Create an organization that prizes the development of ability - and watch the leaders emerge.

Dr. Carol Dweck, Mindset: The New Psychology of Success

4 Districtwide Goals for Mathematics

Goal 1: Establish mathematics goals to focus learning

Teachers develop and communicate clear learning goals and how these ideas build on and relate to each other.

- Goals promote enduring understandings/transfer goals
- Goals aligned to the pacing of the grade level curriculum
- Goals aligned to the skill gaps that may or may not be grade-level aligned

Determine how individual student and/or group goals can be communicated weekly.

Goal 2: Carefully select tasks that promote reasoning and problem solving to engage students in higher level thinking

- Illustrative Mathematics
- PARCC Practice & Released Items
- Authentic Assessments from the district
- Problem Solving Resources in the Mathematics Handbook

Goal 3: Encourage the use of visual representation

- To advance understanding of a concept
- To make sense of problems
- To engage in discourse

Goal 4: Use evidence of student thinking

- To assess progress
- To identify gaps and misconceptions
- To adjust instruction

Note: Evidence collection can be done through online submission as well as traditional paper options.

Mr. Ronald Lee…… Superintendent of Schools

Dr. Paula Howard…… Deputy Superintendent of Schools

Dr. Terri Russo……. Director of Curriculum, Instruction, Professional Development, Data and Assessment

Ms. Karen Harris…….... Director of English Language Arts and Testing

Ms. Shelly Harper…… Director of Special Services

Dr. Tina Powell…… Director of Mathematics and Science

Mathematics Support

Ms. Meng Li Chi Liu
Supervisor of Mathematics, Grades 9-12

Mr. Daniel Ramirez
Supervisor of Mathematics, Grades 6-8

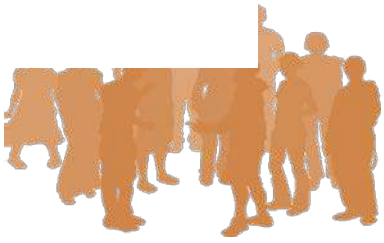
Ms. Asale Harris
Supervisor of Mathematics, Grades 3-5

Ms. Antoinette Booker
Supervisor of Mathematics, Grades K-2

Ms. Farjana Rahman
Mathematics Teacher Coach, Grades 9-12

Ms. Belinda Koloska
Mathematics Teacher Coach, Grades 6-8

Ms. Min Kim
Mathematics Teacher Coach, Grades 3-5



The Math Department functions to provide the students it serves with a mathematical 'lens', allowing them to better access the world with improved decisiveness, precision, and dexterity; facilities attained as students develop a broad and deep understanding of mathematical content. Achieving this goal defines our work - ensuring that students are exposed to excellence via a rigorous, standards-driven mathematics curricula, knowledgeable and effective teachers, and policies that enhance and support learning. To best serve the students of the Orange Public School system, we work to provide the district with research-based (1) school support, (2) curriculum frameworks, standards, and alignment tools, (4) professional development and coaching, (5) assessment systems, (6) intervention strategies, and (7) enrichment options.

Curriculum

The Grades K-8 mathematics curriculum was redesigned to strengthen students' procedural skills and fluency while developing the foundational skills of mathematical reasoning and problem solving that are crucial to success in high school mathematics. Our curriculum maps are Unit Plans that are in alignment with the Common Core State Standards for Mathematics. The curriculum guides for all high school math courses provide the scope and sequence and pacing suggestions to guide teachers instructional planning. The curricula of Algebra I, Geometry, and Algebra II are based on NJ Model Curriculum and fully aligned to Common Core State Standards. The Precalculus course is also aligned to Common Core State Standards and includes an in-depth study of algebra, while combining reviews of geometry, and functions into a preparatory course for calculus. The other two mathematics courses, Statistics, and AB/BC Calculus are aligned to Advanced Placement Test course standards.

Data-informed Instruction

Data is used, consistently and meaningfully, to track student progress and to assist teachers in making data-driven instructional decisions. The district collects data generated from diagnostic, formative, summative, and authentic assessments; thereby encouraging the understanding of assessment as a continuous thread of instructional practice, rather than a series of isolated events.

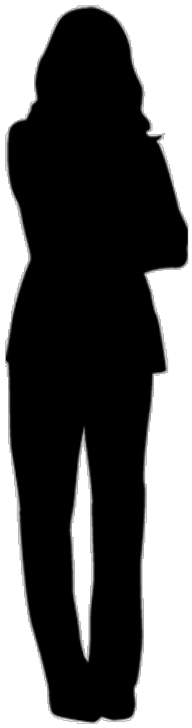
Professional Development

Professional development for all math teachers is provided through regular visits to classrooms; providing teachers with job-embedded support and individual coaching from a team of math supervisors and teacher coaches. District professional development days, institutes, and department meetings provide opportunities for teachers to gain additional mathematics content knowledge and instructional strategies. District professional development days address topics relating to the Common Core State Standards (CCSS), the PARCC assessment, mathematical reasoning, data analysis, and the Student Growth Objectives.

Purpose of this Handbook

Research tells us that teacher knowledge is one of the biggest influences on classroom atmosphere and student achievement (Fennema & Franke, 1992). This is because of the daily tasks of teachers, interpreting someone else's work, representing and forging links between ideas in multiple forms, developing alternative explanations, and choosing usable definitions. (Ball, 2003; Ball, et al., 2005; Hill & Ball, 2009). As such, this handbook was intentionally developed to facilitate the daily work of our teachers; providing the tools necessary for the alignment between curriculum, instruction, and assessment. This document helps to (1) communicate the shifts (explicit and implicit) in the Common Core State Standards for elementary and secondary mathematics (2) set course expectations for each of our courses of study and (3) encourage teaching practices that promote student achievement.

Teachers who are **Mathematically Knowledgeable** are able to…



Set goals and provide feedback

Generate and test hypotheses

Activate prior knowledge using cues, questions, and advance organizers, previews of what they are about to learn or experience thus helping to activate students' prior knowledge.

Select and make good use of assignments

Manage discussions and important ideas

Provide students with examples of concepts, algorithms, and proofs

Make accurate use of representations

Judge and correct textbook treatments of topics

Explain terms and concepts to students-interpreting students' statements and solutions

Build a bridge between everyday and mathematical language

Have a clear understanding of the structures underlying mathematics

Are able to "hear" students' methods

Perceive the common errors that students tend to make

[Ask] "How can I teach them?" not "Can I teach them?" and "How will they learn best?" not "Can they learn?"

