** Scholastic Reading Inventory is a computer administered reading test that measures inferential and literal reading comprehension skills. Scores are reported in a numeric Lexile scores. Percentile ranks are also available. SRI was designed primarily to match students with books of an appropriate level of difficulty. It measures both literal and inferential comprehension. It is a particularly good assessment for identifying advanced readers. It has a disadvantage of not being as sensitive to growth as are CBM measures, of being subject to student sloughing, and having limited reliability if administered a few number of times.

- **R-CBM:** Reading Curriculum-Based Measurement (R-CBM) also known as Oral Reading Fluency (ORF) and CBM-Read Aloud, this is a one-minute measure which results in two primary numerical scores: number of words read correctly per minute (or correct words per minute, CWPM), and percentage of correctly read words (accuracy rate). This measure is highly correlated with reading comprehension in elementary school but outlives its usefulness once students read at the same rate at which they speak. Maze has been identified as a more appropriate CBM once students are reading grade-level texts at rates above 130 words read correctly per minute, with greater than 97% accuracy.

- **Reliability:** The degree to which a measure is free of error. All tests contain error and it results from characteristics of the test (such as poorly designed questions), characteristics of the test taker (bad day, lack of sleep, misreading questions, anxiety, and lack of effort), and characteristics of the environment (distracting noises, room temperature, and distracting odors).

- **RtI:** "Response to Intervention" (see MTSS) is the practice of (1) providing high-quality instruction/intervention matched to student needs and (2) using learning rate over time and level of performance to (3) make important educational decisions". (Batsche et al, 2007).

- **Turnitin Revision Assistant:** A core-aligned formative writing tool that gives students immediate feedback on their writing.

- **Universal Screening:** A procedure in which all students are evaluated for the purpose of identifying those students who need more intensive interventions. For example, reading is a critical and foundational academic skill, for which CSD screens in middle school with the SRI.

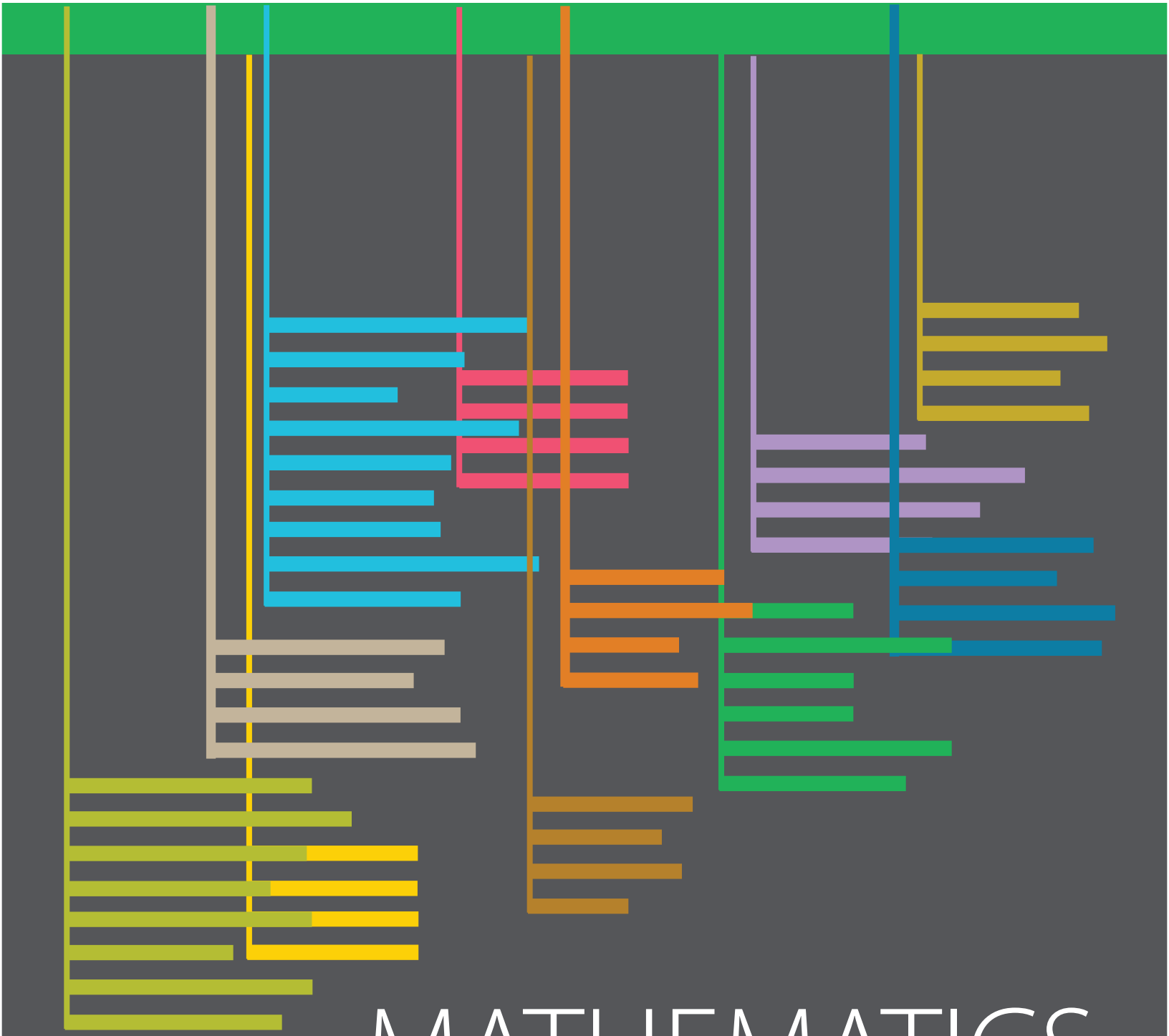
- **Utah Core Standards:** The standards for teaching and learning adopted by the Utah State Board of Education and implemented by local school districts and charter schools with guidance and support from the Utah State Office of Education.

- **Validity:** The degree to which a test measures what it is intended to measure. Establishing the validity of a measurement procedure involves empirical study of item content, accurate prediction, and alignment with theories about what is being measured.

Common Core State Standards
Standards for Mathematical Practice
Questions for Teachers to Ask

Make sense of problems and persevere in solving them	Reason abstractly and quantitatively	Construct viable arguments and critique the reasoning of others	Model with mathematics
Teachers ask: • What is this problem asking? • How could you start this problem? • How could you make this problem easier to solve? • How is ___'s way of solving the problem like/different from yours? • Does your plan make sense? Why or why not? • What tools/manipulatives might help you? • What are you having trouble with? • How can you check this?	*Teachers ask:* • What does the number ____ represent in the problem? • How can you represent the problem with symbols and numbers? • Create a representation of the problem.	*Teachers ask:* • How is your answer different than _____'s? • How can you prove that your answer is correct? • What math language will help you prove your answer? • What examples could prove or disprove your argument? • What do you think about _____'s argument • What is wrong with ____'s thinking? • What questions do you have for ____? **it is important that the teacher poses tasks that involve arguments or critiques*	*Teachers ask:* • Write a number sentence to describe this situation • What do you already know about solving this problem? • What connections do you see? • Why do the results make sense? • Is this working or do you need to change your model? **It is important that the teacher poses tasks that involve real world situations*
Use appropriate tools strategically	**Attend to precision**	**Look for and make use of structure**	**Look for and express regularity in repeated reasoning**
Teachers ask: • How could you use manipulatives or a drawing to show your thinking? • Which tool/manipulative would be best for this problem? • What other resources could help you solve this problem?	*Teachers ask:* • What does the word ____ mean? • Explain what you did to solve the problem. • Compare your answer to _____'s answer • What labels could you use? • How do you know your answer is accurate? • Did you use the most efficient way to solve the problem?	*Teachers ask:* • Why does this happen? • How is ____ related to ____? • Why is this important to the problem? • What do you know about ____ that you can apply to this situation? • How can you use what you know to explain why this works? • What patterns do you see? **deductive reasoning (moving from general to specific)*	*Teachers ask:* • What generalizations can you make? • Can you find a shortcut to solve the problem? How would your shortcut make the problem easier? • How could this problem help you solve another problem? **inductive reasoning (moving from specific to general)*

UTAH CORE STANDARDS



MATHEMATICS

Middle/Junior High (6–8)

UTAH STATE OFFICE OF EDUCATION 250 EAST 500 SOUTH P.O. BOX 144200 SALT LAKE CITY, UTAH 84114-4200 SYDNEE DICKSON, INTERIM STATE SUPERINTENDENT OF PUBLIC INSTRUCTION

Utah STATE OFFICE of Education

UTAH CORE STATE STANDARDS
for
MATHEMATICS
MIDDLE/JUNIOR HIGH SCHOOL
GRADES (6–8)

Adopted August 2010
by the
Utah State Board of Education

Revised September 2015–April 2016

The Utah State Board of Education, in January of 1984, established policy requiring the identification of specific core standards to be met by all K–12 students in order to graduate from Utah's secondary schools. The Utah State Board of Education regularly updates the Utah Core Standards, while parents, teachers, and local school boards continue to control the curriculum choices that reflect local values.

The Utah Core Standards are aligned to scientifically based content standards. They drive high quality instruction through statewide comprehensive expectations for all students. The standards outline essential knowledge, concepts, and skills to be mastered at each grade level or within a critical content area. The standards provide a foundation for ensuring learning within the classroom.

UTAH STATE BOARD OF EDUCATION

250 East 500 South P. O. Box 144200 Salt Lake City, UT 84114-4200
http://schoolboard.utah.gov

INTRODUCTION

Organization of the Standards

The Utah Core Standards are organized into **strands**, which represent significant areas of learning within content areas. Depending on the core area, these strands may be designated by time periods, thematic principles, modes of practice, or other organizing principles.

Within each strand are **standards**. A standard is an articulation of the demonstrated proficiency to be obtained. A standard represents an essential element of the learning that is expected. While some standards within a strand may be more comprehensive than others, all standards are essential for mastery.

Understanding Mathematics

These standards define what students should understand and be able to do in their study of mathematics. Asking a student to understand something means asking a teacher to assess whether the student has understood it. But what does mathematical understanding look like? One hallmark of mathematical understanding is the ability to justify, in a way appropriate to the student's mathematical maturity, why a particular mathematical statement is true or where a mathematical rule comes from. Mathematical understanding and procedural skill are equally important, and both are assessable using mathematical tasks of sufficient richness.

The standards set grade-specific standards but do not dictate curriculum or teaching methods, nor do they define the intervention methods or materials necessary to support students who are well below or well above grade-level expectations. It is also beyond the scope of the Standards to define the full range of supports appropriate for English language learners and for students with special needs. At the same time, all students must have the opportunity to learn and meet the same high standards if they are to access the knowledge and skills necessary in their post-school lives. The standards should be read as allowing for the widest possible range of students to participate fully from the outset, along with appropriate accommodations to ensure maximum participation of students with special education needs. No set of grade-specific standards can fully reflect the great variety in abilities, needs, learning rates, and achievement levels of students in any given classroom. However, the standards do provide clear signposts along the way to the goal of college and career readiness for all students.

What students can learn at any particular grade level depends upon what they have learned before. Ideally then, each standard in this document might have been phrased in the form, "Students who already know… should next come to learn ..." Grade placements for specific topics have been made on the basis of state and international comparisons and the collective experience and collective professional judgment of educators, researchers and mathematicians. Learning opportunities will continue to vary across schools and school systems, and educators should make every effort to meet the needs of individual students based on their current understanding.

Utah STATE OFFICE of Education

UTAH CORE STATE STANDARDS *for* MATHEMATICS

6–8

Mathematics | Grade 7

In Grade 7, instructional time should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples.

(1) Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

(2) Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and between multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

(3) Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8, they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

(4) Students build on their previous work with single-data distributions to compare two-data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Strand: MATHEMATICAL PRACTICES (7.MP)

The Standards for Mathematical Practice in Seventh Grade describe mathematical habits of mind that teachers should seek to develop in their students. Students become mathematically proficient in engaging with mathematical content and concepts as they learn, experience, and apply these skills and attitudes **(Standards 7.MP.1–8).**

- **Standard 7.MP.1 Make sense of problems and persevere in solving them.** Explain the meaning of a problem and look for entry points to its solution. Analyze givens, constraints, relationships, and goals. Make conjectures about the form and meaning of the solution, plan a solution pathway, and continually monitor progress asking, "Does this make sense?" Consider analogous problems, make connections between multiple representations, identify the correspondence between different approaches, look for trends, and transform algebraic expressions to highlight meaningful mathematics. Check answers to problems using a different method.

- **Standard 7.MP.2 Reason abstractly and quantitatively.** Make sense of the quantities and their relationships in problem situations. Translate between context and algebraic representations by contextualizing and decontextualizing quantitative relationships. This includes the ability to decontextualize a given situation, representing it algebraically and manipulating symbols fluently as well as the ability to contextualize algebraic representations to make sense of the problem.

- **Standard 7.MP.3 Construct viable arguments and critique the reasoning of others.** Understand and use stated assumptions, definitions, and previously established results in constructing arguments. Make conjectures and build a logical progression of statements to explore the truth of their conjectures. Justify conclusions and communicate them to others. Respond to the arguments of others by listening, asking clarifying questions, and critiquing the reasoning of others.

- **Standard 7.MP.4 Model with mathematics.** Apply mathematics to solve problems arising in everyday life, society, and the workplace. Make assumptions and approximations, identifying important quantities to construct a mathematical model. Routinely interpret mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

- **Standard 7.MP.5 Use appropriate tools strategically.** Consider the available tools and be sufficiently familiar with them to make sound decisions about when each tool might be helpful, recognizing both the insight to be gained as well as the limitations. Identify relevant external mathematical resources and use them to pose or solve problems. Use tools to explore and deepen their understanding of concepts.

- **Standard 7.MP.6 Attend to precision.** Communicate precisely to others. Use explicit definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose. Specify units of measure and label axes to clarify the correspondence with quantities in a problem. Calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.

- **Standard 7.MP.7 Look for and make use of structure.** Look closely at mathematical relationships to identify the underlying structure by recognizing a simple structure within a more complicated structure. See complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. *For example, see* $5 - 3(x - y)^2$ *as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers* x *and* y.

- **Standard 7.MP.8 Look for and express regularity in repeated reasoning.** Notice if reasoning is repeated, and look for both generalizations and shortcuts. Evaluate the reasonableness of intermediate results by maintaining oversight of the process while attending to the details.

Strand: RATIOS AND PROPORTIONAL RELATIONSHIPS (7.RP)

Analyze proportional relationships and use them to solve real-world and mathematical problems **(Standards 7.RP.1–3).**

- **Standard 7.RP.1** 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 ½ mile in each ¼ hour, compute the unit rate as the complex fraction ½/¼ miles per hour, equivalently 2 miles per hour.*

- **Standard 7.RP.2** Recognize and represent proportional relationships between quantities.

  a. 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.

  b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

  c. 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* $t = pn$.

  d. 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.

- **Standard 7.RP.3** Use proportional relationships to solve multi-step ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

Strand: THE NUMBER SYSTEM (7.NS)

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers **(Standards 7.NS.1–3).**

- **Standard 7.NS.1** 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.

  a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*

  b. 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.

  c. 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.

  d. Apply properties of operations as strategies to add and subtract rational numbers.

- **Standard 7.NS.2** Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

  a. 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.

  b. Understand that integers can be divided, provided the divisor is not zero, and that 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.

  c. Apply properties of operations as strategies to multiply and divide rational numbers.

  d. 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.

- **Standard 7.NS.3** Solve real-world and mathematical problems involving the four operations with rational numbers. Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

Strand: EXPRESSIONS AND EQUATIONS (7.EE)

Use properties of operations to generate equivalent expressions **(Standards 7.EE.1–2).** Solve real-life and mathematical problems using numerical and algebraic expressions and equations **(Standards 7.EE.3–4).**

- **Standard 7.EE.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

- **Standard 7.EE.2** 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 + *0.05*a = *1.05*a *means that "increase by 5%" is the same as "multiply by 1.05."*

- **Standard 7.EE.3** 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 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 3/4 inches long in the center of a door that is 27 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.*

- **Standard 7.EE.4** 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.

  a. 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?*

  b. 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.*

Strand: GEOMETRY (7.G)

Draw, construct, and describe geometrical figures, and describe the relationships between them **(Standards 7.G.1–3).** Solve real-life and mathematical problems involving angle measure, area, surface area, and volume **(Standards 7.G.4–6).**

- **Standard 7.G.1** Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

- **Standard 7.G.2** Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

- **Standard 7.G.3** Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

- **Standard 7.G.4** Know the formulas for the area and circumference of a circle, and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

- **Standard 7.G.5** Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write, and use them to solve simple equations for an unknown angle in a figure.

- **Standard 7.G.6** 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.

Strand: STATISTICS AND PROBABILITY (7.SP)

Use random sampling to draw inferences about a population **(Standards 7.SP.1–2).** Draw informal comparative inferences about two populations **(Standards 7.SP.3–4).** Investigate chance processes and develop, use, and evaluate probability models **(Standards 7.SP.5–8).**

- **Standard 7.SP.1** Understand that statistics can be used to gain information about a population by examining a sample of the population, and that generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling is more likely to produce representative samples and support valid inferences.

- **Standard 7.SP.2** 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.*

- **Standard 7.SP.3** Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, estimating 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, approximately twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*

- **Standard 7.SP.4** 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 a chapter of a seventh grade science book are generally longer than the words in a chapter of a fourth grade science book.*

- **Standard 7.SP.5** 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 ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

- **Standard 7.SP.6** 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.*

- **Standard 7.SP.7** 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.

  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.*

  b. 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?*

- **Standard 7.SP.8** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

  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.

  b. 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.

  c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

Utah STATE OFFICE of Education
250 East 500 South
P.O. Box 144200
Salt Lake City, UT 84114-4200

Sydnee Dickson, Interim State
Superintendent of Public Instruction

www.schools.utah.gov

College Prep Math Core 7 Year at a Glance

	1st Trimester	1st Trimester	2nd Trimester	2nd Trimester	3rd Trimester	3rd Trimester
Big Ideas	**Characteristics**	**Perseverance**	**Challenges and choices**	**Adaptation**	**Innovation**	**Making Sense of Our World**
Standards	HONORS: Number Systems 7.NS.1 7.NS.2 7.NS.3 HONORS: Number Bases **Practice Standards**	7.NS.1 7.NS.2 7.NS.3 HONORS: Patterns **Practice Standards**	7.EE.1 7.EE.2 7.EE.3 7.EE.4 **Practice Standards**	7.RP.1 7.RP.2 7.RP.3 7.EE.2 7.EE.3 **Practice Standards**	7.G.1 7.G.2 7.G.5 7.G.3 7.G.4 7.G.6 **Practice Standards**	7.SP.1 7.SP.2 7.SP.3 7.SP.4 7.SP.5 7.SP.6 7.SP.7 7.SP.8 HONORS: Codes **Practice Standards**
Essential Question	What are the characteristics of rational numbers?	What are the characteristics of rational numbers?	How do we use the characteristics of rational numbers to solve equations?	How does knowing how to solve proportions help you persevere through percent problems?	What life applications do you see for similarity and transformations?	How does data analysis help determine facts in science?
Chapters (2012)	1, 2	1, 2	2	3, 4	5, 6/7	8-9
Chapters (2014)	1, 2	1, 2	3, 4	5, 6	7, 8, 9	10
District Standards-based Assessment	Benchmark 1: October 19 – November 2 Standards: 7.NS.1, 7.NS.2, 7.NS.3		Benchmark 2: January 4 – January 18 Standards: 7.EE.1, 7.EE.2, 7.EE.3, 7.EE.4		Benchmark 3: March 15 – March 29 7.RP.1, 7.RP.2, 7.RP.3, 7.EE.2, 7.EE.3	
Math Concepts	• Operations with Integers • Rational Numbers	• Operations with Integers • Rational Numbers	• Expressions • Equations • Inequalities	• Ratios & • Proportional Relationship • Percent	• Geometry • Surface Area • & Volume of Solids	• Data Analysis • Probability
Writing Focus	Narrative	Informative/ Explanatory	Argument	Informative/ Explanatory	Argument	Narrative
Prioritized Vocabulary	• Analyze • Collaborate • Characteristics	• Infer • Evidence • Structure	• Claim • Refutation • Credibility	• Roots (Chron-, Geo-, Homo-, Hetero-)	• Infer • Variability • Innovate • Roots (-ness, -cide)	• Classify • Probability • Suffix (-ship, -able/-ible)

ELA Connections	• Characteristics of a story	• Choosing credible sources • Citing sources • Recognizing text features/structure	• Identifying & creating claims and evidence • Identifying and refuting counterclaims	• Writing with text structures: • (Cause/Effect • Problem Solution • Sequence • Compare/Contrast • Descriptive)	• Writing with text structures (Inference • Textual evidence • Claims, • Counterclaims, • Refutation, • Figurative language	• Using figurative language • Writing using elements of a story
Science Connections	• Properties of Matter	• Properties of Matter & Earth's Structure	• Cells • Organs • Organ Systems	• Asexual vs. Sexual Reproduction • Acquired vs. Inherited Traits	• Natural Selection	• Classification
Social Studies Connections	• Geography and the environment of Utah	• Early settlers & explorers	• Statehood & Government • Rights and responsibilities of citizens	• Components of Utah's Economy	• Utah in the Modern Age	• Utah's cultural diversity
PE & Health Concepts	• Mental Health • Physical Fitness • Sportsmanship	• Stress Management • Body Image • Goal Setting • Decision Making	• Peer Pressure & Refusal Skills • Addiction	• Nutrition • First Aid • Abstinence • Infectious Disease	• Teamwork • Abstinence • Human Development	• Communication • Puberty

Scope and Sequence Broken Down By Sections (2012)

Ch. 1: Operations on Integers	Honor's Unit "Beyond Base Ten"	Ch. 2: Rational Numbers & Equations	Ch. 3: Proportions and Variation	Ch. 4: Percents	Ch. 5: Similarity	Ch. 6/7: Surface Area & Volume of Solids	Ch. 8: Data Analysis and Samples	Ch. 9: Probability
1.2 1.3 1.4 1.5	Lesson 1: Pre-Assessment Lessons 2-9 Lesson 10: Post-Assessment	2.1 2.2 2.3 2.3B 2.4 2.5 2.5B 2.6 2.6B (Refer to Ch. 8 in Big Ideas blue book)	3.1 3.7 3.7B	4.1 4.2 4.3 4.4	5.4 5.4B Angles: pg. 422 Triangles: pg. 424	6.2 6.2B 6.4 6.6 7.1 7.3 7.5	8.4 8.4B	9.1 9.2 9.3 9.4

Big Ideas (2012) sections NOT covered in the 7th grade core:

1.1	3.2	3.4	3.8	5.3	5.7	8.1
1.6	3.3	3.5	5.1	5.5	6.3	8.2
		3.6	5.2	5.6	7.6	8.3
					7.2	
					7.4	

* Honors: 3 additional topics – Number Systems, Patterns, and Codes. Curriculum guides attached. May be taught when appropriate.

Scope and Sequence Broken Down By Sections (2014)

Ch. 1: Integers	Honor's Unit "Beyond Base Ten"	Ch. 2: Rational Numbers	Ch. 3: Expressions & Equations	Ch. 4: Inequalities	Ch. 5: Ratios & Proportion	Ch. 6: Percents	Ch. 7: Construction & Scale Drawing	Ch. 8: Circles & Area	Ch. 9: Surface Area & Volume	Ch. 10: Probability & Statistics
1.2 1.3 1.4 1.5	Lesson 1: Pre-Assessment Lessons 2-9 Lesson 10: Post-Assessment	2.1 2.2 2.3 2.4	3.1 3.2 3.3 3.4 3.5	4.1 4.2 4.3 4.4	5.1 5.2 5.2 Ext 5.3 5.6	6.1 6.2 6.3 6.4 6.5 6.6 6.7	7.1 7.2 7.3 7.4 7.5	8.1 8.2 8.3 8.4	9.1 9.2 9.4 9.5 9.5 Ext	10.1 10.2 10.3 10.4 10.5 10.5 Ext 10.6 10.7
Big Ideas (2014) sections NOT covered in the 7th grade core: 1.1 5.5					* Honors: 3 additional topics – Number Systems, Patterns, and Codes. Curriculum guides attached. May be taught when appropriate.					

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Content Standard	Big Ideas 2012	Big Ideas 2014	Performance Task
7.NS.1: Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent additional and subtraction on a horizontal or vertical number line diagram.	Section 1.2 Adding Integers Section 1.3 Subtracting Integers Section 2.2 Adding & Subtracting Rational Numbers	Section 1.2 Adding Integers Section 1.3 Subtracting Integers Section 2.2 Adding Rational Numbers Section 2.3 Subtracting Rational Numbers	Big Ideas (2014): 7.NS.1 Bottling (includes a question about percentage) NC pg. 15 #3
7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiple and divide rational numbers.	Section 1.4 Multiplying Integers Section 1.5 Dividing Integers Section 2.3 Multiplying & Dividing Rational Numbers	Section 1.4 Multiplying Integers Section 1.5 Dividing Integers Section 2.1 Rational Numbers Section 2.4 Multiplying & Dividing Rational Numbers	Big Ideas (2014): 7.NS.2 Gasoline Prices NC pg. 15 #1 NC pg. 16 #2
7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.	Section 1.2 Adding Integers Section 1.3 Subtracting Integers Section 1.4 Multiplying Integers Section 1.5 Dividing Integers Section 2.2 Adding & Subtracting Rational Numbers Section 2.3 Multiplying & Dividing Rational Numbers	Section 1.2 Adding Integers Section 1.3 Subtracting Integers Section 1.4 Multiplying Integers Section 1.5 Dividing Integers Section 2.2 Adding Rational Numbers Section 2.3 Subtracting Rational Numbers Section 2.4 Multiplying & Dividing Rational Numbers	Big Ideas (2014): 7.NS.3 Downloads (requires simple knowledge of percents) NC pg. 17 #1-4
7.EE.1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients	Section 2.5b Number Properties	Section 3.1 Algebraic Expressions Section 3.2 Adding & Subtracting Linear Expressions	Big Ideas (2014): 7.EE.1 Expense Report NC pg. 18 #1 NC pg. 19 #3, 5, 6
7.EE.2: 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.	Section 2.5b Number Properties	Section 3.1 Algebraic Expressions Section 3.2 Adding & Subtracting Linear Expressions	Big Ideas (2014): 7.EE.2 Part Time Job (requires knowledge of percents) NC pg. 19 #1 NC pg. 19 #2, 3
7.EE.3: Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of	Section 2.1 Rational Numbers	Section 6.1 Percents Section 6.2 Comparing & Ordering Fractions, Decimals, and Percents Section 6.4 The Percent Equation	Big Ideas (2014): 7.EE.3 Shopping (requires knowledge of percent markup, discount) NC pg. 21 #1 (uses knowledge of percent equation)

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.			
7.EE.4: 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.	Section 2.1 Rational Numbers Section 2.4 Solving Equations Using Addition or Subtraction Section 2.5 Solving Equations Using Multiplication or Division Section 2.6 Solving Two-Step Equations Section 2.6b Solving Inequalities	Section 3.3 Solving Equations Using Addition or Subtraction Section 3.4 Solving Equations Using Multiplication or Division Section 3.5 Solving Two-Step Equations Section 4.1 Writing & Graphing Inequalities Section 4.2 Solving Inequalities Using Addition or Subtraction Section 4.3 Solving Inequalities Using Multiplication or Division Section 4.4 Solving Two-Step Inequalities	Big Ideas (2014): 7.EE.4 Car Dealership NC pg. 22 #1 NC pg. 23 #3-5
7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.	Section 3.1 Ratios/Rates Section 5.4 & 5.4b Scale Drawings	Section 5.1 Ratios and Rates Section 7.5 Scale Drawings	Big Ideas (2014): 7.RP.1 Orbital Speed NC p. 6 Example 1
7.RP.2: Recognize and represent proportional relationships between quantities. a. 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. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and	a) Section 3.7 Direct Variation b) Section 3.1 Ratios/Rates Section 3.7 Direct Variation c)Section 3.7 Direct Variation d)Section 3.7 Direct Variation	a)Section 5.2 Proportions Section 5.6 Direct Variation b)Extension 5.2 Graphing Proportional Reasoning Section 5.6 Direct Variation c) Section 5.3 Writing Proportions Section 5.6 Direct Variation d) Extension 5.2 Graphing Proportional Reasoning Section 5.6 Direct Variation	Big Ideas (2014): 7.RP.2 Currency Exchange Rates NC p.6 Example 1 NC p.7 Example 2 NC p.8 Example 3 NC p.8 Example 4 NC p.9 Example 5

verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. d. 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			
7.RP.3: Use proportional relationships to solve multistep ratio and percent problems.	Section 3.7 Direct Variation Section 4.1 Percent Equation Section 4.2 Percent of increase/decrease Section 4.3 Discounts/Markups Section 4.4 Simple Interest Topic 3 Converting Measures Additional Topics: Quantities	Section 5.1 Ratios and Rates Section 6.3 Percent Proportion Section 6.4 The Percent Equation Section 6.5 Percent of Increase and Decrease Section 6.6 Discounts/Markups Section 6.7 Simple Interest	Big Ideas (2014): 7.RP.3 Gas Stations NC pg.10 # 1 NC pg.11 #2, 3 NC pg.12 #4, 5, 6 NC pg.13 #7, 8, 9
7.EE.2: 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.	Section 2.5b Algebraic Expressions	Section 3.1 Algebraic Expressions Section 3.2 Adding & Subtracting Linear Expressions	Big Ideas (2014): 7.EE.2 Part Time Job (requires knowledge of percents) NC pg. 19 #1, 2, 3
7.EE.3: Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, 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.	Section 2.1 Rational Numbers	Section 6.1 Percents Section 6.2 Comparing & Ordering Fractions, Decimals, and Percents Section 6.4 The Percent Equation	Big Ideas (2014): 7.EE.3 Shopping (requires knowledge of percent markup, discount) NC pg. 21 #1 (uses knowledge of percent equation)
7.G.1: Draw, construct, and describe geometrical figures and describe the relationships between them. Solve problems involving scale drawings of geometric figures, such	Section 5.4 Scale Drawings Section 5.4b Scale Drawings	Section 7.5 Scale Drawings	Big Ideas (2014): 7.G.1 Architecture NC pg. 25 #1 NC pg. 26 #2

as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.			
7.G.2: Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	Topic 2 – Geometry	Section 7.3 Triangles Section 7.4 Quadrilaterals	Big Ideas (2014): 7.G.2 Popcorn Container NC pp. 26,27 #1-6
7.G.5: Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure.	Topic 1 – Angles	Section 7.1 Adjacent & Vertical Angles Section 7.2 Complementary & Supplementary Angles Section 7.3 Angle Measures of Triangles	Big Ideas (2014): 7.G.5 Truss Bridge NC pg. 30,31 #1-3
7.G.3: Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	Big Ideas 2012 does not cover this standard	Extension 9.5 Cross Sections of Three-Dimension Figures	Big Ideas (2014): 7.G.3 Puzzles
7.G.4: Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.	Section 6.2b Circles	Section 8.1 Circles & Circumference Section 8.3 Areas of Circle	Big Ideas (2014): 7.G.4 Hiking NC pg.29 #1 NC pg.30 #3
7.G.6: 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. a)Area	a) Big Ideas 2012 does not cover this standard. b) Section 6.2 Surface Area of Prisms Section 6.4 Surface Area of Pyramids Section 6.6 Surface Are of Composite Solids	a) Section 8.2 Perimeter of Composite Section 8.4 Areas of Composite solids b) Section 9.1 Surface Area of Prisms Section 9.2 Surface Area of Pyramids	Big Ideas (2014): 7.G.6 Trough NC pg. 30 #4 NC pg. 32 #4 NC pg. 33 #5

b)Surface Area c)Volume	c) Section 7.1 Volume of Prisms Section 7.3 Volume of Pyramids Section 7.5 Volume of Composite Solids	c) Section 9.4 Volume of Prisms Section 9.5 Volume of Pyramids *Big Ideas 2014 does not cover Surface Area or Volume of Composite Solids	
7.SP.1: Use random sampling to draw inferences about a population. 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 is more likely to produce representative samples and support valid inferences.	Section 8.4 Samples & Populations	Section 10.6 Samples & Populations	Big Ideas (2014): 7.SP.1 Using the Internet NC pg. 34 7.SP.1
7.SP.2: 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.	Section 8.4 Samples & Populations	Section 10.6 Samples & Populations Extension 10.6 Generating Multiple Samples	Big Ideas (2014): 7.SP.2 Time Spent on Homework NC pg. 34 7.SP.2
7.SP.3: Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, estimating 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, approximately twice the variability (mean absolute	Section 8.3 Circle Graphs (MAD not included) 8.4b Comparing Populations	Section 10.7 Comparing Populations	Big Ideas (2014): 7.SP.3 Snakes *MAD <u>is not</u> included NC pg. 35- 37 7.SP.3 *MAD <u>is included</u> in this task

deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.			
7.SP.4: Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	Section 8.4 Samples & Populations 8.4b Comparing Populations	Section 10.7 Comparing Populations	Big Ideas (2014): 7.SP.4 Hotel Room Prices NC pg. 38
7.SP.5: 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 ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	Section 9.1 Intro to Probability	Section 10.1 Outcomes & Events Section 10.2 Probability Section 10.3 Experimental & Theoretical Probability	Big Ideas (2014): 7.SP.5 Using Spinners NC pg. 39-40 Include Marble Mania and Random drawing Tool links
7.SP.6: 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.	Section 9.3 Experimental Probability	Section 10.3 Experimental & Theoretical Probability	Big Ideas (2014): 7.SP.6 Choosing a Block NC pg. 40-41 #1-3
7.SP.7: 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. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use	Section 9.2 Theoretical Probability	Section 10.3: Experimental and Theoretical Probability	Big Ideas (2014): 7.SP.7 Reality Show NC pg. 42 #1-4

the model to determine probabilities of events. b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.			
7.SP.8 - Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. 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. b. 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. c. Design and use a simulation to generate frequencies for compound events	Section 9.4 Independent & Dependent Events	Section 10.4: Compound events Section 10.5: Independent and Dependent Events Extension 10.5: Simulations	Big Ideas (2014): 7.SP.8 Multiple Choice NC p42-43 Examples 1-4

NC refers to the document North Carolina 7th Math Unpacked Document.