Dr. Carol Dweck, Mindset: The New Psychology of Success

Table of Contents

NON NEGOTIABLES	9
APPROVED CURRICULUM RESOURCES	12
LOOK FOR'S	17
5 COMPONENTS	20
THE IDEAL MATH BLOCK	23
ASSESSMENT REQUIREMENTS	32
COMMON CORE WEB-BASED RESOURCES	42
DISTRICT-WIDE ASSESSMENT STRUCTURE	47
COMMON CORE STATE STANDARDS	48
MATH PRACTICE STANDARDS	62
APPROPRIATE NUMBER SYSTEMS	67
COURSE PROFICIENCIES (KINDERGARTEN-HIGH SCHOOL)	78
STUDENT GROWTH OBJECTIVES	116
THE SMART OBJECTIVE	123
THE MATH NOTEBOOK	124
THE MATH PORTFOLIO GUIDELINES	125
UNDERSTANDING THE PARCC	129
APPENDIX	137

NON-NEGOTIABLES

MATH

Core Non-Negotiables for K – 12 Mathematics

The list below outlines district expectations regarding the district's Mathematics programs in grades K-12. The items are the focus of the school year and define the areas of focus of district- and school-level walk-throughs.

1. **District-approved and adopted programs** (e.g. Math in Focus, Go Math, Connected Math, Carnegie Learning, etc.) are to be used as the primary instructional supports; making use of all essential components.
2. Teachers are to follow the district-approved **Curriculum/Unit Plans** for their respective grade level(s). Teachers, as much as possible, should stay "on grade level" – using their understanding of students' "entry points" and readiness to appropriately scaffold instruction. *See* http://www.orange.k12.nj.us/domain/26
3. **Fluency practice** must be included at the start of each lesson either prior to or immediately following the "Do Now".
4. **Do Now's** and **Homework Checks** should be limited time to 7 – 10 minutes.
5. Every core lesson should begin with a **pre-planned Introductory Task** that serves as the starting point/launch for the referenced standard/objective and should be *diagnostic, prerequisite* or *anticipatory* in nature.
6. Teacher-generated tasks must be AVOIDED; Teachers should use tasks from the **district's approved Web Resource List** (See *Common Core-Aligned Web-based Resources*).
7. Instruction should be anchored around carefully "selected" (not teacher-made) **problems** and **tasks**. Balance instruction with 40% routine tasks that serve as reinforcement of concepts and 60% non-routine tasks serving as a new and non-routine context. Non-routine tasks generally require more than one-step and usually require students to derive intermediate values before arriving at a final solution. Problems of this type encourage student discourse.
8. Daily objectives must be anchored in the **Common Core State Standards**; carefully unpacking the standard to ensure that the objective/activity reflects the meaning, depth, and breadth of the standard.
9. **Conceptual Development** should occur "before" the procedural skill is addressed. Concepts should ALWAYS be introduced via a concrete or pictorial representation. Students demonstrate *conceptual understanding* in mathematics when they provide evidence that they can recognize, label, and generate examples of concepts; use and interrelate models, diagrams, manipulatives, and varied representations of concepts; identify and apply principles; know and apply facts and definitions; compare, contrast, and integrate related concepts and principles; recognize, interpret, and apply the signs, symbols, and terms used to represent concepts. *Conceptual understanding* reflects a student's ability to reason in settings involving the careful application of concept definitions, relations, or representations of either. Conceptual tasks *generally*
    - Have thin or no context
    - All necessary computational skill should be fairly low
    - Embed a concept central to the task
    - Should be easy to solve if the student understands the concept

10. Physical Board Plans (e. g. Date, **Objective**, **written CCSS** beyond the notation, **Do Now**, **Introductory Task**, **key academic vocabulary** for the day, **journal question**, **DOL**, etc.) should be set up before students enter the classroom. A demonstration of learning MUST accompany every objective.

11. **Whole Group** instruction should be evident – serving the purpose of (1) identifying and treating potential misconceptions (initial part of the lesson); (2) summarizing individual work and solidifying understandings (3) completion of the Demonstration of Learning (end of lesson)

12. **Small, collaborative groupings** should be evident - When using **small groups** for mathematics instruction, teachers should:

    - Choose tasks that deal with important mathematical concepts and ideas;
    - Select tasks that are appropriate for group work;
    - Consider having students initially work individually on a task and then follow this with group work where students share and build on their individual ideas and work;
    - Give clear instructions to the groups and set clear expectations for each;
    - Emphasize both group goals and individual accountability;
    - Choose tasks that students find interesting;
    - Ensure that there is closure to the group work, where key ideas and methods are brought to the surface either by the teacher or the students, or both.
    - Identify group(s) that will work with the teacher during this time.

13. **Independent Practice** should be evident – During this time, students are provided with multiple opportunities and formats to apply a newly acquired skill or strategy on their own. Through independent practice, students continue to review and practice the skills and strategies learned. Independent practice is characterized by **students**…
    - Working independently
    - Using visual models[1] to explain their thinking
    - Justify their answers[1]
    - Using academic language in their explanations[1]
    - Using precision in their written explanations[1]
    - clear definitions, specified units of measure , clearly labeled quantities[1]

14. All students must use a notebook identified as the **MATH NOTEBOOK**.

15. **Classroom Artifacts** should promote the teaching and learning of mathematics. This includes, but is not limited to progressive **Word/Vocabulary Walls**, posted current **student work exemplars**, **Anchor Charts** that convey Big Ideas, Mathematical Goals, Problem Solving Goals, Mathematical Practices, and Memory Walls of interrelated concepts.

16. **Calculator Use**: Students primarily need to interact with a 5-function calculator in grades 6/7, a scientific calculator in grade 8, and a graphing calculator in High School.

17. **Assessment Portfolios** are to be maintained in every K – 12 Mathematics class. *See pages 121-124.*

[1] During Independent Practice, the teacher should encourage students to communicate their thought processes and explanations, express their answers in complete sentences, and find multiple methods for problem solving.

Great teachers believe in the growth of the intellect and talent, and they are fascinated with the process of learning.