7th Grade Chapter 1 (2012 & 2014): Operations with Integers Unit 1 Big Idea: Character				
There are a few approaches to the first two units: • No calculators until AFTER this unit. • Do a mini unit of review without a calculator and then do the unit with a calculator. • Teach add/sub rational and integers then mult/divide rational and integers. • Teach add/sub mult/divide integers first then add/sub mult/divide rational numbers.				
Suggested Pacing: 3 - 4 Weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• What are the characteristics of rational numbers? • How do we use these characteristics to solve equations?	• How are velocity and speed related? • Is the sum of two integers positive, negative, or zero? How can you tell? • How are adding and subtracting integers related? • Is the product of two integers positive, negative, or zero? How can you tell? • How are multiplying and dividing integers related?	Words for review (Tier 1): sum, difference, product, quotient, estimate Tier 2: solution, integer, reasonableness Tier 3: Additive Inverse	• 2012 Chapter 1 Alternative Assessment • Big Ideas (2014): 7.NS.1 Bottling • Big Ideas (2014): 7.NS.2 Gasoline Prices • Big Ideas (2014): 7.NS.3 Downloads • NC pg. 15 #1 • NC pg. 15 #3 • NC pg. 16 #2 • NC pg. 17 #1-4	• Analyze • Collaborate • Characteristics

Utah Core Standards For Mathematics	Student Learning Targets	Curriculum Resources
7.NS.1 – Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a vertical number line diagram. **a.** Describe situations in which opposite quantities combine to make 0. **b.** Understand $p + q$ as a 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 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.	• I can understand, apply, and explain the additive inverse property. • I can model addition and subtraction of rational numbers, including integers, decimals, and fractions, on a vertical or horizontal number line. • I can add and subtraction rational numbers, including integers, decimals, and fractions.	Big Ideas 2012: 1.2 Adding Integers 1.3 Subtracting Integers Big Ideas 2014: 1.2 Adding Integers 1.3 Subtracting Integers Performance Task: Big Ideas (2014) 7.NS.1 Bottling

c. 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. **d.** Apply properties of operations as strategies to add and subtract rational numbers.		
7.NS.2 – Apply and extend previous understandings of multiplication and division and of fractions to multiple and divide rational numbers. **a.** 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. **b.** 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 $-(p/q) = (-p)/(-q)$. Interpret quotients of rational numbers by describing real-world contexts. **c.** Apply properties of operations as strategies to multiply and divide rational numbers.	• I can multiply and divide rational numbers, including integers, decimals, and fractions, and use properties of arithmetic to model multiplication and division of rational numbers. • I can explain why division by zero is undefined. • I can use long division to change a fraction into a terminating or repeating decimal. • I can interpret products and quotients of rational numbers, including integers, decimals, and fractions, in real-world contexts.	Big Ideas 2012: 1.4 Multiplying Integers 1.5 Dividing Integers Big Ideas 2014: 1.4 Multiplying Integers 1.5 Dividing Integers Performance Task: Big Ideas (2014) 7.NS.2 Gasoline Prices
7.NS.3 – Solve real-world and mathematical problems involving the four operations with rational numbers.	• I can model and solve real world problems using numbers and operations. • I can explain the solution to a real-world problem in context.	Big Ideas 2012: 1.2 Adding Integers 1.3 Subtracting Integers 1.4 Multiplying Integers 1.5 Dividing Integers Big Ideas 2014: 1.2 Adding Integers 1.3 Subtracting Integers 1.4 Multiplying Integers 1.5 Dividing Integers

		Performance Task: Big Ideas (2014) 7.NS.3 Downloads (requires simple knowledge of percents)

Resources
Algebra Tiles: Exploring Algebra Tiles Adding Integers with Algebra Tiles Modeling Multiplying and Dividing with Algebra Tiles

Science and Technical Subject Literacy Standards		Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade
Honor's Topic: "Beyond Base Ten"
Unit 1 Big Idea: Character

Suggested Pacing: 1-2 weeks

Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• How do different cultures represent different numbers?	•	Words for review (Tier 1): numbers, digit, numeral Tier 2: base Tier 3: binary	• See "Beyond Base Ten" Book	History: Different Cultures

Utah Core Standards For Mathematics	Student Learning Targets	Curriculum Resources
• **HONORS**: Research and analyze ancient number systems. • **HONORS:** Understand number systems using different bases and their applications.	• I can explore the benefits and limitations of a variety of ancient number systems within their historical context, including Egyptian, Roman, Babylonian, Chinese, or Mayan numerals. • I can perform a variety of computations using different number systems. • I can compare and contrast ancient number systems and modern number systems. • I can research the use of number systems with different bases by different cultures. • I can understand the modern applications of number systems with different bases. • I can compare and contrast the benefits and limitations of numbers systems with different bases. • I can compute using different bases.	Lesson 1: Pre-Assessment Lessons 2-9 Lesson 10: Post-Assessment

Resources

Algebra Tiles:
Exploring Algebra Tiles
Adding Integers with Algebra Tiles
Modeling Multiplying and Dividing with Algebra Tiles

Science and Technical Subject Literacy Standards	Literacy Implementation Ideas

Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

STATE CURRICULUM GUIDE

Honors Core Content
Cluster Title: Number Systems
Standard: Research and analyze ancient number systems.

Concepts and Skills to Master

- Explore the benefits and limitations of a variety of ancient number systems within their historical context, including
  Egyptian, Roman, Babylonian, Chinese, or Mayan numerals.
- Perform a variety of computations using different number systems.
- Compare and contrast ancient number systems and modern number systems.

Guiding Instructional Questions

- How did early civilizations keep track of numerical information?
- How did the needs of a civilization influence the development of its mathematics?
- What similarities and differences exist in the way different civilizations represented their numbers?
- How did changes in representation allow for more complex mathematics?
- How did ancient civilizations represent negative numbers and how was that concept developed?
- Has mathematics always existed and people discovered it or did people create it?
- Which ancient number system(s) most influenced our current number systems?
- What happens to mathematics when civilizations meet?

Instructional Strategies

- Write a paper that compares and contrasts two number systems.
- Write an argument that supports the influence of an ancient numbering system on our current system.
- Research and present how ancient civilizations represented and used mathematics.
- Create a unique numbering system and support its benefits.

STATE CURRICULUM GUIDE

Honors Core Content
Cluster Title: Number Bases

Standard: Understand number systems using different bases and their applications.

Concepts and Skills to Master

- Research the use of number systems with different bases by different cultures.
- Understand the modern applications of number systems with different bases.
- Compare and contrast the benefits and limitations of number systems with different bases.
- Compute using different bases.

Guiding Instructional Questions

- Why do you think humans use a base ten system and what base system might a spider or other creature use?
- Why do computers use base 2?
- What applications are there for other bases such as 8, 12, and 16?
- How do the calendars of various cultures relate to the base systems in their mathematics?
- Which computations are made easier in different number systems?
- How are different number system revealed in nature?

Instructional Strategies

- Perform computations in various number bases and compare and contrast the results.
- Research and present applications of various number bases.
- Bring in a guest speaker from a field that uses different bases (e.g. computer engineer) and explore the use of different bases in careers.
- Write an argument for or against converting to a base-ten system for time.

7th Grade
Chapter 2 (2012 & 2014): Rational Numbers
Unit 2 Big Idea: Perserverance

There are a few approaches to the first two units:

- No calculators until AFTER this unit.
- Do a mini unit of review without a calculator and then do the unit with a calculator.
- Teach add/sub rational and integers then mult/divide rational and integers.
- Teach add/sub mult/divide integers first then add/sub mult/divide rational numbers.

Suggested Pacing: 3 - 4 weeks

Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• What are the characteristics of rational numbers?	• How can you use a number line to order rational numbers? • How does adding and subtracting rational numbers compare with adding and subtracting integers? • How can you use operations with rational numbers in story?	Words for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: rational number, integer, reasonableness Tier 3: Commutative Property, Associative Property, terminating decimal, Commutative Property, Associative Property, terms, coefficient, like-terms, Distributive Property, distribute, expression, rational, linear, expand, factor, simplify, equivalent	• Big Ideas (2014): 7.NS.1 Bottling • Big Ideas (2014): 7.NS.2 Gasoline Prices • Big Ideas (2014): 7.NS.3 Downloads • NC pg. 15 #1 • NC pg. 15 #3 • NC pg. 16 #2 • NC pg. 17 #1-4	• Infer • Evidence • Structure

Utah Core Standards For Mathematics	Student Learning Targets	Curriculum Resources
7.NS.1 – Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a vertical number line diagram. **a.** Describe situations in which opposite quantities combine to make 0. **b.** Understand $p + q$ as a the number located a	• I can understand, apply, and explain the additive inverse property. • I can model addition and subtraction of rational numbers, including integers, decimals, and fractions, on a vertical or horizontal number line. • I can add and subtraction rational	Big Ideas 2012: 2.2 Adding & Subtracting Rational Numbers Big Ideas 2014: 2.2 Adding Rational Numbers 2.3 Subtracting Rational Numbers

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 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. **c.** 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. **d.** Apply properties of operations as strategies to add and subtract rational numbers.	numbers, including integers, decimals, and fractions.	Performance Task: Big Ideas (2014) 7.NS.1 Bottling
7.NS.2 – Apply and extend previous understandings of multiplication and division and of fractions to multiple and divide rational numbers. **a.** 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. **b.** 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 $-(p/q) = (-p)/(-q)$. Interpret quotients of rational numbers by describing real-world contexts. Apply properties of operations as strategies to multiply and divide rational numbers.	• I can multiply and divide rational numbers, including integers, decimals, and fractions, and use properties of arithmetic to model multiplication and division of rational numbers. • I can explain why division by zero is undefined. • I can use long division to change a fraction into a terminating or repeating decimal. • I can interpret products and quotients of rational numbers, including integers, decimals, and fractions, in real-world contexts.	Big Ideas 2012: 2.3 Multiplying & Dividing Rational Numbers Big Ideas 2014: 2.1 Rational Numbers 2.4 Multiplying & Dividing Rational Numbers Performance Task: Big Ideas (2014) 7.NS.2 Gasoline Prices
7.NS.3 – Solve real-world and mathematical problems involving the four operations with rational numbers.	• I can model and solve real world problems using numbers and operations. • I can explain the solution to a real-world problem in context.	Big Ideas 2012: 2.2 Adding & Subtracting Rational Numbers 2.3 Multiplying & Dividing Rational Numbers

		Big Ideas 2014: 2.2 Adding Rational Numbers 2.3 Subtracting Rational Numbers 2.4 Multiplying & Dividing Rational Numbers Performance Task: Big Ideas (2014) 7.NS.3 Downloads (requires simple knowledge of percents)

Resources

	Science and Technical Literacy Standards	Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade Chapter 2 (2012): Equations and Inequalities Chapters 3 & 4 (2014): Expressions and Equations, Inequalities Unit 3 Big Idea: Challenges and Choices				
Suggested Pacing: 5 - 6 Weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
How do we use the characteristics of rational numbers to solve equations?	• How can you use inverse operations to solve an equation? • How can you use multiplication or division to solve an equation? • In a two-step equation, which step should you do first? • How is solving an inequality similar to solving an equation?	Words for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: solution, integer, reasonableness Tier 3: Commutative Property, Associative Property, terminating decimal, additive inverse, Commutative Property, Associative Property, terms, coefficient, like-terms, Distributive Property, distribute, expression, rational, linear, expand, simplify, equivalent, algebraic, inequality, equation, inverse operations, solution set, at most, at least, less than, greater than, <, >, ≤, ≥	• Big Ideas (2014): 7.EE.1 Expense Report • Big Ideas (2014): 7.EE.2 Part Time Job (requires knowledge of percents) • Big Ideas (2014): 7.EE.3 Shopping (requires knowledge of percent markup, discount) • Big Ideas (2014): 7.EE.4 Car Dealership • NC pg. 18 #1 • NC pg. 19 #1,2, 3, 5, 6 • NC pg. 21 #1 (uses knowledge of percent equation) • NC pg. 23 #3-5	• Claim • Refutation • Credibility

Utah Core Standards for Mathematics	Student Learning Targets	Curriculum Resources
7.EE.1 – Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients	• I can use the Distributive Property to expand and factor linear expressions with rational numbers.	Big Ideas 2012: 2.5b Number Properties Big Ideas 2014: 3.1 Algebraic Expressions 3.2 Adding & Subtracting Linear Expressions

		Performance Task: Big Ideas (2014) 7.EE.1 Expense Report
7.EE.2 – Understand that rewriting an expression in different forms in a problem context can she light	• I can recognize and explain the meaning of a given expression and its component parts. • I can recognize that different forms of an expression may reveal different attributes of the context.	Big Ideas 2012: 2.5b Number Properties Big Ideas 2014: 3.1 Algebraic Expressions 3.2 Adding & Subtracting Linear Expressions Performance task: Big Ideas (2014): 7.EE.2 Part Time Job
7.EE.3 – 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.	• I can solve multi-step mathematical problems involving calculations with positive and negative rational numbers in a variety of forms. • I can solve multi-step real-life problems involving calculations with positive and negative rational numbers in a variety of forms. • I can convert between forms of a rational number to simplify calculations or communicate solutions meaningfully. • I can assess the reasonableness of answers using mental computation and estimation.	Big Ideas 2012: 2.1 Rational Numbers Big Ideas 2014: 2.1 Rational Numbers Performance Task: Big Ideas (2014) 7.EE.3 Shopping
7.EE.4 – 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. **a.** 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 equation of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. **b.** Solve word problems leading to	• I can use variables to create equations and inequalities that model word problems. • I can solve word problems leading to linear equations and inequalities. • I can connect arithmetic solution processes that do not use variables to algebraic solution processes that use equations. • I can use symbols of inequality to express phrases such as “at most”, “at least”, “as much as”, or “no more than”.	Big Ideas 2012: 2.1 Rational Numbers 2.4 Solving Equations Using Addition or Subtraction 2.5 Solving Equations Using Multiplication or Division 2.6 Solving Two-Step Equations 2.6b Solving Inequalities Big Ideas 2014: 3.3 Solving Equations Using Addition or Subtraction 3.4 Solving Equations Using

inequalities of the form $px + q > r$ 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.		Multiplication or Division 3.5 Solving Two-Step Equations 4.1 Writing & Graphing Inequalities 4.2 Solving Inequalities Using Addition or Subtraction 4.3 Solving Inequalities Using Multiplication or Division 4.4 Solving Two-Step Inequalities Performance Task: Big Ideas (2014) 7.EE.4 Car Dealership

Resources		
Science and Technical Literacy Standards		**Literacy Implementation Ideas**
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade Chapter 3 (2012): Proportions and Variation Chapter 5 (2014): Ratios and Proportions Unit 4 Big Idea: Adaptation and Survival				
Suggested Pacing: 5 weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
How does knowing how to solve proportions help you persevere through percent problems?	• How do rates help you describe real-life problems? • How can you compare two rates graphically? • How can proportions help you decide when things are "fair"? • How can you write a proportion that solves a problem in real life? • What can you use to solve proportions in science? • How can you use a graph to show the relationship between two variables that vary directly? How can you use an equation?	Words for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: unit rate, complex fraction, rational number, solution, integer, reasonableness Tier 3: linear, equivalent ratios, proportional relationship, constant of proportionality, percent error, gratuity, commission	• Big Ideas (2014): 7.RP.1 Orbital Speed • Big Ideas (2014): 7.RP.2 Currency Exchange Rates • Big Ideas (2014): 7.RP.3 Gas Stations • NC pg. 6 #1 • NC pg. 7 #2 • NC pg. 8 #3, 4 • NC pg. 9 #5 • NC pg. 10 #1 • NC pg. 11 #2, 3 • NC pg. 12 #4, 5, 6 • NC pg. 13 #7, 8, 9	• Roots (Chron-, Geo-, Homo-, Hetero)

Utah Core Standards for Mathematics	Student Learning Targets	Curriculum Resources
7.RP.1 – Compute unit rates associate with ratios of fraction, including ratios of lengths, areas, and other quantities measure in like or different units.	• I can extend the concept of a unit rate to include ratios of fractions. • I can compute a unit rate, involving quantities measures in like or different units.	Big Ideas 2012: 3.1 Ratios/Rates Big Ideas 2014: 5.1 Ratios and Rates Performance Task: Big Ideas (2014) 7.RP.1 Orbital Speed

7.RP.2 – Recognize and represent proportional relationship between quantities. **a.** Decide whether two quantities are in a proportional relationship, e.g. by testing for equivalent rations in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. **b.** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. **c.** Represent proportional relationships by equations. **d.** 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.	• I can verify that two quantities expressed in a table or in a graph are in a proportional relationship. • I can determine a unit rate from a table, graph, equation, diagram or verbal description and relate it to the constant of proportionality. • I can write an equation for a proportional relationships in the form $y = kx$. • I can explain the meaning of the point (*x, y*) in the context of a proportional relationship. • I can explain the significance of (0, 0) and (1, *r*) in a graph of a proportional relationship, where *r* is the unit rate.	Big Ideas 2012: a) 3.7 Direct Variation b) 3.1 Ratios/Rates 3.7 Direct Variation c) 3.7 Direct Variation d) 3.7 Direct Variation Big Ideas 2014: a) 5.2 Proportions 5.6 Direct Variation b) 5.2 Ext Graphing Proportional Reasoning 5.6 Direct Variation c) 5.3 Writing Proportions 5.6 Direct Variation d) 5.2 Ext Graphing Proportional Reasoning 5.6 Direct Variation Performance Task: Big Ideas (2014) 7. RP.2 Currency Exchange Rates
7.RP.3 – Use proportional relationships to solve multi-step ratio and percent problems.	• I can solve multi-step problem involving present using proportional reasoning. • I can find the percent of a number and extend the concept to solving real life percent applications. • I can calculate percent, percent increase, decrease, and error.	Big Ideas 2012: 3.5 Solving Proportions** 3.6 Converting Measures** 3.7 Direct Variation 3.7B Proportional Relationships Topic 3 Converting Measures Additional Topics: Quantities Big Ideas 2014: 5.1 Ratios and Rates Performance Task: Big Ideas (2014) 7.RP.3 Gas Stations
HONORS: Recognize and appreciate patterns in nature, art, and mathematics.	• I can understand the origin of the Fibonacci Sequence, compute consecutive terms in the sequence, and be able to identify the sequence in nature and art. • I can recognize where the Golden Ratio is	Book: Hands-On Math Projects by Muschla ISBN#: 0-7879-8179-6 Pg. 73-77 *Exploring Geometry with Geometer's Sketchpad* Book (if available at your

	found in nature and art. • I can create wallpaper patterns and tessellations using mathematical principles. • I can understand fractals as iterations of a process, recognize fractals in nature and art, and recreate basic fractals. • I can study the patterns found in Pascal's Triangle. • I can research the use of patterns in a variety of cultures.	school) – lessons on tessellations and fractals, "Creating Tessellations" document "Tessellations" PowerPoint The Golden Ratio Discover Math NLVM: http://nlvm.usu.edu/en/nav/grade_g_3.html Fibonacci Sequence Pascal's Triangle Fractals Tessellations

Resources
The word "proportion" does not show up in the core. The RP standards are focusing on proportional relationships (direct variation) not solving proportions. Solving proportions is 6th grade core. MARS study does not cover 7.RP. 2 and had to be supplemented with big ideas/ other curriculum.

Science and Technical Literacy Standards		Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

=**STATE CURRICULUM GUIDE**

Honors Core Content
Cluster Title: Patterns
Standards: Recognize and appreciate patterns in nature, art, and mathematics.

Concepts and Skills to Master

- Understand the origin of the Fibonacci Sequence, compute consecutive terms in the sequence, and be able to identify the sequence in nature and art.
- Recognize where the Golden Ratio is found in nature and art.
- Create wallpaper patterns and tessellations using mathematical principles.
- Understand fractals as iterations of a process, recognize fractals in nature and art, and recreate basic fractals.
- Study the patterns found in Pascal's Triangle.
- Research the use of patterns in a variety of cultures.

Guiding Instructional questions

- What happens when you color the multiples of 3 (or other factors) on Pascal's Triangle?
- How do cultures use symbols to identify themselves and how do they use these patterns in art?
- How do manufacturers use patterns to create and market products?
- How would you use the Golden Ratio to market a product?
- How is the Golden Ratio used in photography?

Instructional Strategies

- Identify patterns in art and nature.
- Use the principles of a particular pattern to create a work of art.
- Explore patterns created by student-generated rules.

7th Grade Chapter 4 (2012): Percents Chapter 6: (2014): Percents Unit 4 Big Idea: Adaptation and Survival				
Suggested Pacing: 4 weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• How does knowing how to solve proportions help you persevere through percent problems?	• How can you use models to estimate percent questions? • What is a percent of decrease? What is a percent of increase? • How can you find discounts and markups efficiently? • How can you find the amount of simple interest earned on a savings account? • How can you find the amount of interest owed on a loan?	Words for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: unit rate, complex fraction, rational number, solution, integer, reasonableness Tier 3: percent error, percent increase, percent decrease, markup, markdown, simple interest, gratuity, commission	• Big Ideas (2014) 7.RP.3 Gas Stations • Big Ideas (2014): 7.EE.2 Part Time Job • Big Ideas (2014): 7.EE.3 • NC pg.10 #1 • NC pg.11 #2, 3 • NC pg.12 #4, 5, 6 • NC pg.13 #7, 8, 9 • NC pg. 19 #1, 2, 3 • NC pg. 21 #1 (uses knowledge of percent equation) • HONORS: Simple Interest	• Components of Utah's Economy

Utah Core Standards for Mathematics	Student Learning Targets	Curriculum Resources
7.RP.3 – Use proportional relationships to solve multistep ratio and percent problems.	• I can solve multistep problems involving percent using proportional reasoning. • I can find the percent of a number and extend the concept to solving real life percent applications. • I can calculate percent, percent increase, decrease, and error.	Big Ideas 2012: 4.1 Percent Equation 4.2 Percent of increase/decrease 4.3 Discounts/Markups 4.4 Simple Interest Big Ideas 2014: 6.3 Percent Proportion 6.4 The Percent Equation 6.5 Percent of Increase and Decrease 6.6 Discounts/Markups 6.7 Simple Interest Performance Task: Big Ideas (2014) 7.RP.3 Gas Stations

7.EE.2 – 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.	• I can recognize and explain the meaning of a given expression and its component parts. • I can recognize that different forms of an expression may reveal different attributes of the context.	Performance Task: Big Ideas (2014) 7.EE.2 Part Time Job
7.EE.3 – 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.	• I can solve multi-step mathematical problems involving calculators with positive and negative rational numbers in a variety of forms. • I can solve multi-step real-life problems involving calculations with positive and negative rational numbers in a variety of forms. • I can convert between forms of a rational number to simplify calculations or communicate solutions meaningfully. • I can assess the reasonableness of answers using mental computation and estimation.	Big Ideas 2014: 6.1 Percents 6.2 Comparing & Ordering Fractions, Decimals, and Percents 6.4 The Percent Equation Performance Task: Big Ideas (2014) 7.Ee.3 Shopping (requires knowledge of percent markup, discount)

Resources
Big Ideas covers both proportions and equations as methods for solving multi-step percent problems. We've tried teaching markups & discounts where you add/subtract first, then find the percent vs. finding the percent first, then adding and subtracting. We aren't sure which way works best - both have pros and cons and seem to have similar results. Diagrams used in MARS study seemed to be helpful in assisting students in making sense of the relationships between the two steps.

Science and Technical Literacy Standards		Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	

Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade Chapter 5 (2012): Similarity Chapter 7 (2014): Constructions and Scale Drawings Unit 5 Big Idea: Innovation				
Suggested Pacing: 3 weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• What life applications do you see for similarity and transformations?	• How do changes in dimensions of similar geometric figures affect the perimeters and areas of the figures? • What information do you need to know to find the dimensions of a figure that is similar to another figure? • How can you use a scale drawing to estimate the cost of painting a room? • How do the different types angles affect similarity of shapes?	Words for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: unit rate, rational number, solution, integer, reasonableness Tier 3: angle (∠), angle measure ($m\angle$), acute, obtuse, right, degrees (°), polygon, vertex, line segment (side AB of ΔABC), scale, scale factor, scale drawing, enlarge, reduce, scale model, supplementary, complementary, vertical angles, adjacent angles, intersecting lines	• Big Ideas (2014): 7.G.1 Architecture • Big Ideas (2014): 7.G.2 Popcorn Container • Big Ideas (2014): 7.G.5 Truss Bridge • NC pg. 25 #1 • NC pg. 26 #2 • NC pg. 26,27 #1-6 • NC pg. 30,31 #1-3	• Infer • Variability • Innovate • Suffix (-ness, -cide)

Utah Core Standards For Mathematics	Student Learning Targets	Curriculum Resources
7.G.1 – 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.	• I can use a scale or scale factor to find a measurement. • I can find actual lengths and areas from a scale drawing, using a scale factor. • I can create multiple scale drawings from the original model or drawing, using different scales.	Big Ideas 2012: 5.4 Scale Drawings 5.4b Scale Drawings Big Ideas 2014: 7.5 Scale Drawings Performance Task: Big Ideas (2014) 7.G.1 Architecture
7.G.2 – Draw geometric shapes with given conditions. Focus on constructing triangle from three measures of	• I can draw precise geometric figures based on given conditions.	Big Ideas 2012: Topic 2 – Geometry

angles or sides noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	• I can discover the conditions necessary for a given set of angles or sides to make a triangle. • I can explore conditions that determine unique triangles, multiple triangles, or no triangles.	Big Ideas 2014: 7.3 Triangles 7.4 Quadrilaterals Performance Task: Big Ideas (2014) 7.G.5 Popcorn Containers
7.G.5 – 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.	• I can define and understand properties of supplementary, complementary, vertical, and adjacent angles. • I can use properties of supplementary, complementary, vertical, and adjacent angles to solve for unknown angles in a figure. • I can write and solve equations based on diagram of intersecting lines with some known angle measures.	Big Ideas 2012: Topic 1 – Angles Big Ideas 2014: 7.1 Adjacent & Vertical Angles 7.2 Complementary & Supplementary Angles 7.3 Angle Measures of Triangles Performance Task: Big Ideas (2014) 7.G.5 Truss Bridge

Resources
Make a scale drawing of the classroom and have students design a new layout. Next day pick one and have the classroom set up the new way. Use models students can hold and and take apart Use pencils or straws to construct triangles

	Science and Technical Literacy Standards	Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts,	

	and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade Chapter 6/7 (2012): Surface Area and Volume of Solids Chapter 8/9 (2014): Circles and Areas, Surface Area and Volume Unit 5 Big Idea: Innovation				
Suggested Pacing: 4 Weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• How will knowing surface area and volume help you "survive" in life?	• How can you use a net to find the surface area of a prism? • How can you find the surface area of a cylinder?	Word for review (Tier 1): three-dimensional figure (3D), cube, two-dimensional figure (2D), integer, sum, difference, product, quotient, estimate Tier 2: unit rate, rational number, solution, integer, reasonableness Tier 3: cross sections, plane sections, slant height, base, altitude, height, circumference, radius, diameter, center, Pi (π), altitude, height regular, pyramid, area, right rectangular prism, right rectangular pyramid, surface area, volume, base	• Big Ideas (2014) 7.G.3 Puzzles • Big Ideas (2014) 7.G.4 Hiking • Big Ideas (2014) 7.G.6 Trough • HONORS: Popcorn Containers (use if you te	• Natural Selection

Utah Core Standards for Mathematics	Student Learning Targets	Curriculum Resources
7.G.3 – Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	• I can describe the different ways to slice a 3D figure (i.e. vertical slice, horizontal slice, and angled slice). • I can describe the different 2D cross-sections that will result depending on how you slice the 3D figure.	Big Ideas 2012 does not cover this standard Big Ideas 2014: 9.5 Ext - Cross Sections of Three-Dimension Figures Performance Task: Big Ideas (2014) 7.G.3 Puzzles

7.G.4 – Know the formulas for the area and circumference of a circle and use them to solve problems; given an informal derivation of the relationship between circumference and area of a circle. THIS IS THE FIRST TIME STUDENTS WORK WITH CIRCLES	• I can use the formulas for area and circumference of a circle to solve problems. • I can understand the relationship between diameter, circumference, and pi. • I can show and explain how the circumference and area of a circle are related.	Big Ideas 2012: 6.2b Circles Big Ideas 2014: 8.1 Circles & Circumference 8.3 Areas of Circle Performance Task: Big Ideas (2014) 7.G.4 Hiking
7.G.6 – 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.	• I can find the areas of triangles, quadrilaterals, polygons, and composite figures, including those found in real-world contexts. • I can find surface areas of cubes, right prisms, and right pyramids whose faces are triangles, quadrilaterals, and polygons, including those found in real-world contexts. • I can find volumes of cubes, right prisms, and composite polyhedra including those found in real-world contexts.	Big Ideas 2012: a) Big Ideas does not cover perimeter and area of Composite solids b) 6.2 Surface Area of Prisms 6.4 Surface Area of Pyramids 6.6 Surface Area of Composite Solids c) 7.1 Volume of Prisms 7.3 Volume of Pyramids 7.5 Volume of Composite Solids Big Ideas 2014: a) 8.2 Perimeter of Composite 8.4 Areas of Composite solids b) 9.1 Surface Area of Prisms 9.2 Surface Area of Pyramids c) 9.4 Volume of Prisms 9.5 Volume of Pyramids *Big Ideas 2014 does not cover Surface Area or Volume of Composite Solids Performance Task: Big Ideas (2014) 7.G.6 Trough

Resources
Additional Resources: Cross Sections and Solids Have students use dental floss and modeling clay to act out the slices, however this can be costly.

Science and Technical Literacy Standards		Literacy Implementation Ideas
Reading	**RI 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.	

	RI 7.2 – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade Chapter 8 (2012): Data Analysis and Samples Chapter 10 (2014): Probability and Statistics Unit 6 Big Idea: Making Sense of Our World				
Suggested Pacing: 2-3 weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
How does data analysis help determine facts in science? Which types of data representations are seen most commonly in science writing?	• How can you use a survey to make conclusions about the general population?	Word for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: rational number, solution, integer, reasonableness Tier 3: inference, sample, random sample, population, variation, prediction, sampling error, variability	• Big Ideas (2014): 7.SP.1 Using the Internet • Big Ideas (2014): 7.SP.2 Time Spent on Homework • Big Ideas (2014): 7.SP.3 Snakes • *MAD <u>is not</u> included • Big Ideas (2014): 7.SP.4 Hotel Room Prices • NC pg. 34 7.SP.1 • NC pg. 34 7.SP.2 • NC pp. 35-37 7.SP.3 *MAD <u>is included</u> in this task • NC pg. 38 7.SP.4	• Classify • Probability • Suffix (-ship, -able, -ible)

Utah Core Standards for Mathematics	Student Learning Targets	Curriculum Resources
7.SP.1 – 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 sample and support valid inferences.	• I understand that representative samples can be used to make valid inferences about a population. • I can understand that a random sample increases the likelihood of obtaining a representative sample of a population.	Big Ideas 2012: 8.4 Samples & Populations Big Ideas 2014: 10.6 Samples & Populations Performance Task: Big Ideas (2014) 7.SP.1 Using the Internet
7.SP.2 – 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.	• I can make inferences about a population based on a sample. • I can explore the variation in estimates or predictions based on multiple samples of the same data.	Big Ideas 2012: 8.4 Samples & Populations Big Ideas 2014: 10.6 Samples & Populations 10.6 Ext Generating Multiple Samples

		Performance Task: Big Ideas (2014) 7.SP.2 Time Spent on Homework
7.SP.3 – 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.	• I can understand that the measure of mean is independent of the measure of variability. • I can use visual representations to compare and contrast numerical data from two populations using measures of variability and center.	Big Ideas 2012: 8.4b Comparing Populations Big Ideas 2014: 10.7 Comparing Populations Performance Task: Big Ideas (2014) 7.SP.3 Snakes (mean absolute deviation not included)
7.SP.4 – Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	• I can make comparative inferences about two populations using measures of center and variability.	Big Ideas 2012: 8.4b Comparing Populations Big Ideas 2014: 10.7 Comparing Populations Performance Task: Big Ideas (2014) 7.SP.4 Hotel Room Prices

Resources		
Social Studies Literacy Standards		Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of	

	relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

7th Grade Chapter 9 (2012): Probability Chapter 10 (2014): Probability and Statistics Unit 6 Big Idea: Making Sense of Our World				
Suggested Pacing: 2-3 weeks				
Essential Questions	Supporting Questions	Key Terms	Practice Standards Task(s)	Cross Curricular Connections
• Which professions use probability to make sense of their "worlds"? **This is students' first exposure to probability in the Utah Core	• How can you predict the results of spinning a spinner? • How can you find a theoretical probability? • What is meant by experimental probability? • What is the difference between dependent and independent events?	Word for review (Tier 1): integer, sum, difference, product, quotient, estimate Tier 2: rational number, solution, integer, reasonableness Tier 3: probability, event, chance event, likelihood, outcome, probability model, uniform probability, sample space, theoretical probability, sample space, discrepancy, experimental probability, relative frequency, simple event, compound events, tree diagram, simulation, sample space	• Big Ideas (2014): 7.SP.5 Using Spinners • Big Ideas (2014): 7.SP.6 Choosing a Block • Big Ideas (2014): 7.SP.7 Reality Show • Big Ideas (2014): 7.SP.8 Multiple Choice • NC pg. 39-40 • NC pg. 40-41 Examples 1-3 • NC pg. 42 Examples 1-4 • NC pg. 42-43 Examples 1-4	• Classification

Utah State Core Standards for Mathematics	Student Learning Targets	Curriculum Resources
7.SP.5 – 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 ½ indicates an event that is neither unlikely nor likely, and probability near 1 indicates a likely event.	• I can represent the probability of an event as a fraction or decimal from 0 to 1 from 0% to 100%. • I can understand that a probability of 0 is impossible. • I can understand that probabilities near 0 are unlikely to occur. • I can understand that probabilities of .5 are equally likely and unlikely. • I can understand that probabilities near 1 are more likely to occur.	Big Ideas 2012: 9.1 Intro to Probability Big Ideas 2014: 10.1 Outcomes & Events 10.2 Probability 10.3 Experimental & Theoretical Probability Performance Task: Big Ideas (2014) 7.SP.5 Using Spinners

	• I can understand that probability of 1 is certain.	
7.SP.6 – Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency given the probability.	• I can perform an experiment and collect data on a chance event. • I can relate the results of an experiment to the theoretical relative frequency of an event. • I can use the results of an experiment to estimate the probability of an event. • I can estimate the long-run relative frequency of an event given the probability of the event.	Big Ideas 2012: 9.3 Experimental Probability Big Ideas 2014: 10.3 Experimental & Theoretical Probability Performance Task: Big Ideas (2014) 7.SP.6 Choosing a Block
7.SP.7 – 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 possibly sources of discrepancy. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.	• I can use theoretical probabilities to create probability model (e.g. table showing the potential outcomes of an experiment or random process with their corresponding probabilities) in which all outcomes are equally likely (uniform). • I can use observed frequencies to create a probability model for the data generated from a chance process. • I can use probability models to find probabilities of events. • I can compare theoretical and experimental probability. • I can compare theoretical and experimental probability.	Big Ideas 2012: Theoretical Probability Big Ideas 2014: 10.3: Experimental and Theoretical Probability Performance Task: Big Ideas (2014) 7.SP.7 Reality Show
7.SP.8 – Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. 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. b. 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 composes the event. c. Design and use a simulation to generate	• I can represent probabilities of simple and compound events as a fraction, decimal, or percent. • I can find the sample space of a compound event. • I can create organized lists, tables, tree diagrams, and simulations to determine the probability of compound events. • I can generate frequencies for compound events using random number generators (e.g. tables, calculators, manipulatives).	Big Ideas 2012: 9.4 Independent & Dependent Events Big Ideas 2014: 10.4: Compound events 10.5: Independent and Dependent Events 10.5 Ext: Simulations Performance Task: Big Ideas (2014) 7.SP.8 Multiple Choice

frequencies for compound events.		
HONORS: Examine the use of mathematics in creating codes	• I can explore codes used in everyday life such as zip codes, area codes, license plates, and social security numbers. • I can explore codes used in commerce such as check digits, UPC codes, and bank numbers. • I can explore various codes used in cryptography.	HONORS: Codes Cryptography http://en.wikipedia.org/wiki/Cryptography http://www.purdue.edu/discoverypark/gk12/downloads/Cryptography.pdf How UPC Bar Codes Work: http://electronics.howstuffworks.com/gadgets/high-tech-gadgets/upc.htm

Resources		
Science and Technical Literacy Standards		Literacy Implementation Ideas
Reading	**RI 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. **RI 7.2** – Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text. **RI 7.4** – Determine the meaning of words and phrase's 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. **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. **RI 7.8** – Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	
Writing	**W 7.1 –** Write arguments to support claims with clear reasons and relevant evidence. **W 7.2** – Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **W 7.3** – Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences. **W 7.7** – Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	

STATE CURRICULUM GUIDE

Honors Core Content
Cluster Title: Codes
Standard: Examine the use of mathematics in creating codes.