Dr. Carol Dweck, Mindset: The New Psychology of Success

APPROVED CURRICULUM RESOURCES

MATH

Curriculum (K-5)

MATH IN FOCUS v. 2015
(HOUGHTON MIFFLIN HARCOURT)

GRADE	TEACHER RESOURCES	STUDENT RESOURCES
K (v. 2013)	• **Teacher Edition (A & B)** • Implementation Guide • Assessment Package • Enrichment Bundle • Extra Practice Set • Teacher and Student Activity Cards • Home -to- School Connection Book • Online Teacher Technology Kit • Big Book Set • Online Interactive Whiteboard Lessons	• Student Edition A – Pt. 1 • Student Edition A – Pt. 2 • Student Edition B – Pt. 1 • Student Edition B – Pt. 2 • Online Student Technology Kit
1	• **Teacher Edition (A & B)** • Implementation Guide • Assessment Package • Enrichment Bundle • Extra Practice Guide • Reteaching Guide • Home -to- School Connection Book • Online Teacher Technology Kit • Fact Fluency • Online Interactive Whiteboard Lessons	• Student Texts (A & B) • Student Workbooks • Online Student Technology Kit • Student Interactivities
2-5	• **Teacher Edition (A & B)** • Implementation Guide • Assessment Package • Enrichment Bundle • Extra Practice Guide • Transition Guides • Reteaching Guide • Home -to- School Connection Book • Online Teacher Technology Kit • Fact Fluency • Online Interactive Whiteboard Lessons	• Student Texts (A & B) • Student Workbooks • Online Student Technology Kit • Student Interactivities

Curriculum (6-8)

CONNECTED MATHEMATICS PROJECT 3
(PEARSON)

MATH IN FOCUS V. 2013
(HOUGHTON MIFFLIN HARCOURT)

GRADE	TEACHER RESOURCES	STUDENT RESOURCES
6	• **Teacher Edition (A & B)** • Implementation Guide • Assessment Package • Enrichment Bundle • Extra Practice Guide • Transition Guides • Reteaching Guide • Solution Key • Online Technology Kit • Teacher One-Stop CD-ROM • Exam View Assessment Generator • Online Interactive White Board Lessons	• Student Texts (A & B) • Online Student Technology Kit • Student Interactivities
7	• **Teacher Edition (A & B)** • Implementation Guide • Assessment Package • Enrichment Bundle • Extra Practice Guide • Transition Guides • Reteaching Guide • Solution Key • Online Technology Kit • Teacher One-Stop CD-ROM • Exam View Assessment Generator • Online Interactive White Board Lessons	• Student Texts (A & B) • Online Student Technology Kit • Student Interactivities
8	• **CMP3: Butterflies, Pinwheels, and Wallpaper** • **CMP3: Growing, Growing, Growing** • **CMP3: Thinking with Mathematical Models** • **CMP3: Say it with Symbols** • **CMP3: It's in the System** • **CMP3: Looking for Pythagoras** • Special Needs Handbook • Additional Practice and Skills Workbook Teachers Guide • Assessment Resources • Teaching Transparencies	• CMP3: Butterflies, Pinwheels, and Wallpaper • CMP3: Growing, Growing, Growing • CMP3: Thinking with Mathematical Models • CMP3: Say it with Symbols • CMP3: It's in the System • CMP3: Looking for Pythagoras

Curriculum (High School)

VARIOUS PUBLISHERS

SUBJECT	TEACHER RESOURCES	STUDENT RESOURCES
Algebra	**Carnegie (Algebra I Common Core)** • Teacher's Assessments • Teacher's Assignment • Teacher's Implementation Guide • Warm-ups & CFUS • Access code for website Resource Center Agile Mid (Intensive Algebra I) • Teacher Online Resource (http://orange.agilemind.com) • Agile Mind Assessment	**Carnegie (Algebra I Common Core)** • Students Textbook set • Carnegie Tutorial license for each student Agile Mind (Intensive Algebra I) • Student Workbook Set • Agile Mind Digital Access (http://orange.agilemind.com)
Geometry	**Agile Mind (Common Core Geometry)** • Teacher Online Resource • Agile Mind Assessment	**Agile Mind (Common Core Geometry)** • Student Workbook Set • Agile Mind Digital Access
Algebra II	**Agile Mind (Common Core Algebra II)** • Teacher Online Resource • Agile Mind Assessment	**Pe Agile Mind (Common Core Algebra II)** • Student Workbook Set • Agile Mind Digital Access
Pre-Calculus	**Larson and Hostetler, Pre-Calculus** • Teachers Edition	**Larson and Hostetler, Pre-Calculus** • Student Edition
AP Calculus	**Prentice Hall (Calculus 10th Edition)** • Teacher's Edition	**Prentice Hall (Calculus 10th Edition)** • Student Edition
Statistics	**Prentice (Elementary Statistics)** • Teacher's Edition	**Prentice Hall (Calculus 10th Edition)** • Student Edition

LOOK FORS IN THE CCSSM CLASSROOM

Look-For's in the Common Core Mathematics Classroom

The Classroom Environment reflects…

- Easy access to student learning tools (manipulatives, number lines, etc.)
- Vocabulary support (math "word wall"/vocabulary lists)
- Summary statements, evidence of solutions and conclusions
- Whole group, direct instruction and questioning
- Guided instruction (sometimes groups with differentiation)
- Independent practice
- Closure, summary of key mathematical ideas
- Ample student work that includes revisions especially *revised* explanations and justifications, and reflections
- Limited use of calculators in the elementary grades and strategic use in the middle and secondary grades such to develop conceptual understanding, procedural fluency, and fact fluency

The Teacher is…

- Predicting patterns of error
- Connecting visual representations (concrete manipulatives to visual models; visual models to abstract notation)
- Using pretest and other formative assessments cycles to provide appropriate instruction
- Helping students use visual models to explain their thinking
- Asking questions that prompt higher-level thinking
- Asking students to justify their answers
- Prompting students to use academic language in their explanations and discussions
- Encouraging students for precision in their written explanations
    - Use of clear definitions in their reasoning
    - Appropriately stating the meaning of the symbols they choose
    - Specifying units of measure
    - Labeling to clarify quantities in a solution

The Students are…

- Able to identify what they are learning and how they are doing
- Using manipulatives and other tools to appropriate solve problems
- Recording their work in their booklets/notebooks
- Sharing strategies, including mental math and problem-solving methods
- Working on tasks with others, as well as working independently
- Talking about each other's thinking

The Unit/Lesson Plans reflect…

- Reference to the CCSS **Content Standards**
- Connection to the CCSS **Mathematical Practice Standards**
- **Essential Questions** (The Big Picture Question)
- Evidence of **Backwards Planning** from a complex task
- **Planned Objectives**
- Planned & Timed **Sequence**
- **Resources/ Materials**
- Address of **Academic Vocabulary**
- Planned **Focus Questions**
- Check for **Prior Knowledge**
- **Launch/Introductory Activity**
- **Connections:** An answer to the question, *"Why Do I Need To Learn This?"*
- Evidence of **Multiple Representations** of a concept or skill
- Evidence that the lesson supports a **Gradual Release** of Responsibility (Whole Group → Collaborative → Independent)
- Multiple and Frequent **Checks for Understanding**
- Address of potential **Misconceptions**
- **Reflective Questions**
- **Homework**
- **Modifications**
- **Assessments**
- **Concrete /Pictorial Model** for Examples
- Appropriate and Enriching use of **Tools / Technologies**
- Development of a **Conceptual Understanding, a Procedural Skill & Fluency, or Application**

What does all this talk of mindsets have to do with modern education? The mindsets cut right to the core of why we teach (hopefully). Educators must truly believe that EVERY child can be successful through the right combination of hard work and good instruction.

We are all about fulfilling potential – our students', our schools, our community's, and our own potential.

Dr. Carol Dweck, Mindset: The New Psychology of Success

THE

5 COMPONENTS

5 components of our Mathematics Programs

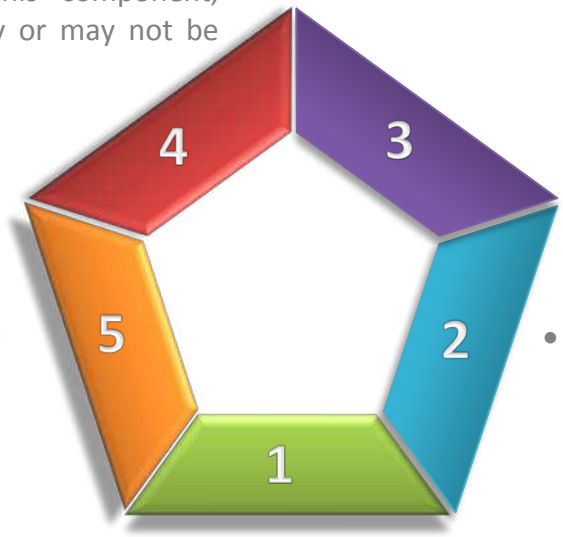
While not mutually exclusive, these components serve to help students develop a broad and deep understanding of mathematical content.

4. 21st Century Learning

- Generally accomplished in a rotation model, this component, via a technology-enhanced environment allows students to work either collaboratively or independently and in their own time, place, path, and pace; and serves the purpose of prevention, remediation, practice, enrichment, problem based learning, or game play. Within this component, content, while supporting the CCSS-M, may or may not be fully aligned to the CCSS-M for that grade.

3. Intervention

- Provides a formal and daily structure to repair deficits and prevent future deficits. Within this component, instruction, while supporting the CCSS-M, may or may not be fully aligned to the CCSS-M for that grade.



5. Home Connections

- Improved home access to core and supplemental programs and 21st century learning.

2. Supplemental Reinforcements

- Includes content, beyond the core program, that either promotes fluency, reinforced CCSS-M alignment, or ensures the progression of concepts (within a grade and between grades)

1. Core Program

- Emphasizes Concept vs. Activity
- Emphasizes the Mathematical Practices
- Emphasizes the underlying structures of Place Value, Properties of Operations, Scale, Equal Partitioning, precise terminology, etc.
- Emphasizes fluency as flexible thinking and deriving vs. memorizing
- Emphasizes careful selection of representations
- Emphasizes the balance of instruction, application, and assessment

MATH

There's a lot of intelligence out there being wasted by underestimating students' potential to develop.

Dr. Carol Dweck, Mindset: The New Psychology of Success

MATH

THE

IDEAL MATH BLOCK

Kindergarten Ideal Math Block

Essential Components

FLUENCY: Small Group

5-10 min.

CONCRETE, PICTORIAL, and **ABSTRACT** approaches to support **ARITHMETIC FLUENCY** and **FLUENT USE OF STRATEGIES.**

GETTING READY: Whole Group

5-10 min.

Morning Routine
Do Now; Homework Review;

INVESTIGATE: Whole Group

Children are invited to sing, clap, rhyme, and discuss colorful, playful scenes presented in the **BIG BOOK** while the teacher **SYSTEMATICALLY EMPLOYS** and **ELICITS** related **MATH TALK**.

DISCOVER: Whole Group

Provides **HANDS-ON** work to allow children to **ACT OUT** or **ENGAGE ACTIVELY** with the new **MATH IDEA**.

50-60 min.

EXPLORE: Partner / Small Group

REINFORCES and **ENHANCES** concepts as **CHILDREN** go one step further with the concept.

APPLY: Individual: Differentiation

Opportunity to work **INDEPENDENTLY** to **PRACTICE CONCEPT** using MIF Re-Teach, Practice, Extra Practice, and/or Enrichment.

SUMMARY: Whole Group

Lesson Closure: Student Reflection;
Real Life Connections to Concept

CENTERS/STATIONS: Individual /Partners/ Small Group

15-20 min.

DIFFERENTIATED activities designed to **RETEACH, REMEDIATE, ENRICH** student's understanding of concepts.

Small Group Instruction	Technology Lab	Problem Solving	Fluency Lab	Math Journal

1st and 2nd Grade Ideal Math Block

Essential Components

FLUENCY: Partner/Small Group

CONCRETE, PICTORIAL, and **ABSTRACT** approaches to support **ARITHMETIC FLUENCY** and **FLUENT USE OF STRATEGIES.**

LAUNCH: Whole Group

Anchor Task: Math In Focus Learn

EXPLORATION: Partner / Small Group

Math In Focus Hands-On, Guided Practice, Let's Explore

INDEPENDENT PRACTICE: Individual

Math In Focus Let's Practice, Workbook, Reteach, Extra Practice, Enrichment

SUMMARY: Whole Group

Lesson Closure: Student Reflection; Real Life Connections to Concept

EXIT TICKET (DOL): Individual

Students complete independently; Used to guide instructional decisions; Used to set instructional goals for students;

MATH WORKSTATIONS: Pairs / Small Group/ Individual

DIFFERENTIATED activities designed to **RETEACH, REMEDIATE, ENRICH** student's understanding of concepts.