Concepts and Skills to Master
- Explore codes used in everyday life such as zip codes, area codes, license plates, and social security numbers.
- Explore codes used in commerce such as check digits, UPC codes, and bank numbers.
- Explore various codes used in cryptography.

Guiding Instructional Questions
- How does the use of codes facilitate commerce and other aspects of everyday life?
- Why do stores scan your receipt when you return an item?
- How does the use of codes protect our identity?
- How have codes been used throughout history?
- How do codes facilitate the collection of information?

Instructional Strategies
- Create codes to send messages to other students.
- Investigate your own ID numbers and determine how they reveal information about you.
- Research the use of codes during World War II and present your findings.
- Collect a variety of UPCs and compare the codes to investigate product information.
- Give students coded information to decode.

What are Mathematical Tasks? & Why are they important to the implementation of the new Utah Core Standards for Mathematics (UCSM)?

With the implementation of the new UCSM comes not only a shift of what mathematical concepts are taught, but also a shift in how students show their understanding. Previously, it was enough for a student to "show their work" to show they mastered a concept. With standards that are asking students to "Understand" mathematics, computational steps will not be enough to show mastery.

"Asking a student to understand something means asking a teacher to assess whether the student has understood it. But what does mathematical understanding look like? One hallmark of mathematical understanding is the ability to justify, in a way appropriate to the student's mathematical maturity, why a particular mathematical statement is true or where a mathematical rule comes from. There is a world of difference between a student who can summon a mnemonic device to expand a product such as $(a + b)(x + y)$ and a student who can explain where the mnemonic comes from. The student who can explain the rule understands the mathematics, and may have a better chance to succeed at a less familiar task such as expanding $(a + b + c)(x + y)$. Mathematical understanding and procedural skill are equally important, and both are assessable using mathematical tasks of sufficient richness." (www.corestandards.org/math)

By integrating mathematical tasks into their instruction and assessment, teachers will be able to fully assess if students truly understand mathematical concepts.

A mathematical task is a problem or set of problems that focuses students' attention on a particular mathematical idea and provides an opportunity for students to develop or use particular mathematical skills. A task has a well-defined purpose and is accessible for all students (www.commoncoretools.me). Tasks also require students to defend and justify their solutions.

The following documents outline tasks that are aligned to Canyons School District Scope and Sequence and are supported through our text resource: Big Ideas Mathematics. The rubric can help guide teachers when planning for integration of mathematical tasks with the Standards for Mathematic Practices.

7th Grade Performance Tasks from Big Ideas Learning

Standard	Title	For Use After
The Number System:		
7.NS.1	Bottling	2.2
7.NS.2	Gasoline Prices	2.3
7.NS.3	Downloads	2.5
Expressions and Equations:		
7.EE.1	Expense Report	2.5
7.EE.2	Part-Time Job	4.2
7.EE.3	Shopping	4.3
7.EE.4	Car Dealership	2.6
Ratios & Proportions:		
7.RP.1	Orbital Speed	3.1
7.RP.2	Currency Exchange Rates	3.7
7.RP.3	Gas Stations	3.7
Geometry		
7.G.1	Architecture	5.4
7.G.2	Popcorn Containers	Topic 2
7.G.3	Slicing Puzzles	Topic 2
7.G.4	Hiking	6.2
7.G.5	Truss Bridge	Topic 1
7.G.6	Trough	7.1
Statistics & Probability		
7.SP.1	Using the Internet	8.4
7.SP.2	Time Spent on Homework	8.4
7.SP.3	Snakes	8.4
7.SP.4	Hotel Room Prices	8.4
7.SP.5	Using Spinners	9.2
7.SP.6	Choosing a Block	9.3
7.SP.7	Reality Show	9.2
7.SP.8	Multiple Choice	9.4

The Cornerstone of WIDA's Standards: Guiding Principles of Language Development

1. **Students' languages and cultures are valuable resources to be tapped and incorporated into schooling.**
   Escamilla & Hopewell (2010); Goldenberg & Coleman (2010); Garcia (2005); Freeman, Freeman, & Mercuri (2002); González, Moll, & Amanti (2005); Scarcella (1990)

2. **Students' home, school, and community experiences influence their language development.**
   Nieto (2008); Payne (2003); Collier (1995); California State Department of Education (1986)

3. **Students draw on their metacognitive, metalinguistic, and metacultural awareness to develop proficiency in additional languages.**
   Cloud, Genesee, & Hamayan (2009); Bialystok (2007); Chamot & O'Malley (1994); Bialystok (1991); Cummins (1978)

4. **Students' academic language development in their native language facilitates their academic language development in English. Conversely, students' academic language development in English informs their academic language development in their native language.**
   Escamilla & Hopewell (2010); Gottlieb, Katz, & Ernst-Slavit (2009); Tabors (2008); Espinosa (2009); August & Shanahan (2006); Genesee, Lindholm-Leary, Saunders, & Christian (2006); Snow (2005); Genesee, Paradis, & Crago (2004); August & Shanahan (2006); Riches & Genesee (2006); Gottlieb (2003); Schleppegrell & Colombi (2002); Lindholm & Molina (2000); Pardo & Tinajero (1993)

5. **Students learn language and culture through meaningful use and interaction.**
   Brown (2007); Garcia & Hamayan, (2006); Garcia (2005); Kramsch (2003); Díaz-Rico & Weed (1995); Halliday & Hasan (1989); Damen (1987)

6. **Students use language in functional and communicative ways that vary according to context.**
   Schleppegrell (2004); Halliday (1976); Finocchiaro & Brumfit (1983)

7. **Students develop language proficiency in listening, speaking, reading, and writing interdependently, but at different rates and in different ways.**
   Gottlieb & Hamayan (2007); Spolsky (1989); Vygotsky (1962)

8. **Students' development of academic language and academic content knowledge are inter-related processes.**
   Gibbons (2009); Collier & Thomas (2009); Gottlieb, Katz, & Ernst-Slavit (2009); Echevarria, Vogt, & Short (2008); Zwiers (2008); Gee (2007); Bailey (2007); Mohan (1986)

9. **Students' development of social, instructional, and academic language, a complex and long-term process, is the foundation for their success in school.**
   Anstrom, et.al. (2010); Francis, Lesaux, Kieffer, & Rivera (2006); Bailey & Butler (2002); Cummins (1979)

10. **Students' access to instructional tasks requiring complex thinking is enhanced when linguistic complexity and instructional support match their levels of language proficiency.**
    Gottlieb, Katz, & Ernst-Slavit (2009); Gibbons (2009, 2002); Vygotsky (1962)

Performance Definitions for the Levels of English Language Proficiency in Grades K-12

At the given level of English language proficiency, English language learners will process, understand, produce, or use:

6 Reaching	• specialized or technical language reflective of the content areas at grade level • a variety of sentence lengths of varying linguistic complexity in extended oral or written discourse as required by the specified grade level • oral or written communication in English comparable to English-proficient peers
5 Bridging	• specialized or technical language of the content areas • a variety of sentence lengths of varying linguistic complexity in extended oral or written discourse, including stories, essays, or reports • oral or written language approaching comparability to that of English-proficient peers when presented with grade-level material
4 Expanding	• specific and some technical language of the content areas • a variety of sentence lengths of varying linguistic complexity in oral discourse or multiple, related sentences, or paragraphs • oral or written language with minimal phonological, syntactic, or semantic errors that do not impede the overall meaning of the communication when presented with oral or written connected discourse with sensory, graphic, or interactive support
3 Developing	• general and some specific language of the content areas • expanded sentences in oral interaction or written paragraphs • oral or written language with phonological, syntactic, or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written, narrative, or expository descriptions with sensory, graphic, or interactive support
2 Beginning	• general language related to the content areas • phrases or short sentences • oral or written language with phonological, syntactic, or semantic errors that often impede the meaning of the communication when presented with one- to multiple-step commands, directions, questions, or a series of statements with sensory, graphic, or interactive support
1 Entering	• pictorial or graphic representation of the language of the content areas • words, phrases, or chunks of language when presented with one-step commands, directions, WH-, choice, or yes/no questions, or statements with sensory, graphic, or interactive support • oral language with phonological, syntactic, or semantic errors that often impede meaning when presented with basic oral commands, direct questions, or simple statements with sensory, graphic, or interactive support

North Carolina Unpacked Standards

*Note: Since Utah has modified and adopted their own core, some standards may be different. However, this is a good resource for tasks for your class.

North Carolina Department of Public Instruction
INSTRUCTIONAL SUPPORT TOOLS
FOR ACHIEVING NEW STANDARDS

7th Grade Mathematics ● Unpacked Content

For the new Common Core standards that will be effective in all North Carolina schools in the 2012-13 School Year.

This document is designed to help North Carolina educators teach the Common Core (Standard Course of Study). NCDPI staff are continually updating and improving these tools to better serve teachers.

What is the purpose of this document?
To increase student achievement by ensuring educators understand specifically what the new standards mean a student must know, understand and be able to do.

What is in the document?
Descriptions of what each standard means a student will know, understand and be able to do. The "unpacking" of the standards done in this document is an effort to answer a simple question "What does this standard mean that a student must know and be able to do?" and to ensure the description is helpful, specific and comprehensive for educators.

How do I send Feedback?
We intend the explanations and examples in this document to be helpful and specific. That said, we believe that as this document is used, teachers and educators will find ways in which the unpacking can be improved and made ever more useful. Please send feedback to us at feedback@dpi.state.nc.us and we will use your input to refine our unpacking of the standards. Thank You!

Just want the standards alone?
You can find the standards alone at www.corestandards.org .

At A Glance

New to 7th Grade:

- Constant of proportionality (7.RP.2b)
- Percent of error (7.RP.3)
- Factoring to create equivalent expressions (7.EE.1)
- Triangle side lengths (7.G.2)
- Area and circumference of circles (7.G.4)
- Angles (supplementary, complementary, vertical) (7. G.5)
- Surface area and volume of pyramids (7.G.6)
- Probability (7.SP.5 – 7.SP.8)

Moved from 7th Grade:

- Similar and congruent polygons (moved to 8th grade)
- Surface area and volume of cylinders (moved to 8th grade – volume only)
- Creation of box plots and histograms (moved to 6th grade – 7th grade continues to compare)
- Linear relations and functions (y-intercept moved to 8th grade)
- Views from 3-Dimensional figures (removed from CCSS)
- Statistical measures (moved to 6th grade)

Notes:

- Topics may appear to be similar between the CCSS and the 2003 NCSCOS; however, the CCSS may be presented at a higher cognitive demand.
- Proportionality in 7th grade now includes identifying proportional relationships from tables and graphs; writing equations to represent proportional relationships.
- Using a number line for rational number operations is emphasized in CCSS.
- **For more detailed information, see the crosswalks (http://www.ncpublicschools.org/acre/standards/common-core-tools)**

Instructional considerations for CCSS implementation in 2012 – 2013:

- Work with ratio tables and relationships between tables, graphs and equations; focus on the multiplicative relationship between and within ratios (6.RP.3a, 6.RP.3b)
- Unit conversions within systems (6.RP.3d)
- Opposites and absolute value (6.NS.6a, 6.NS.7c)
- Distributive property with area models and factoring (6.EE.3) – prerequisite to 7.EE.1
- Volume of rectangular prisms (6.G.2) and surface area (6.G.4) – prerequisite to 7.G.6
- Mean Absolute Deviation (6.SP.5c) – prerequisite to 7.SP.3 and foundational to standard deviation in Math One

Standards for Mathematical Practice

The Common Core State Standards for Mathematical Practice are expected to be integrated into every mathematics lesson for all students Grades K-12. Below are a few examples of how these Practices may be integrated into tasks that students complete.

Standards for Mathematical Practice	Explanations and Examples
1. Make sense of problems and persevere in solving them.	In grade 7, students solve problems involving ratios and rates and discuss how they solved the problems. Students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".
2. Reason abstractly and quantitatively.	In grade 7, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
3. Construct viable arguments and critique the reasoning of others.	In grade 7, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). The students further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?", "Does that always work?". They explain their thinking to others and respond to others' thinking.
4. Model with mathematics.	In grade 7, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students explore covariance and represent two quantities simultaneously. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences, make comparisons and formulate predictions. Students use experiments or simulations to generate data sets and create probability models. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to any problem's context.
5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 7 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Students might use physical objects or applets to generate probability data and use graphing calculators or spreadsheets to manage and represent data in different forms.
6. Attend to precision.	In grade 7, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students define variables, specify units of measure, and label axes accurately. Students use appropriate terminology when referring to rates, ratios, probability models, geometric figures, data displays, and components of expressions, equations or inequalities.

Standards for Mathematical Practice	Explanations and Examples
7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables making connections between the constant of proportionality in a table with the slope of a graph. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 3(2 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality), $c = 6$ by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving scale drawings, surface area, and volume. Students examine tree diagrams or systematic lists to determine the sample space for compound events and verify that they have listed all possibilities.
8. Look for and express regularity in repeated reasoning.	In grade 7, students use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, they may notice that $a/b \div c/d = ad/bc$ and construct other examples and models that confirm their generalization. They extend their thinking to include complex fractions and rational numbers. Students formally begin to make connections between covariance, rates, and representations showing the relationships between quantities. They create, explain, evaluate, and modify probability models to describe simple and compound events.

Grade 7 Critical Areas (from CCSS pg. 46)

The Critical Areas are designed to bring focus to the standards at each grade by describing the big ideas that educators can use to build their curriculum and to guide instruction. The Critical Areas for seventh grade can be found on page 46 in the *Common Core State Standards for Mathematics.*

1. **Developing understanding of and applying proportional relationships**
   Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

2. **Developing understanding of operations with rational numbers and working with expressions and linear equations**
   Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

3. **Solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume**
   Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

4. **Drawing inferences about populations based on samples**
   Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Ratios and Proportional Relationships 7.RP

Common Core Cluster

Analyze proportional relationships and use them to solve real-world and mathematical problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **unit rates, ratios, proportional relationships, proportions, constant of proportionality, complex fractions**

A detailed progression of the Ratios and Proportional Relationships domain with examples can be found at http://commoncoretools.wordpress.com/

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.RP.1 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 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.*	**7.RP.1** Students continue to work with unit rates from 6th grade; however, the comparison now includes fractions compared to fractions. The comparison can be with like or different units. Fractions may be proper or improper. Example 1: If $\frac{1}{2}$ gallon of paint covers $\frac{1}{6}$ of a wall, then how much paint is needed for the entire wall? *Solution:* $\frac{1}{2}$ gal / $\frac{1}{6}$ wall. 3 gallons per 1 wall
7.RP.2 Recognize and represent proportional relationships between quantities. a. 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. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	**7.RP.2** Students' understanding of the multiplicative reasoning used with proportions continues from 6th grade. Students determine if two quantities are in a proportional relationship from a table. Fractions and decimals could be used with this standard. **Note:** This standard focuses on the representations of proportions. Solving proportions is addressed in **7.SP.3**. Example 1: The table below gives the price for different numbers of books. Do the numbers in the table represent a proportional relationship? **Number of Books** / **Price** 1 / 3 3 / 9 4 / 12 7 / 18

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.*

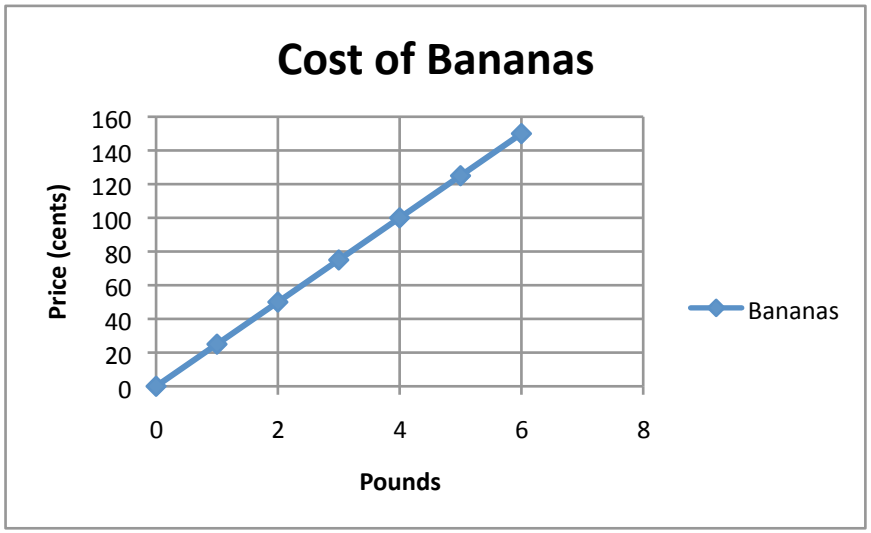
c. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.

Solution:
Students can examine the numbers to determine that the price is the number of books multiplied by 3, except for 7 books. The row with seven books for $18 is not proportional to the other amounts in the table; therefore, the table does ***not*** represent a proportional relationship.

Students graph relationships to determine if two quantities are in a proportional relationship and to interpret the ordered pairs. If the amounts from the table above are graphed (number of books, price), the pairs (1, 3), (3, 9), and (4, 12) will form a straight line through the origin (0 books, 0 dollars), indicating that these pairs are in a proportional relationship. The ordered pair (4, 12) means that 4 books cost $12. However, the ordered pair (7, 18) would not be on the line, indicating that it is not proportional to the other pairs.

The ordered pair (1, 3) indicates that 1 book is $3, which is the unit rate. The y-coordinate when $x = 1$ will be the unit rate. The constant of proportionality is the unit rate. Students identify this amount from tables (see example above), graphs, equations and verbal descriptions of proportional relationships.

<u>Example 2:</u>
The graph below represents the price of the bananas at one store. What is the constant of proportionality?



Solution:
From the graph, it can be determined that 4 pounds of bananas is $1.00; therefore, 1 pound of bananas is $0.25, which is the constant of proportionality for the graph. Note: Any point on the line will yield this constant of proportionality.

Students write equations from context and identify the coefficient as the unit rate which is also the constant of proportionality.

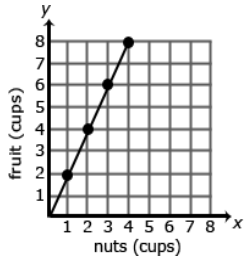
Example 3:
The price of bananas at another store can be determined by the equation: $P = \$0.35n$, where P is the price and n is the number of pounds of bananas. What is the constant of proportionality (unit rate)?

Solution:
The constant of proportionality is the coefficient of x (or the independent variable). The constant of proportionality is 0.35.

Example 4:
A student is making trail mix. Create a graph to determine if the quantities of nuts and fruit are proportional for each serving size listed in the table. If the quantities are proportional, what is the constant of proportionality or unit rate that defines the relationship? Explain how the constant of proportionality was determined and how it relates to both the table and graph.

Serving Size	**1**	**2**	**3**	**4**
cups of nuts (x)	1	2	3	4
cups of fruit (y)	2	4	6	8

Solution:

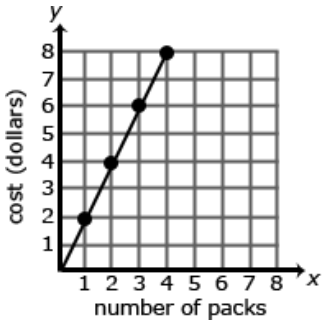


The relationship is proportional. For each of the other serving sizes there are 2 cups of fruit for every 1 cup of nuts (2:1).

The constant of proportionality is shown in the first column of the table and by the steepness (rate of change) of the line on the graph.

Example 5:

The graph below represents the cost of gum packs as a unit rate of $2 dollars for every pack of gum. The unit rate is represented as $2/pack. Represent the relationship using a table and an equation.



Solution:

Table:

Number of Packs of Gum (*g*)	Cost in Dollars (*d*)
0	0
1	2
2	4
3	6
4	8

Equation: $d = 2g$, where d is the cost in dollars and g is the packs of gum

A common error is to reverse the position of the variables when writing equations. Students may find it useful to use variables specifically related to the quantities rather than using x and y. Constructing verbal models can also be helpful. A student might describe the situation as "the number of packs of gum times the cost for each pack is the total cost in dollars". They can use this verbal model to construct the equation. Students can check their equation by substituting values and comparing their results to the table. The checking process helps student revise and recheck their model as necessary. The number of packs of gum times the cost for each pack is the total cost. (g x 2 = d)

Ratios and Proportional Relationships 7.RP

Common Core Cluster

Analyze proportional relationships and use them to solve real-world and mathematical problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **proportion, ratio, proportional relationships, percent, simple interest, rate, principal, tax, discount, markup, markdown, gratuity, commissions, fees, percent of error**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.RP.3 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** In 6th grade, students used ratio tables and unit rates to solve problems. Students expand their understanding of proportional reasoning to solve problems that are easier to solve with cross-multiplication. Students understand the mathematical foundation for cross-multiplication. An explanation of this foundation can be found in Developing Effective Fractions Instruction for Kindergarten Through 8th Grade. Example 1: Sally has a recipe that needs $\frac{3}{4}$ teaspoon of butter for every 2 cups of milk. If Sally increases the amount of milk to 3 cups of milk, how many teaspoons of butter are needed? Using these numbers to find the unit rate may not be the most efficient method. Students can set up the following proportion to show the relationship between butter and milk. $\frac{\frac{3}{4}}{2} = \frac{x}{3}$ *Solution:* One possible solution is to recognize that $2 \cdot 1\frac{1}{2} = 3$ so $\frac{3}{4} \cdot 1\frac{1}{2} = x$. The amount of butter needed would be $1\frac{1}{8}$ teaspoons. A second way to solve this proportion is to use cross-multiplication $\frac{3}{4} \cdot 3 = 2x$. Solving for x would give $1\frac{1}{8}$ teaspoons of butter. Finding the percent error is the process of expressing the size of the error (or deviation) between two measurements. To calculate the percent error, students determine the absolute deviation (positive difference) between an actual measurement and the accepted value and then divide by the accepted value. Multiplying by 100 will give the percent error. (Note the similarity between percent error and percent of increase or decrease) $\% \text{ error} = \frac{\lvert \text{estimated value} - \text{actual value} \rvert}{\text{actual value}} \times 100\,\%$

Example 2:
Jamal needs to purchase a countertop for his kitchen. Jamal measured the countertop as 5 ft. The actual measurement is 4.5 ft. What is Jamal's percent error?

Solution:

$$\% \text{ error} = \frac{|5 \text{ ft} - 4.5 \text{ ft}|}{4.5} \times 100$$

$$\% \text{ error} = \frac{0.5 \text{ ft}}{4.5} \times 100$$

The use of proportional relationships is also extended to solve percent problems involving sales tax, markups and markdowns simple interest ($I = prt$, where I = interest, p = principal, r = rate, and t = time (in years)), gratuities and commissions, fees, percent increase and decrease, and percent error.

Students should be able to explain or show their work using a representation (numbers, words, pictures, physical objects, or equations) and verify that their answer is reasonable. Students use models to identify the parts of the problem and how the values are related. For percent increase and decrease, students identify the starting value, determine the difference, and compare the difference in the two values to the starting value.

For example, Games Unlimited buys video games for $10. The store increases their purchase price by 300%? What is the sales price of the video game?
Using proportional reasoning, if $10 is 100% then what amount would be 300%? Since 300% is 3 times 100%, $30 would be $10 times 3. Thirty dollars represents the amount of increase from $10 so the new price of the video game would be $40.

Example 3:
Gas prices are projected to increase by 124% by April 2015. A gallon of gas currently costs $3.80. What is the projected cost of a gallon of gas for April 2015?

Solution:
Possible response: "The original cost of a gallon of gas is $3.80. An increase of 100% means that the cost will double. Another 24% will need to be added to figure out the final projected cost of a gallon of gas. Since 25% of $3.80 is about $0.95, the projected cost of a gallon of gas should be around $8.15."

$$\$3.80 + 3.80 + (0.24 \bullet 3.80) = 2.24 \times 3.80 = \$8.15$$

100%	100%	24%
$3.80	$3.80	?

Example 4:
A sweater is marked down 33% off the original price. The original price was $37.50. What is the sale price of the sweater before sales tax?

Solution:
The discount is 33% times 37.50. The sale price of the sweater is the original price minus the discount or 67% of the original price of the sweater, or Sale Price = 0.67 x Original Price.

37.50	
33% of 37.50 Discount	67% of 37.50 Sale price of sweater

Example 5:
A shirt is on sale for 40% off. The sale price is $12. What was the original price? What was the amount of the discount?

Solution:

Discount 40% of original	Sale Price - $12 60% of original price
Original Price (p)	

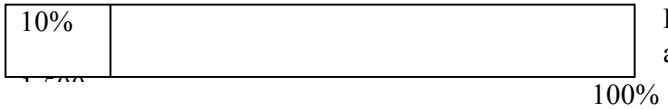
The sale price is 60% of the original price. This reasoning can be expressed as $12 = 0.60p$. Dividing both sides by 0.60 gives an original price of $20.

Example 6:
At a certain store, 48 television sets were sold in April. The manager at the store wants to encourage the sales team to sell more TVs by giving all the sales team members a bonus if the number of TVs sold increases by 30% in May. How many TVs must the sales team sell in May to receive the bonus? Justify the solution.

Solution:
The sales team members need to sell the 48 and an additional 30% of 48. 14.4 is exactly 30% so the team would need to sell 15 more TVs than in April or 63 total (48 + 15)

Example 7:
A salesperson set a goal to earn $2,000 in May. He receives a base salary of $500 per month as well as a 10% commission for all sales in that month. How much merchandise will he have to sell to meet his goal?

Solution:
$2,000 - $500 = $1,500 or the amount needed to be earned as commission. 10% of what amount will equal $1,500.



Because 100% is 10 times 10%, then the commission amount would be 10 time 1,500 or 15,000

Example 8:
After eating at a restaurant, Mr. Jackson's bill before tax is $52.50 The sales tax rate is 8%. Mr. Jackson decides to leave a 20% tip for the waiter based on the pre-tax amount. How much is the tip Mr. Jackson leaves for the waiter? How much will the total bill be, including tax and tip? Express your solution as a multiple of the bill.

Solution:
The amount paid = $\underbrace{0.20 \text{ x } \$52.50}_{\text{tip}} + \underbrace{0.08 \text{ x } \$52.50}_{\text{tax}}$ = 0.28 x $52.50 or $14.70 for the tip and tax. The total bill would be $67.20,

Example 9:
Stephanie paid $9.18 for a pair of earrings. This amount includes a tax of 8%. What was the cost of the item before tax?

Solution:
One possible solution path follows:
$9.18 represents 100% of the cost of the earrings + 8% of the cost of the earrings. This representation can be expressed as $1.08c = 9.18$, where c represents the cost of the earrings. Solving for c gives $8.50 for the cost of the earrings.

Several problem situations have been represented with this standard; however, every possible situation cannot be addressed here.

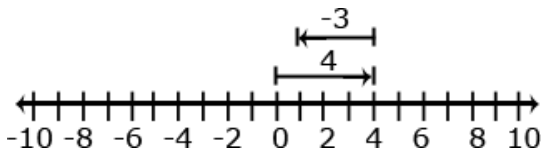
The Number System 7.NS

Common Core Cluster

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **rational numbers, integers, additive inverse**

Common Core Standard	**Unpacking** What does this standard mean that a student will know and be able to do?
7.NS.1 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. a. Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged. b. 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. c. 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. d. Apply properties of operations as strategies to add and subtract rational numbers.	**7.NS.1** Students add and subtract rational numbers. Visual representations may be helpful as students begin this work; they become less necessary as students become more fluent with these operations. The expectation of the CCSS is to build on student understanding of number lines developed in 6th grade. <u>Example 1:</u> Use a number line to add -5 + 7. *Solution:* Students find -5 on the number line and move 7 in a positive direction (to the right). The stopping point of 2 is the sum of this expression. Students also add negative fractions and decimals and interpret solutions in given contexts. In 6th grade, students found the distance of horizontal and vertical segments on the coordinate plane. In 7th grade, students build on this understanding to recognize subtraction is finding the distance between two numbers on a number line. In the example, 7 – 5, the difference is the distance between 7 and 5, or 2, in the direction of 5 to 7 (positive). Therefore the answer would be 2. <u>Example 2:</u> Use a number line to subtract: -6 – (-4) *Solution:* This problem is asking for the distance between -6 and -4. The distance between -6 and -4 is 2 and the direction from -4 to -6 is left or negative. The answer would be -2. Note that this answer is the same as adding the opposite of -4: -6 + 4 = -2

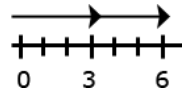
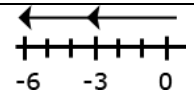
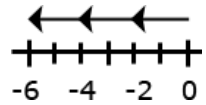
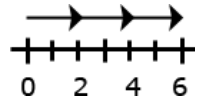
	Example 3: Use a number line to illustrate: • $p - q$ *ie.* $7 - 4$ • $p + (-q)$ *ie.* $7 + (-4)$ • Is this equation true $p - q = p + (-q)$? Students explore the above relationship when p is negative and q is positive and when both p and q are negative. Is this relationship always true? Example 4: Morgan has \$4 and she needs to pay a friend \$3. How much will Morgan have after paying her friend? *Solution:* 4 + (-3) = 1 or (-3) + 4 = 1 
7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. 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. b. 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	**7.NS.2** Students understand that multiplication and division of integers is an extension of multiplication and division of whole numbers. Students recognize that when division of rational numbers is represented with a fraction bar, each number can have a negative sign. Example 1: Which of the following fractions is equivalent to $\frac{-4}{5}$? Explain your reasoning. a. $\frac{4}{-5}$ b. $\frac{-16}{20}$ c. $\frac{-4}{-5}$ Example Set 2:

are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

c. Apply properties of operations as strategies to multiply and divide rational numbers.

d. 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.

Examine the family of equations in the table below. What patterns are evident? Create a model and context for each of the products. Write and model the family of equations related to 3 x 4 = 12.

Equation	Number Line Model	Context
2 • 3 = 6		Selling two packages of apples at $3.00 per pack
2 • -3 = -6		Spending 3 dollars each on 2 packages of apples
-2 • 3 = -6		Owing 2 dollars to each of your three friends
-2 • -3 = 6		Forgiving 3 debts of $2.00 each

Using long division from elementary school, students understand the difference between terminating and repeating decimals. This understanding is foundational for the work with rational and irrational numbers in 8th grade.

<u>Example 3:</u>

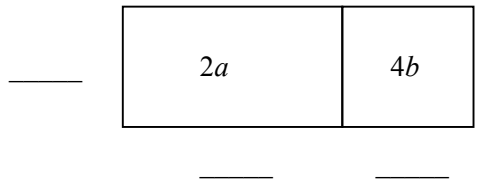
	Using long division, express the following fractions as decimals. Which of the following fractions will result in terminating decimals; which will result in repeating decimals? Identify which fractions will terminate (the denominator of the fraction in reduced form only has factors of 2 and/or 5)
7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.[1] [1]Computations with rational numbers extend the rules for manipulating fractions to complex fractions.	**7.NS.3** Students use order of operations from 6th grade to write and solve problem with all rational numbers. <u>Example 1:</u> Calculate: [-10(-0.9)] – [(-10) • 0.11] *Solution:* 10.1 <u>Example 2:</u> Jim's cell phone bill is automatically deducting $32 from his bank account every month. How much will the deductions total for the year? *Solution:* -32 + (-32) + (-32) + (-32)+ (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) = 12 (-32) <u>Example 3:</u> It took a submarine 20 seconds to drop to 100 feet below sea level from the surface. What was the rate of the descent? *Solution:* $\frac{\text{-100 feet}}{\text{20 seconds}} = \frac{\text{- 5 feet}}{\text{1 second}} = \text{-5 ft/sec}$ <u>Example 4:</u> A newspaper reports these changes in the price of a stock over four days: $\frac{-1}{8}, \frac{-5}{8}, \frac{3}{8}, \frac{-9}{8}$. What is the average daily change? *Solution:* The sum is $\frac{-12}{8}$; dividing by 4 will give a daily average of $\frac{-3}{8}$

Expressions and Equations 7.EE

Common Core Cluster

Use properties of operations to generate equivalent expressions.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **coefficients, like terms, distributive property, factor**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	**7.EE.1** This is a continuation of work from 6th grade using properties of operations (table 3, pg. 90) and combining like terms. Students apply properties of operations and work with rational numbers (integers and positive / negative fractions and decimals) to write equivalent expressions. <u>Example 1:</u> What is the length and width of the rectangle below?  *Solution:* The Greatest Common Factor (GCF) is 2, which will be the width because the width is in common to both rectangles. To get the area $2a$ multiply by a, which is the length of the first rectangles. To get the area of $4b$, multiply by $2b$, which will be the length of the second rectangle. The final answer will be $2(a + 2b)$ <u>Example 2:</u> Write an equivalent expression for $3(x + 5) – 2$. *Solution:* $3x + 15 – 2$ Distribute the 3 $3x + 13$ Combine like terms

	Example 3: Suzanne says the two expressions $2(3a - 2) + 4a$ and $10a - 2$ are equivalent? Is she correct? Explain why or why not? *Solution:* The expressions are not equivalent. One way to prove this is to distribute and combine like terms in the first expression to get $10a - 4$, which is not equivalent to the second expression. A second explanation is to substitute a value for the variable and perform the calculations. For example, if 2 is substituted for a then the value of the first expression is 16 while the value of the second expression is 18. Example 4: Write equivalent expressions for: $3a + 12$. *Solution:* Possible solutions might include factoring as in $3(a + 4)$, or other expressions such as $a + 2a + 7 + 5$. Example 5: A rectangle is twice as long as its width. One way to write an expression to find the perimeter would be $w + w + 2w + 2w$. Write the expression in two other ways. *Solution:* $6w$ ***or*** $2(2w)$  Example 6: An equilateral triangle has a perimeter of $6x + 15$. What is the length of each side of the triangle? *Solution:* $3(2x + 5)$, therefore each side is $2x + 5$ units long.
7.EE.2 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** Students understand the reason for rewriting an expression in terms of a contextual situation. For example, students understand that a 20% discount is the same as finding 80% of the cost, c ($0.80c$). Example 1: All varieties of a certain brand of cookies are \$3.50. A person buys peanut butter cookies and chocolate chip cookies. Write an expression that represents the total cost, T, of the cookies if p represents the number of peanut butter cookies and c represents the number of chocolate chip cookies

Solution:
Students could find the cost of each variety of cookies and then add to find the total.
$T = 3.50p + 3.50c$
Or students could recognize that multiplying 3.50 by the total number of boxes (regardless of variety) will give the same total.
$T = 3.50(p + c)$

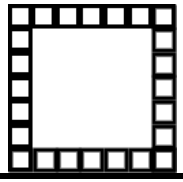
<u>Example 2:</u>
Jamie and Ted both get paid an equal hourly wage of $9 per hour. This week, Ted made an additional $27 dollars in overtime. Write an expression that represents the weekly wages of both if J = the number of hours that Jamie worked this week and T = the number of hours Ted worked this week? What is another way to write the expression?

Solution:
Students may create several different expressions depending upon how they group the quantities in the problem. Possible student responses are:
Response 1: To find the total wage, first multiply the number of hours Jamie worked by 9. Then, multiply the number of hours Ted worked by 9. Add these two values with the $27 overtime to find the total wages for the week. The student would write the expression $9J + 9T + 27$.