Small Group Instructi	Technology Lab	Problem Solving Lab	Fluency Lab	Math Journal Lab

Ideal 90-min Math Block (Gr. 3-7)

FLUENCY PRACTICE

- Part of the daily Morning Routine
- Whole Group
- e.g. Calendar Counts 3-5, FIRST In Math, program-embedded practice

GETTING READY

- Do Now
- Homework Review
- Morning Routine

LAUNCHING THE LESSON (Whole Group)

- **Task:** Anchor Task (Learn)
- Teacher led
- Few parts of the task are explicitly shown and the majority addresses through constructivist approach and questioning.
- Teacher facilitates; Students find the solution

STUDENT EXPLORATION (Small Group)

- **Task:** Hands-on, Game-based Activity, Guided Practice, Let's Explore (MIF)
- Partner/Small Group Work
- Homogenous ability grouping; Teacher spends the majority of time w/struggling learning groups and sometimes w/ on-level groups, and little time with advanced learning groups

INDEPENDENT PRACTICE (Individual)

- **Task:** Let's Practice (MIF); Workbook (MIF)
- Each student works independently
- Used as formative assessment
- Workbook is used to continue independent practice
- Homework: Select problems from Workbook, Extra Practice, or Reteach based on Let's Practice results.

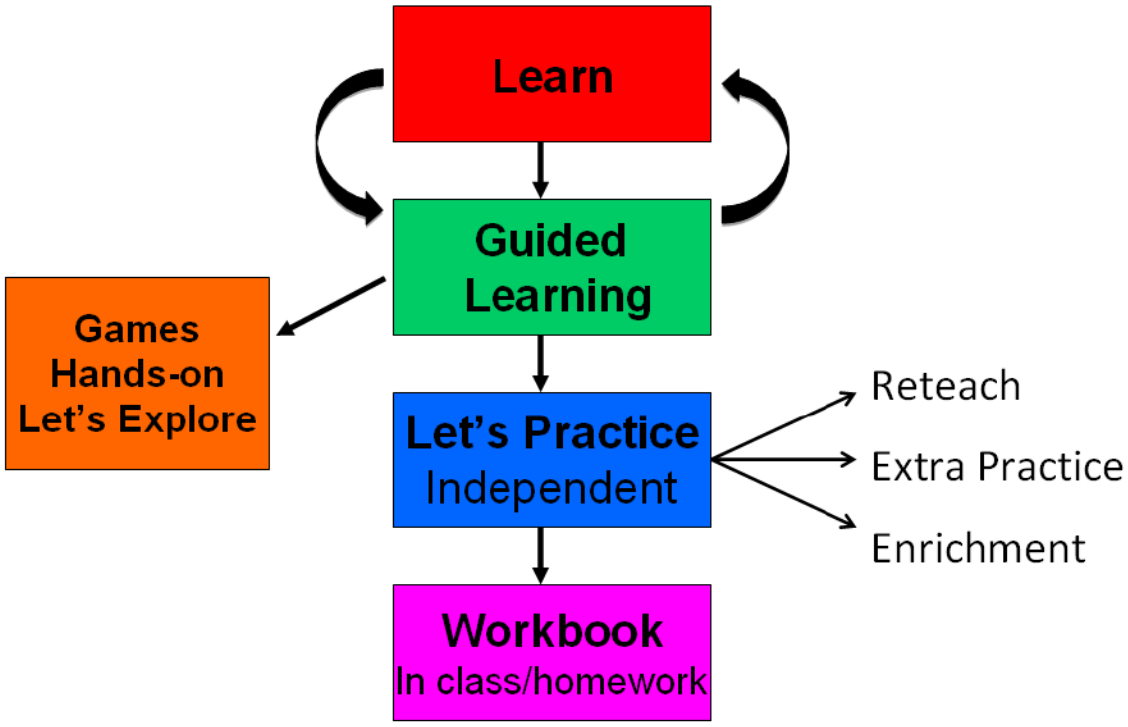
SUMMARY (Whole Group)

- Connection to concept
- Student Reflection

DOL (Demonstration of Learning)

- Exit Ticket

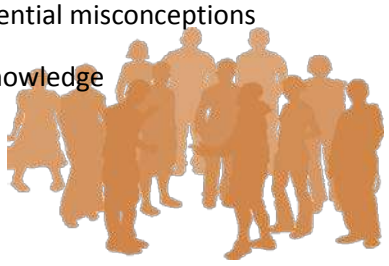
Lesson Structure (Grades 3-7)



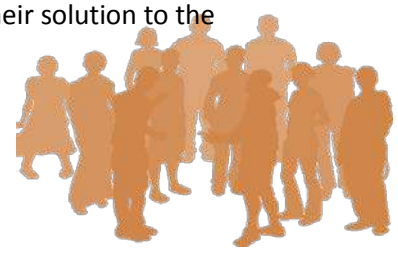
MATH

Ideal 90-min Math Block (Grade 8)

Activity Description	Time	What the plan should reflect…
FLUENCY PRACTICE	**3-5 minutes**	Part of the daily Morning Routine Whole Group e.g. FIRST In Math, program-embedded practice
Do Now and Debrief	**7 minutes**	The actual task or problem What the teacher is looking for and listening for during the debrief conversation or student demonstration Extension problems or additional problems for early finishers Teacher Actions ("I will identify students who have incorrectly solved the problem and pair them with a student who has correctly solved the problem," "I will circulate to identify students who can demonstrate the solution at the SmartBoard")
Selected Homework Review	**7 minutes**	A few select homework problems will be reviewed Description of the debrief ("selected students will demonstrate…") Extension problem to review the concept
Launch of New Material	**7 minutes**	What the teacher is looking for and listening for during the conversation Informal assessment of prior knowledge ("Raise your hand if you have ever heard of the GCF?", "Turn and talk to your partner, what is the GCF of 6 and 50? Be prepared to share.") Probing questions to prompt students to today's lesson concepts
Student Exploration	**20 minutes**	Teacher Actions ("I will initially work with the struggling group to get them started and then I will spend no more than 3 minutes with each group in a regular rotation") What the teacher is looking for and listening for in student conversations Extension problems or additional problems for early finishers Questioning methods in response to potential misconceptions Questioning methods for extension of knowledge



Debrief of Exploration	**20 minutes**	Teacher Actions ("I will be facilitating from the back of the room, gradually calling up student volunteers or pre-selected groups to demonstrate.") Student Actions ("Students will be focused on the front of the room will track the speaker and will be prepared to demonstrate portions of today's class work.") Potential questions in response to each portion of the exploration Questioning methods in response to misconceptions Questioning methods for extension of knowledge
Independent Practice and Debrief	**10 minutes**	Summarization of activity Selected problem(s) from text ("ACE") Teacher Actions ("I will begin working individually with struggling learners and then will circulate the room and give individual feedback") Student Actions ("Students will work independently and silently unless I have given them a specific peer tutor to pair up with.") What the teacher is looking for and listening for during the debrief conversation or student demonstration Description of the debrief process ("Students will volunteer to demonstrate their solutions and as class students will question their peer.")
Summarization of Today's Skills	**5 minutes**	Teacher Actions ("I will demonstrate today's skill with one example problem," "I will select a strong student to demonstrate the skill on the board," "I will select a student to verbally state today's concepts and will use talk moves among the students to create a concise explanation for an anchor chart.")
Exit Ticket/Demonstration of Learning, Distribution of Homework	**5 minutes**	Student Actions ("Students will take notes on the concept …") Actual problem ("ACE", CMP) Description of how the DOL will be relayed back to students ("Students will be given the problem back at the start of tomorrow's class," "Students will add their solution to the Twitter wall.")



Ideal 82-min Math Block (High School)

1) **FLUENCY PRACTICE**
    a. Part of the daily Morning Routine
    b. Whole Group
    c. e.g. program-embedded practice; differentiated

2) **Do Now (7-10 min)**
    a. Serves as a review from last class or of prerequisite material
    b. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

3) **Starter/launch (5 min)**
    a. Designed to introduce the lesson
    b. Uses concrete or pictorial examples
    c. Attempts to bridge the gap between grade level deficits and rigorous, on grade level content
    d. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

4) **Mini-Lesson (15-20 min)**
    a. Design varies based on content
    b. May include an investigative approach, direct instruction approach, whole class discussion led approach, etc.
    c. Includes CFU's
    d. Anticipates misconceptions and addresses common mistakes

5) **Class Activity (25-30 min)**
    a. Design varies based on content
    b. May include partner work, group work/project, experiments, investigations, game-based activities, etc.

6) **Independent practice (7-10 min)**
    a. Provides students an opportunity to work/think independently

7) **Closure (5-10 min)**
    a. Connects lesson/activities to big ideas
    b. Allows students to reflect and summarize what they have learned
    c. May occur after the activity or independent practice depending on the content and objective

8) **DOL (5 min)**
    a. Exit slip

What any person in the world can learn, almost all persons can learn, if provided with the appropriate prior and current conditions of learning. Remember, test scores and measures of achievement tell you where a student is, but they don't tell you where a student could end up.

Dr. Carol Dweck, Mindset: The New Psychology of Success

ASSESSMENT REQUIREMENTS

MATH

District Assessments

Diagnostic Assessments (K - 12)

- Assessment of readiness preceding the unit of study and found in the MIF, CMP3, HS programs, or district approved curriculum unit plans
- Used September - June
- Results inform the daily Do Now, Mini Lesson, etc.
- Graded/scored and included in Genesis; Entered as a TEST (weight "zero")

Checks for Understanding / Check Points (K - 12)

- Small assessments found in the MIF, CMP3, and HS programs (ExamView-generated, Problem of the Lesson, CheckUps, Extra Practice Wkbk)
- Used September - June
- Graded/Scored and included in Genesis; Entered as a **Quiz** grade (20%)

Chapter or Unit Assessments (K - 12)

- (Grades K – 2)** Summative, assessing multiple standards/skills; Interview-format w/anecdotal documentation and included in Portfolios
- (Grades 3 – 12) Longer, more summative, assessing multiple standards/skills; 'mini' unit assessments are included in this section
- September - March 25 (Grades 3 – 12; District generated; tracker-aligned); (Grades K – 2; District generated; rubric-scored)
- April – June (Developed using program components in conjunction with item banks provided in the unit plans)
- The latter will be co-developed by grade level teachers during the CPTs
- Graded/Scored and included in Genesis; Entered as a **Test** grade (25%)

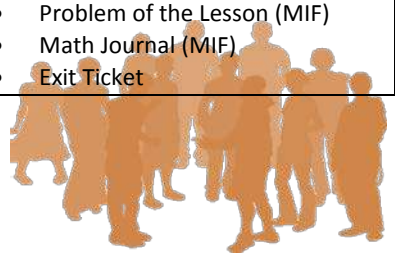
Portfolio Assessments (K - 12)

- September – March 25 -- Aligned to SGO focus and rubric scored
- Approximately 1 – 2 tasks per month aligned to either SGO #1 or SGO #2
- Tasks reflective of "taught" content ; September task reflects prior year content
- All tasks are "practice forward" (Closely aligned to the Standards for Mathematical Practice)
- Tasks will be labeled as "Individual", "Partner/Group", "Individual w/Opportunity for Student Interviews"
- 4 Additional tasks will be included in Student Reflection and will be labeled as such
- Certain interview tasks will embed a technology-integrated component to allow teachers to ascertain students' comfort in using the tools of technology as well as the content
- April – June -- Tasks shift from SGO focus to the In-depth Opportunities for each grade
- All student work in folders is attached to a completed rubric
- Graded/Scored and included in Genesis; Entered as an **Authentic Assessment** grade (25%)

MATH

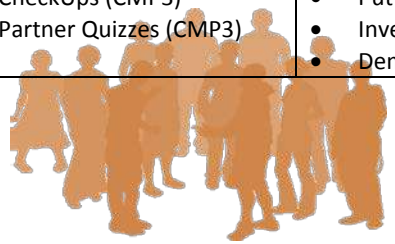
Elementary School Math Grading (Grades 1-2)