Response 2: To find the total wages, add the number of hours that Ted and Jamie worked. Then, multiply the total number of hours worked by 9. Add the overtime to that value to get the total wages for the week. The student would write the expression $9(J + T) + 27$.

Response 3: To find the total wages, find out how much Jamie made and add that to how much Ted made for the week. To figure out Jamie's wages, multiply the number of hours she worked by 9. To figure out Ted's wages, multiply the number of hours he worked by 9 and then add the $27 he earned in overtime. My final step would be to add Jamie and Ted wages for the week to find their combined total wages. The student would write the expression $(9J) + (9T + 27)$.

<u>Example 3:</u>
Given a square pool as shown in the picture, write four different expressions to find the total number of tiles in the border. Explain how each of the expressions relates to the diagram and demonstrate that the expressions are equivalent. Which expression is most useful? Explain.



Expressions and Equations 7.EE

Common Core Cluster

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **numeric expressions, algebraic expressions, maximum, minimum**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.EE.3 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 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 3/4 inches long in the center of a door that is 27 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** Students solve contextual problems and mathematical problems using rational numbers. Students convert between fractions, decimals, and percents as needed to solve the problem. Students use estimation to justify the reasonableness of answers. <u>Example 1:</u> Three students conduct the same survey about the number of hours people sleep at night. The results of the number of people who sleep 8 hours a nights are shown below. In which person's survey did the most people sleep 8 hours? • Susan reported that 18 of the 48 people she surveyed get 8 hours sleep a night • Kenneth reported that 36% of the people he surveyed get 8 hours sleep a night • Jamal reported that 0.365 of the people he surveyed get 8 hours sleep a night *Solution:* In Susan's survey, the number is 37.5%, which is the greatest percentage. Estimation strategies for calculations with fractions and decimals extend from students' work with whole number operations. Estimation strategies include, but are not limited to: • front-end estimation with adjusting (using the highest place value and estimating from the front end making adjustments to the estimate by taking into account the remaining amounts), • clustering around an average (when the values are close together an average value is selected and multiplied by the number of values to determine an estimate), • rounding and adjusting (students round down or round up and then adjust their estimate depending on how much the rounding affected the original values), • using friendly or compatible numbers such as factors (students seek to fit numbers together - i.e., rounding to factors and grouping numbers together that have round sums like 100 or 1000), and • using benchmark numbers that are easy to compute (students select close whole numbers for fractions or decimals to determine an estimate).

7.EE.4 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.

a. 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 and b Students write an equation or inequality to model the situation. Students explain how they determined whether to write an equation or inequality and the properties of the real number system that you used to find a solution. In contextual problems, students define the variable and use appropriate units.

7.EE.4a

Students solve multi-step equations derived from word problems. Students use the arithmetic from the problem to generalize an algebraic solution

<u>Example 1:</u>

The youth group is going on a trip to the state fair. The trip costs $52. Included in that price is $11 for a concert ticket and the cost of 2 passes, one for the rides and one for the game booths. Each of the passes cost the same price. Write an equation representing the cost of the trip and determine the price of one pass.

Solution:

x =cost of one pass

x	x	11
52		

$2x + 11 = 52$

$2x = 41$

$x = \$20.50$

<u>Example 2:</u>

Solve: $\frac{2}{3}x - 4 = -16$

Solution:

$\frac{2}{3}x - 4 = -16$

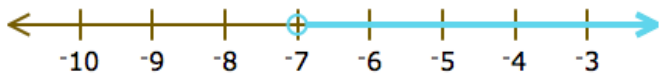
$\frac{2}{3}x = -12$ Added 4 to both sides

$\frac{3}{2} \cdot \frac{2}{3}x = -12 \cdot \frac{3}{2}$ Multiply both sides by $\frac{3}{2}$

$x = -18$

Students could also reason that if $\frac{2}{3}$ of some amount is -12 then $\frac{1}{3}$ is -6. Therefore, the whole amount must be 3 times -6 or -18.

	<u>Example 3:</u> Amy had \$26 dollars to spend on school supplies. After buying 10 pens, she had \$14.30 left. How much did each pen cost including tax? *Solution:* x = number of pens $26 = 14.30 + 10x$ Solving for x gives \$1.17 for each pen. <u>Example 4:</u> The sum of three consecutive even numbers is 48. What is the smallest of these numbers? *Solution:* x = the smallest even number $x + 2$ = the second even number $x + 4$ = the third even number $x + x + 2 + x + 4 = 48$ $3x + 6 = 48$ $3x = 42$ $x = 14$ <u>Example 5:</u> Solve: $\frac{x + 3}{-2} = -5$ *Solution:* $x = 7$

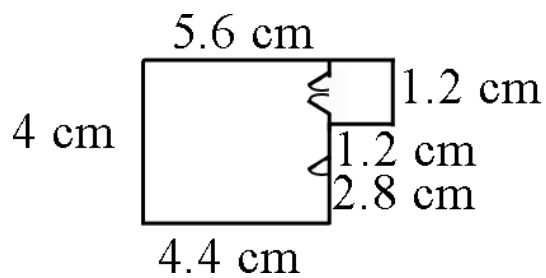
b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. 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.*	Students solve and graph inequalities and make sense of the inequality in context. Inequalities may have negative coefficients. Problems can be used to find a maximum or minimum value when in context. <u>Example 1:</u> Florencia has at most $60 to spend on clothes. She wants to buy a pair of jeans for $22 dollars and spend the rest on t-shirts. Each t-shirt costs $8. Write an inequality for the number of t-shirts she can purchase. *Solution:* x = cost of one t-shirt $8x + 22 \leq 60$ $x = 4.75$ → 4 is the most t-shirts she can purchase <u>Example 2:</u> Steven has $25 dollars to spend. He spent $10.81, including tax, to buy a new DVD. He needs to save $10.00 but he wants to buy a snack. If peanuts cost $0.38 per package including tax, what is the maximum number of packages that Steven can buy? *Solution:* x = number of packages of peanuts $25 \geq 10.81 + 10.00 + 0.38x$ $x = 11.03$ → Steven can buy 11 packages of peanuts <u>Example 3:</u> $7 - x > 5.4$ *Solution:* $x < 1.6$ <u>Example 4:</u> Solve $-0.5x - 5 < -1.5$ and graph the solution on a number line. *Solution:* $x > -7$ 

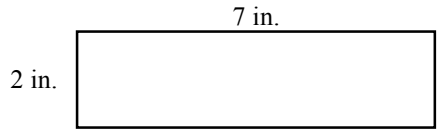
Geometry 7.G

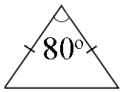
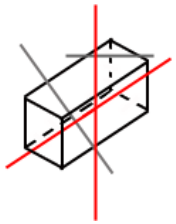
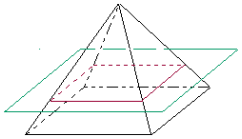
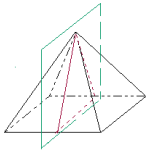
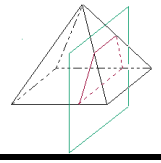
Common Core Cluster

Draw, construct, and describe geometrical figures and describe the relationships between them.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **scale drawing, dimensions, scale factor, plane sections, right rectangular prism, right rectangular pyramids, parallel, perpendicular**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.G.1 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** Students determine the dimensions of figures when given a scale and identify the impact of a scale on actual length (one-dimension) and area (two-dimensions). Students identify the scale factor given two figures. Using a given scale drawing, students reproduce the drawing at a different scale. Students understand that the lengths will change by a factor equal to the product of the magnitude of the two size transformations. <u>Example 1:</u> Julie shows the scale drawing of her room below. If each 2 cm on the scale drawing equals 5 ft, what are the actual dimensions of Julie's room? Reproduce the drawing at 3 times its current size.  *Solution:* 5.6 cm → 14 ft 1.2 cm → 3 ft 2.8 cm → 7 ft 4.4 cm → 11 ft 4 cm → 10 ft

	Example 2: If the rectangle below is enlarged using a scale factor of 1.5, what will be the perimeter and area of the new rectangle?  *Solution*: The perimeter is linear or one-dimensional. Multiply the perimeter of the given rectangle (18 in.) by the scale factor (1.5) to give an answer of 27 in. Students could also increase the length and width by the scale factor of 1.5 to get 10.5 in. for the length and 3 in. for the width. The perimeter could be found by adding 10.5 + 10.5 + 3 + 3 to get 27 in. The area is two-dimensional so the scale factor must be squared. The area of the new rectangle would be 14 x 1.5^2 or 31.5 in^2.
7.G.2 Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	**7.G.2** Students draw geometric shapes with given parameters. Parameters could include parallel lines, angles, perpendicular lines, line segments, etc. Example 1: Draw a quadrilateral with one set of parallel sides and no right angles. Students understand the characteristics of angles and side lengths that create a unique triangle, more than one triangle or no triangle. Example 2: Can a triangle have more than one obtuse angle? Explain your reasoning. Example 3: Will three sides of any length create a triangle? Explain how you know which will work. Possibilities to examine are: a. 13 cm, 5 cm, and 6 cm b. 3 cm, 3cm, and 3 cm c. 2 cm, 7 cm, 6 cm *Solution:* "A" above will not work; "B" and "C" will work. Students recognize that the sum of the two smaller sides must be larger than the third side. Example 4: Is it possible to draw a triangle with a 90˚ angle and one leg that is 4 inches long and one leg that is 3 inches long? If so, draw one. Is there more than one such triangle? (NOTE: Pythagorean Theorem is NOT expected – this is an exploration activity only)

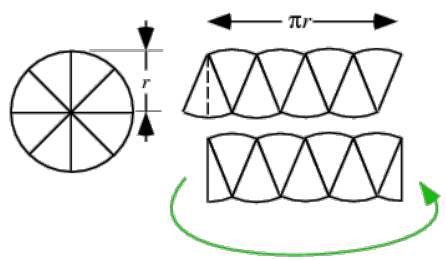
	<u>Example 5:</u> Draw a triangle with angles that are 60 degrees. Is this a unique triangle? Why or why not? <u>Example 6:</u> Draw an isosceles triangle with only one 80° angle. Is this the only possibility or can another triangle be drawn that will meet these conditions?  Through exploration, students recognize that the sum of the angles of any triangle will be 180° .
7.G.3 Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	**7.G.3** Students need to describe the resulting face shape from cuts made parallel and perpendicular to the bases of right rectangular prisms and pyramids. Cuts made parallel will take the shape of the base; cuts made perpendicular will take the shape of the lateral (side) face. Cuts made at an angle through the right rectangular prism will produce a parallelogram;   If the pyramid is cut with a plane (green) parallel to the base, the intersection of the pyramid and the plane is a square cross section (red).  If the pyramid is cut with a plane (green) passing through the top vertex and perpendicular to the base, the intersection of the pyramid and the plane is a triangular cross section (red).  If the pyramid is cut with a plane (green) perpendicular to the base, but not through the top vertex, the intersection of the pyramid and the plane is a trapezoidal cross section (red). http://intermath.coe.uga.edu/dictnary/descript.asp?termID=95

Geometry 7.G

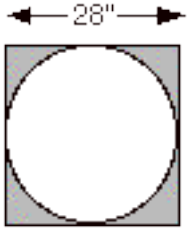
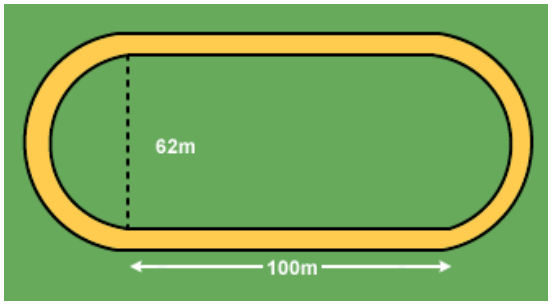
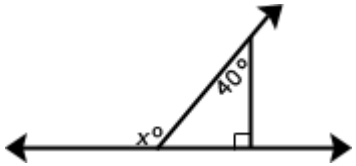
Common Core Cluster

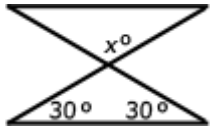
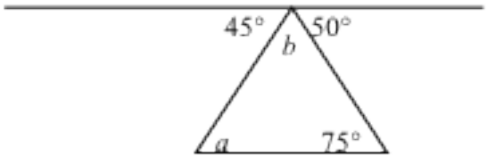
Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **inscribed, circumference, radius, diameter, pi, π, supplementary, vertical, adjacent, complementary, pyramids, face, base**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.G.4 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** Students understand the relationship between radius and diameter. Students also understand the ratio of circumference to diameter can be expressed as pi. Building on these understandings, students generate the formulas for circumference and area. The illustration shows the relationship between the circumference and area. If a circle is cut into wedges and laid out as shown, a parallelogram results. Half of an end wedge can be moved to the other end a rectangle results. The height of the rectangle is the same as the radius of the circle. The base length is $\frac{1}{2}$ the circumference ($2\pi r$). The area of the rectangle (and therefore the circle) is found by the following calculations:  http://mathworld.wolfram.com/Circle.html A_{rect} = Base x Height Area = ½ ($2\pi r$) x r Area = πr x r Area = πr^2 Students solve problems (mathematical and real-world) involving circles or semi-circles. **Note:** Because pi is an irrational number that neither repeats nor terminates, the measurements are approximate when 3.14 is used in place of π.

	<u>Example 1:</u> The seventh grade class is building a mini-golf game for the school carnival. The end of the putting green will be a circle. If the circle is 10 feet in diameter, how many square feet of grass carpet will they need to buy to cover the circle? How might someone communicate this information to the salesperson to make sure he receives a piece of carpet that is the correct size? Use 3.14 for pi. *Solution:* Area = πr^2 Area = $3.14\ (5)^2$ Area = $78.5\ ft^2$ To communicate this information, ask for a 9 ft by 9 ft square of carpet. <u>Example 2:</u> The center of the circle is at (5, -5). What is the area of the circle? $\frac{1}{2}$ *Solution:* The radius of the circle is 4. Using the formula, Area = πr^2, the area of the circle is approximately 50.24 units^2. Students build on their understanding of area from 6th grade to find the area of left-over materials when circles are cut from squares and triangles or when squares and triangles are cut from circles.

	<u>Example 3:</u> If a circle is cut from a square piece of plywood, how much plywood would be left over?  *Solution:* The area of the square is 28 x 28 or 784 in^2. The diameter of the circle is equal to the length of the side of the square, or 28", so the radius would be 14". The area of the circle would be approximately 615.44 in2. The difference in the amounts (plywood left over) would be 168.56 in^2 (784 – 615.44). <u>Example 4:</u> What is the perimeter of the inside of the track.  *Solution:* The ends of the track are two semicircles, which would form one circle with a diameter of 62m. The circumference of this part would be 194.68 m. Add this to the two lengths of the rectangle and the perimeter is 2194.68 m "Know the formula" does not mean memorization of the formula. To "know" means to have an understanding of ***why*** the formula works and how the formula relates to the measure (area and circumference) and the figure. This understanding should be for *all* students.
7.G.5 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** Students use understandings of angles and deductive reasoning to write and solve equations <u>Example1:</u> Write and solve an equation to find the measure of angle *x*.  *Solution:* Find the measure of the missing angle inside the triangle (180 – 90 – 40), or 50°. The measure of angle *x* is supplementary to 50°, so subtract 50 from 180 to get a measure of 130° for *x*.

	<u>Example 2:</u> Find the measure of angle *x*.  *Solution:* First, find the missing angle measure of the bottom triangle (180 – 30 – 30 = 120). Since the 120 is a vertical angle to *x*, the measure of *x* is also 120°. <u>Example 3:</u> Find the measure of angle *b*.  Note: Not drawn to scale. *Solution:* Because, the 45°, 50° angles and *b* form are supplementary angles, the measure of angle *b* would be 85°. The measures of the angles of a triangle equal 180° so 75° + 85°+ *a* = 180°. The measure of angle *a* would be 20°.
7.G.6 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** Students continue work from 5th and 6th grade to work with area, volume and surface area of two-dimensional and three-dimensional objects. (composite shapes) Students will not work with cylinders, as circles are not polygons. At this level, students determine the dimensions of the figures given the area or volume. "Know the formula" does not mean memorization of the formula. To "know" means to have an understanding of ***why*** the formula works and how the formula relates to the measure (area and volume) and the figure. This understanding should be for *all* students. Surface area formulas are not the expectation with this standard. Building on work with nets in the 6th grade, students should recognize that finding the area of each face of a three-dimensional figure and adding the areas will give the surface area. No nets will be given at this level; however, students could create nets to aid in surface area calculations.

Students understanding of volume can be supported by focusing on the area of base times the height to calculate volume.
Students solve for missing dimensions, given the area or volume.

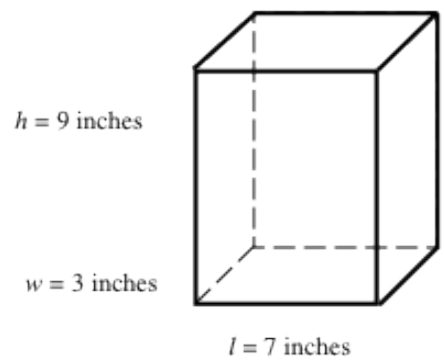
Example 2:
A triangle has an area of 6 square feet. The height is four feet. What is the length of the base?

Solution:
One possible solution is to use the formula for the area of a triangle and substitute in the known values, then solve for the missing dimension. The length of the base would be 3 feet.

Example 3:
The surface area of a cube is 96 in^2. What is the volume of the cube?

Solution:
The area of each face of the cube is equal. Dividing 96 by 6 gives an area of 16 in^2 for each face. Because each face is a square, the length of the edge would be 4 in. The volume could then be found by multiplying 4 x 4 x 4 or 64 in^3.

Example 4:
Huong covered the box to the right with sticky-backed decorating paper. The paper costs 3¢ per square inch. How much money will Huong need to spend on paper?