	Summative Assessments: Assessment of Learning		**Formative Assessment: Assessment for Learning**		
Definition/What do they measure?	Tests and projects that evaluate students' learning once the instructional period is complete; these assessments are infrequent, generally occurring at the end of a unit or grading period.		Helps students demonstrate their current understanding; Formative assessments occur frequently.		
How are they generated?	Based upon clear, consistent, and explicit expectations (**Learning Outcomes**) across grade levels.		Teachers work together, plan together, know the outcomes in advance, and engage in backward planning for activities and experiences and calibrate grading. **Learning Outcomes** are shared with students at the beginning of the course of study, quarter, or the start of the unit.		
Examples	Tests and Structured Extra Credit	Authentic Assessments	Quizzes	Classwork	Homework
Impact	**3 Test's per MP + Diagnostic(s)** # Program-supported and teacher-generated Traditional scoring After a Diagnostic, Chapter or Benchmark Assessment is issued; teachers should immediately address deficiencies in a structured 1-2 day plan of relearning.	**2 Authentic's per MP** 2 Program-supported and teacher-generated Standards-based rubric scoring and assesses multiple standards SGO-aligned Note: Gives teachers scoring practice and use in using the PLD rubric	**3 Quizzes per MP** 3 Program-supported and/or teacher-generated Traditional and/or Standards-based rubric scoring Replacement can occur here Retakes should at times be more demanding and in a different format Entered in Genesis: Quiz1_Adding w/in 100 **10 Classwork's per MP** 10 Program-supported and/or teacher-generated assignments Standards/Practice-based Rubric Scoring Entered in Genesis: Classwork 1: Part-to-whole ratios **9-15 Homework's per MP** All teacher-generated Scoring is based on teacher-discretion No retakes in the last week of the marking period to protect data management. Grades are to be entered one week prior to the end of the MP.		
Assignment Examples	**Tests** • Test Prep(s) (Math in Focus) • Benchmark Assessment (Math in Focus) • Teacher-generated tests	**Authentic Assessments** • "Extended Response" (Math in Focus) • "Put on Your Thinking Cap" (Math in Focus) • Math Projects Illustrative Math Tasks • See the Math Handbook pgs. 23-24	**Quizzes** • ExamView Tests • Extra Practice Wkbk (MIF) • Do Now/5-minute Warm Up (MIF) • Problem of the Lesson (MIF) • Math Journal (MIF) • Exit Ticket	**Classwork - Captured during** • Guided Learning (MIF) • Partner Work • Problem of the Lesson (MIF) • Workbook pages (MIF) • Reteach pages (MIF) • Extra Practice pages (MIF) • Enrichment pages (MIF)	



Elementary School Math Grading (Grades 3 – 8)

	Summative Assessments: Assessment of Learning		Formative Assessment: Assessment for Learning		
Definition/What do they measure?	Tests and projects that evaluate students' learning once the instructional period is complete; these assessments are infrequent, generally occurring at the end of a unit or grading period.		Helps students demonstrate their current understanding; Formative assessments occur frequently.		
How are they generated?	Based upon clear, consistent, and explicit expectations (**Learning Outcomes**) across grade levels.		Teachers work together, plan together, know the outcomes in advance, and engage in backward planning for activities and experiences and calibrate grading. **Learning Outcomes** are shared with students at the beginning of the course of study, quarter, or the start of the unit.		
Examples	Tests and Structured Extra Credit	Authentic Assessments	Quizzes	Classwork	Homework
Impact	**3 Test's per MP + Diagnostic(s)** 1 district + 2 teacher-generated Traditional scoring No replacement for the Unit Assessment; "Retakes" occurs as awarding extra credit points. Extra-credit assignments/Unit Retake Assessment(s) should be standards-based, teacher/team-developed allowing failure to be fully recoverable, and are assigned at the teacher's discretion. Unit Assessments will be issued no fewer than 2 weeks before the end of the MP. After a Diagnostic or Unit Assessment is issued, teachers should immediately address deficiencies in a structured 1-2 day plan of relearning.	**4 Authentic's per MP** 3 district + 1 teacher-generated Standards-based rubric scoring and assesses multiple standards SGO-aligned No replacement Note: Gives teachers scoring practice and use in using the PLD rubric	**6 Quizzes per MP** 6 depart-generated Traditional and/or Standards-based rubric scoring Replacement can occur here Retakes should at times be more demanding and in a different format Entered in Genesis: Quiz1_Solving Quadratic Equations **15 Classwork's per MP** 15 teacher-generated assignments Standards/Practice-based Rubric Scoring Entered in Genesis: Classwork 1: Part-to-whole ratios **9 Homework's per MP** 9 teacher-generated Scoring is based on teacher-discretion No retakes in the last week of the marking period to protect data management. Grades are to be entered one week prior to the end of the MP.		
Assignment Examples	**Tests** • Diagnostic, Readiness, or Pre • Test Prep (MIF) • Chapter Tests (MIF) • End-of-Book Test (CMP3) • Unit Test (District) • Exam View Tests	**Authentic Assessments** • District SGO Performance Tasks • Illustrative Math Tasks • See the Math Handbook pgs. 23-24	**Quizzes** • ExamView Tests • Prob of the Lesson (MIF) • Extra Practice Wkbk (MIF) • CheckUps (CMP3) • Partner Quizzes (CMP3)	**Classwork - Captured during** • Guided Learning (MIF) • Indep Practice (MIF/CMP3) • Problem of the Lesson (MIF) • Put on your thinking cap (MIF) • Investigations/ACE • Demonstration of Learning (DOL)/Exit Ticket	



High School Math Grading (Grades 9-12)