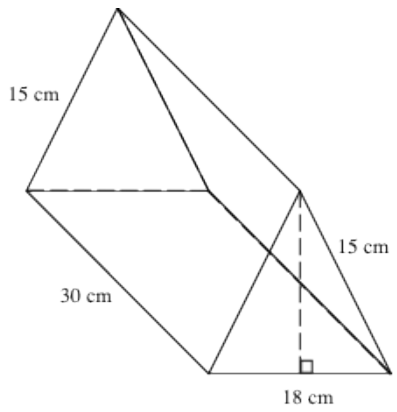
Solution:
The surface area can be found by using the dimensions of each face to find the area and multiplying by 2:

Front: 7 in. x 9 in. = 63 in^2 x 2 = 126 in^2
Top: 3 in. x 7 in. = 21 in^2 x 2 = 42 in^2
Side: 3 in. x 9 in. = 27 in^2 x 2 = 54 in^2

The surface area is the sum of these areas, or 222 in^2. If each square inch of paper cost \$0.03, the cost would be \$6.66.

Example 5:

Jennie purchased a box of crackers from the deli. The box is in the shape of a triangular prism (see diagram below). If the volume of the box is 3,240 cubic centimeters, what is the height of the triangular face of the box? How much packaging material was used to construct the cracker box? Explain how you got your answer.



Solution:

Volume can be calculated by multiplying the area of the base (triangle) by the height of the prism. Substitute given values and solve for the area of the triangle

$V = Bh$

$3{,}240\ cm^3 = B\ (30cm)$

$\frac{3{,}240\ cm^3}{30\ cm} = \frac{B(30cm)}{30\ cm}$

$108\ cm^2 = B$ (area of the triangle)

To find the height of the triangle, use the area formula for the triangle, substituting the known values in the formula and solving for height. The height of the triangle is 12 cm.

The problem also asks for the surface area of the package. Find the area of each face and add:

2 triangular bases: ½ (18 cm)(12 cm) = 108 cm^2 x 2 = 216 cm^2

2 rectangular faces: 15 cm x 30 cm = 450 cm^2 x 2 = 900 cm^2

1 rectangular face: 18 cm x 30 cm = 540 cm^2

Adding 216 cm^2 + 900 cm^2 + 540 cm^2 gives a total surface area of 1656 cm^2.

Statistics and Probability 7.SP

Common Core Cluster

Use random sampling to draw inferences about a population.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **random sampling, population, representative sample, inferences**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.SP.1 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.	**7.SP.1** Students recognize that it is difficult to gather statistics on an entire population. Instead a random sample can be representative of the total population and will generate valid predictions. Students use this information to draw inferences from data. A random sample must be used in conjunction with the population to get accuracy. For example, a random sample of elementary students cannot be used to give a survey about the prom. <u>Example 1:</u> The school food service wants to increase the number of students who eat hot lunch in the cafeteria. The student council has been asked to conduct a survey of the student body to determine the students' preferences for hot lunch. They have determined two ways to do the survey. The two methods are listed below. Determine if each survey option would produce a random sample. Which survey option should the student council use and why? 1. Write all of the students' names on cards and pull them out in a draw to determine who will complete the survey. 2. Survey the first 20 students that enter the lunchroom. 3. Survey every 3rd student who gets off a bus.
7.SP.2 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** Students collect and use multiple samples of data to make generalizations about a population. Issues of variation in the samples should be addressed. <u>Example 1:</u> Below is the data collected from two random samples of 100 students regarding student's school lunch preference. Make at least two inferences based on the results. **Student Sample** / **Hamburgers** / **Tacos** / **Pizza** / **Total** #1 / 12 / 14 / 74 / 100 #2 / 12 / 11 / 77 / 100 *Solution:* • Most students prefer pizza. • More people prefer pizza and hamburgers and tacos combined.

Statistics and Probability 7.SP

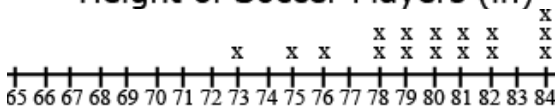
Common Core Cluster

Draw informal comparative inferences about two populations.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **variation/variability, distribution, measures of center, measures of variability**

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.SP.3 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** This is the students' first experience with comparing two data sets. Students build on their understanding of graphs, mean, median, Mean Absolute Deviation (MAD) and interquartile range from 6th grade. Students understand that 1. a full understanding of the data requires consideration of the measures of variability as well as mean or median, 2. variability is responsible for the overlap of two data sets and that an increase in variability can increase the overlap, and 3. median is paired with the interquartile range and mean is paired with the mean absolute deviation . <u>Example:</u> Jason wanted to compare the mean height of the players on his favorite basketball and soccer teams. He thinks the mean height of the players on the basketball team will be greater but doesn't know how much greater. He also wonders if the variability of heights of the athletes is related to the sport they play. He thinks that there will be a greater variability in the heights of soccer players as compared to basketball players. He used the rosters and player statistics from the team websites to generate the following lists. Basketball Team – Height of Players in inches for 2010 Season 75, 73, 76, 78, 79, 78, 79, 81, 80, 82, 81, 84, 82, 84, 80, 84 Soccer Team – Height of Players in inches for 2010 73, 73, 73, 72, 69, 76, 72, 73, 74, 70, 65, 71, 74, 76, 70, 72, 71, 74, 71, 74, 73, 67, 70, 72, 69, 78, 73, 76, 69 To compare the data sets, Jason creates a two dot plots on the same scale. The shortest player is 65 inches and the tallest players are 84 inches.

Height of Soccer Players (in)



Height of Basketball Players (in)

In looking at the distribution of the data, Jason observes that there is some overlap between the two data sets. Some players on both teams have players between 73 and 78 inches tall. Jason decides to use the mean and mean absolute deviation to compare the data sets.

The mean height of the basketball players is 79.75 inches as compared to the mean height of the soccer players at 72.07 inches, a difference of 7.68 inches.

The mean absolute deviation (MAD) is calculated by taking the mean of the absolute deviations for each data point. The difference between each data point and the mean is recorded in the second column of the table The difference between each data point and the mean is recorded in the second column of the table. Jason used rounded values (80 inches for the mean height of basketball players and 72 inches for the mean height of soccer players) to find the differences. The absolute deviation, absolute value of the deviation, is recorded in the third column. The absolute deviations are summed and divided by the number of data points in the set.

The mean absolute deviation is 2.14 inches for the basketball players and 2.53 for the soccer players. These values indicate moderate variation in both data sets.

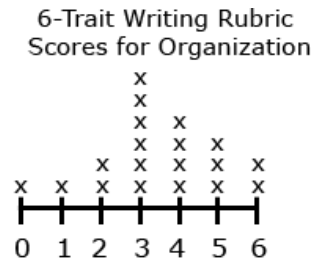
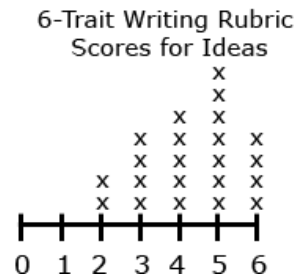
Solution:
There is slightly more variability in the height of the soccer players. The difference between the heights of the teams (7.68) is approximately 3 times the variability of the data sets (7.68 ÷ 2.53 = 3.04; 7.68 ÷ 2.14 = 3.59).

Soccer Players (*n* = 29)		
Height (in)	Deviation from Mean (in)	Absolute Deviation (in)
65	-7	7
67	-5	5
69	-3	3
69	-3	3
69	-3	3
70	-2	2
70	-2	2
71	-1	1
71	-1	1
71	-1	1
72	0	0
72	0	0
72	0	0
72	0	0
73	+1	1
73	+1	1
73	+1	1
73	+1	1
73	+1	1
73	+1	1
74	+2	2
74	+2	2
74	+2	2
74	+2	2
76	+4	4
76	+4	4
76	+4	4
78	+6	6
∑ = 2090		∑ = 62

Basketball Players (n = 16)		
Height (in)	Deviation from Mean (in)	Absolute Deviation (in)
73	-7	7
75	-5	5
76	-4	4
78	-2	2
78	-2	2
79	-1	1
79	-1	1
80	0	0
80	0	0
81	+1	1
81	+1	1
82	+2	2
82	+2	2
84	+4	4
84	+4	4
84	+4	4
∑ = 1276		∑ = 40

Mean = 2090 ÷ 29 =72 inches
MAD = 62 ÷ 29 = 2.14 inches

Mean = 1276 ÷ 16 =80 inches
MAD = 40 ÷ 16 = 2.53 inches

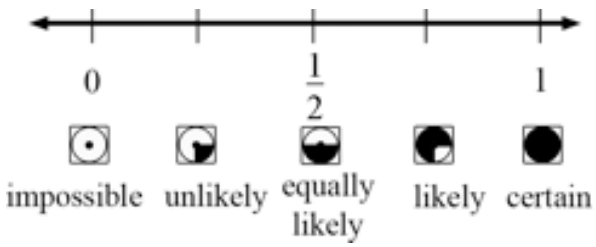
7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*	**7.SP.4** Students compare two sets of data using measures of center (mean and median) and variability MAD and IQR). Showing the two graphs vertically rather than side by side helps students make comparisons. For example, students would be able to see from the display of the two graphs that the ideas scores are generally higher than the organization scores. One observation students might make is that the scores for organization are clustered around a score of 3 whereas the scores for ideas are clustered around a score of 5.   <u>Example 1:</u> The two data sets below depict random samples of the management salaries in two companies. Based on the salaries below which measure of center will provide the most accurate estimation of the salaries for each company? • Company A: 1.2 million, 242,000, 265,500, 140,000, 281,000, 265,000, 211,000 • Company B: 5 million, 154,000, 250,000, 250,000, 200,000, 160,000, 190,000 *Solution:* The median would be the most accurate measure since both companies have one value in the million that is far from the other values and would affect the mean.

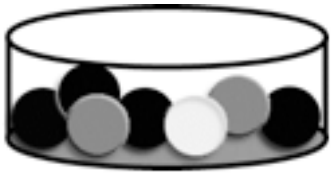
Statistics and Probability 7.SP

Common Core Cluster

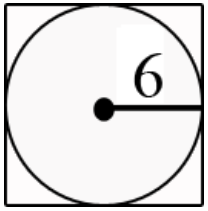
Investigate chance processes and develop, use, and evaluate probability models.

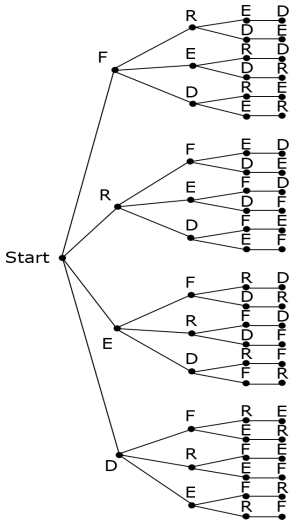
Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **sample spaces**
See list from essential standards work.

Common Core Standard	Unpacking What does this standard mean that a student will know and be able to do?
7.SP.5 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 ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	**7.SP.5** This is the students' first formal introduction to probability. Students recognize that the probability of any single event can be can be expressed in terms such as impossible, unlikely, likely, or certain or as a number between 0 and 1, inclusive, as illustrated on the number line below.  The closer the fraction is to 1, the greater the probability the event will occur. Larger numbers indicate greater likelihood. For example, if someone has 10 oranges and 3 apples, you have a greater likelihood of selecting an orange at random. Students also recognize that the sum of all possible outcomes is 1. <u>Example 1:</u> There are three choices of jellybeans – grape, cherry and orange. If the probability of getting a grape is $\frac{3}{10}$ and the probability of getting cherry is $\frac{1}{5}$, what is the probability of getting orange?

	Solution: The combined probabilities must equal 1. The combined probability of grape and cherry is $\frac{5}{10}$. The probability of orange must equal $\frac{5}{10}$ to get a total of 1. <u>Example 2:</u> The container below contains 2 gray, 1 white, and 4 black marbles. Without looking, if Eric chooses a marble from the container, will the probability be closer to 0 or to 1 that Eric will select a white marble? A gray marble? A black marble? Justify each of your predictions. *Solution:* White marble: Closer to 0 Gray marble: Closer to 0 Black marble: Closer to 1  Students can use simulations such as Marble Mania on AAAS or the Random Drawing Tool on NCTM's Illuminations to generate data and examine patterns. Marble Mania http://www.sciencenetlinks.com/interactives/marble/marblemania.html Random Drawing Tool - http://illuminations.nctm.org/activitydetail.aspx?id=67
7.SP.6 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** Students collect data from a probability experiment, recognizing that as the number of trials increase, the experimental probability approaches the theoretical probability. The focus of this standard is relative frequency -- The relative frequency is the observed number of successful events for a finite sample of trials. Relative frequency is the observed proportion of successful event, expressed as the value calculated by dividing the number of times an event occurs by the total number of times an experiment is carried out. <u>Example 1</u>: Suppose we toss a coin 50 times and have 27 heads and 23 tails. We define a head as a success. The relative frequency of heads is: $\frac{27}{50} = 54\%$ The probability of a head is 50%. The difference between the relative frequency of 54% and the probability of 50% is due to small sample size. The probability of an event can be thought of as its long-run relative frequency when the experiment is carried out many times.

	Students can collect data using physical objects or graphing calculator or web-based simulations. Students can perform experiments multiple times, pool data with other groups, or increase the number of trials in a simulation to look at the long-run relative frequencies. <u>Example 2:</u> Each group receives a bag that contains 4 green marbles, 6 red marbles, and 10 blue marbles. Each group performs 50 pulls, recording the color of marble drawn and replacing the marble into the bag before the next draw. Students compile their data as a group and then as a class. They summarize their data as experimental probabilities and make conjectures about theoretical probabilities (How many green draws would are expected if 1000 pulls are conducted? 10,000 pulls?). Students create another scenario with a different ratio of marbles in the bag and make a conjecture about the outcome of 50 marble pulls with replacement. (An example would be 3 green marbles, 6 blue marbles, 3 blue marbles.) Students try the experiment and compare their predictions to the experimental outcomes to continue to explore and refine conjectures about theoretical probability. <u>Example 3:</u> A bag contains 100 marbles, some red and some purple. Suppose a student, without looking, chooses a marble out of the bag, records the color, and then places that marble back in the bag. The student has recorded 9 red marbles and 11 purple marbles. Using these results, predict the number of red marbles in the bag. (Adapted from SREB publication *Getting Students Ready for Algebra I: What Middle Grades Students Need to Know and Be Able to Do)*
7.SP.7 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. 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*	**7.SP.7** Probabilities are useful for predicting what will happen over the long run. Using theoretical probability, students predict frequencies of outcomes. Students recognize an appropriate design to conduct an experiment with simple probability events, understanding that the experimental data give realistic estimates of the probability of an event but are affected by sample size. Students need multiple opportunities to perform probability experiments and compare these results to theoretical probabilities. Critical components of the experiment process are making predictions about the outcomes by applying the principles of theoretical probability, comparing the predictions to the outcomes of the experiments, and replicating the experiment to compare results. Experiments can be replicated by the same group or by compiling class data. Experiments can be conducted using various random generation devices including, but not limited to, bag pulls, spinners, number cubes, coin toss, and colored chips. Students can collect data using physical objects or graphing calculator or web-based simulations. Students can also develop models for geometric probability (i.e. a target).

girl will be selected. b. 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?*	<u>Example 1:</u> If Mary chooses a point in the square, what is the probability that it is not in the circle? *Solution:* The area of the square would be 12 x 12 or 144 units squared. The area of the circle would be 113.04 units squared. The probability that a point is not in the circle would be $\frac{30.96}{144}$ or 21.5%  <u>Example 2:</u> Jason is tossing a fair coin. He tosses the coin ten times and it lands on heads eight times. If Jason tosses the coin an eleventh time, what is the probability that it will land on heads? *Solution:* The probability would be $\frac{1}{2}$. The result of the eleventh toss does not depend on the previous results. <u>Example 3:</u> Devise an experiment using a coin to determine whether a baby is a boy or a girl. Conduct the experiment ten times to determine the gender of ten births. How could a number cube be used to simulate whether a baby is a girl or a boy or girl? <u>Example 4:</u> Conduct an experiment using a Styrofoam cup by tossing the cup and recording how it lands. • How many trials were conducted? • How many times did it land right side up? • How many times did it land upside down/ • How many times did it land on its side? • Determine the probability for each of the above results
7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Understand that, just as with simple events, the probability of a compound event is the fraction of	**7.SP.8** Students use tree diagrams, frequency tables, and organized lists, and simulations to determine the probability of compound events. <u>Example 1:</u> How many ways could the 3 students, Amy, Brenda, and Carla, come in 1st, 2nd and 3rd place?

outcomes in the sample space for which the compound event occurs. b. Represent 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. c. Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?	*Solution:* Making an organized list will identify that there are 6 ways for the students to win a race A, B, C A, C, B B, C, A B, A, C C, A, B C, B, A <u>Example 2:</u> Students conduct a bag pull experiment. A bag contains 5 marbles. There is one red marble, two blue marbles and two purple marbles. Students will draw one marble without replacement and then draw another. What is the sample space for this situation? Explain how the sample space was determined and how it is used to find the probability of drawing one blue marble followed by another blue marble. <u>Example 3:</u> A fair coin will be tossed three times. What is the probability that two heads and one tail in any order will results? (Adapted from SREB publication *Getting Students Ready for Algebra I: What Middle Grades Students Need to Know and Be Able to Do* *Solution:* HHT, HTH and THH so the probability would be $\frac{3}{8}$. <u>Example 4:</u> Show all possible arrangements of the letters in the word FRED using a tree diagram. If each of the letters is on a tile and drawn at random, what is the probability of drawing the letters F-R-E-D in that order? What is the probability that a “word” will have an F as the first letter?  *Solution:* There are 24 possible arrangements (4 choices • 3 choices • 2 choices • 1 choice) The probability of drawing F-R-E-D in that order is $\frac{1}{24}$. The probability that a “word” will have an F as the first letter is $\frac{6}{24}$ or $\frac{1}{4}$.

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