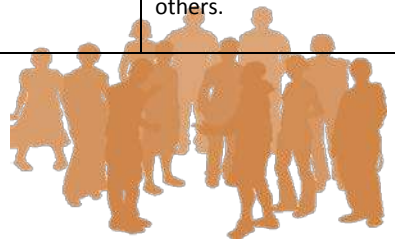
	Summative Assessments: Assessment of Learning		**Formative Assessment: Assessment for Learning**		
Definition What do they measure?	Tests and projects that evaluate students' learning once the instructional period is complete; these assessments are infrequent, generally occurring at the end of a unit or grading period.		Helps students demonstrate their current understanding; Formative assessments occur frequently.		
How are they generated?	Based upon clear, consistent, and explicit expectations (**Learning Outcomes**) across grade levels. See the *Unit Assessment Map*.		Teachers work together, plan together, know the outcomes in advance, and engage in backward planning for activities and experiences and calibrate grading. **Learning Outcomes** are shared with students at the beginning of the course of study, quarter, or the start of the unit.		
Examples	Tests and Structured Extra Credit	Authentic Assessments	Quizzes	Classwork	Homework
Impact	**3 Test's per MP + Diagnostic(s)** 1 district + 2 depart-generated Traditional scoring No replacement for Unit Assessment; "Retakes" occurs as awarding extra credit points (recommended for students making individual retake requests and is up to 5 per MP). Extra-credit assignments and the Unit Retake Assessment(s) should be standards-based, department-developed allowing failure to be fully recoverable, and are assigned at the teacher's discretion. Unit Assessments must be issued no fewer than 2 weeks before the end of the MP. After a Diagnostic or Unit Assessment is issued, teachers should immediately address deficiencies in a structured 1-2 day plan of relearning.	**4 Authentic's per MP** 3 district + 1 depart-generated Integrated Standards-based scoring SGO-aligned No replacement Gives teachers scoring practice and use in using the PLD rubric	**6 Quizzes per MP** 6 depart-generated Standards-based Rubric Scoring Replacement can occur here Retakes should at times be more demanding and in a different format Entered in Genesis: Quiz1_Solving Quadratic Equations **9 (OHS), 15(OPA) Classwork's per MP** 15 teacher-generated assignments **Standards/Practice-based Rubric Scoring (see the rubric)** **9 Homework's per MP** 9 teacher-generated Scoring is based on teacher-discretion No retakes in the last week of the marking period to protect data management. Grades are to be entered one week prior to the end of the MP.		

* Recommendation: Students should not be penalized for missed assignments; build in additional opportunities for students to DO THE WORK.

SAMPLE ASSESSMENT OF MATHEMATICAL PRACTICES RUBRIC[2] **For use during Student Exploration** (e.g. Small Group, Partner Work, Investigation, Game-based Activities, Let's Explore (MIF))					
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**	**Level 1: No Command**
SMP 1: Make Sense of Problems/Persevere in Solving them	With **No academic support,** the student is able to discuss, explain, and demonstrate solving a problem with multiple representations and in multiple ways. The student may struggle with various attempts yet learns from previous solution attempts.	With **No academic support,** the student is able to explain their thought processes in solving a problem and representing it in several ways. The student may struggle to try several approaches in finding a solution, and only seek hints if stuck.	With **little academic support,** the student is able to explain their thought processes in solving a problem one way. The student stays with a challenging problem for more than one attempt.	With **additional academic support,** the student is able to explain their thought processes in solving a problem one way.	Students within this command level require **extensive academic support/intervention**. Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review. Interventions should include instruction on solving word problems that are based on common underlying structures. Intervention materials should include
SMP 2: Reason Abstractly and Quantitatively	With **No academic support**, the student can convert situations into symbols to appropriately solve problems as well as convert symbols into meaningful situations.	With **No academic support,** the student is able translate situations into symbols for solving problems.	With **little academic support,** the student is able to reason with models or pictorial representations to solve problems.	With additional **academic support,** the student is able to reason with models or pictorial representations to solve problems.	

[2] During Classwork assignments, teacher should be monitoring students' progress toward meeting the written objective.

SMP 3: Construct Viable Arguments/Critique the Reasoning of Others	With **No academic support**, the student is able to justify and explain, with accurate language and vocabulary, why their strategy/solution is correct, and compare and contrast various solution strategies and explain the reasoning of others.	With **No academic support,** the student is able to explain their own thinking and the thinking of others with accurate vocabulary; and explain other students' solutions and identify strengths and weaknesses of the solution.	With **little academic support,** the student is able to explain their thinking for the solution they found and understand and discuss other ideas and approaches.	With **additional academic support,** the student is able to explain their thinking for the solution they found and understand.	opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.
SMP 4: Model with Mathematics	With **No academic support**, the student is able to use a variety of models, symbolic representations, and/or technology tools to demonstrate a solution to a problem.	With **No academic support,** the student is able to use models and symbols to represent and solve a problem, and accurately explain the solution representation.	With **little academic support,** the student is able to use models to represent and solve a problem and translate the solution to mathematical symbols.	With additional **academic support,** the student is able to use models to represent and solve a problem.	
SMP 5: Use appropriate tools strategically	With **No academic support**, the student combines various tools, including technology, explore and solve a problem as well as justify their tool selection and problem solution.	With **No academic support,** the student selects from a variety of tools the ones that can be used to solve a problem and explain their reasoning for the selection.	With **little academic support,** the student is able to use the appropriate tools to find a solution and communicate their reasoning and solution to others.	With additional **academic support,** the student is able to use the appropriate tools to find a solution.	Students within this command level require extensive academic support/intervention. Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review. Interventions should include instruction on solving word problems that are based on common underlying structures. Intervention
SMP 6: Attend to precision	With **No academic support**, the student uses appropriate symbols, vocabulary, and labeling to effectively communicate and exchange ideas.	With **No academic support,** the student uses appropriate symbols, vocabulary, and labeling when communicating with others.	With **little academic support,** the student uses appropriate symbols, vocabulary, and labeling when communicating with others.	With additional **academic support,** the student uses appropriate symbols, vocabulary, and labeling when communicating with others.	



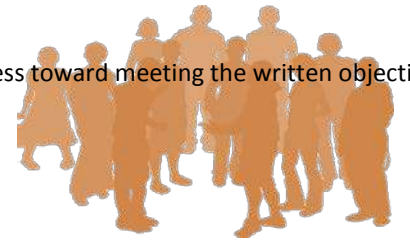
SMP 7: Look for and make use of structure	With **No academic support**, the student is able to see complex and complicated mathematical expressions as component parts.	With **No academic support,** the student is able to compose and decompose number situations and relationships through observed patterns in order to simplify solutions.	With **little academic support,** the student is able to look for structure within mathematics to help them solve problems efficiently.	With additional **academic support,** the student is able to look for structure within mathematics to help them solve problems efficiently.	materials should include opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.
SMP 8: Look for and express regularity in repeated reasoning	With **No academic support**, the student is able to discover deep, underlying relationships.	With **No academic support,** the student is able to find and explain subtle patterns.	The student finds obvious patterns and uses if/ then reasoning strategies for obvious patterns.	The student finds obvious patterns and uses if/ then reasoning strategies for obvious patterns.	

	PLD	**Genesis Conversion**
Rubric Scoring	PLD 5	100
	PLD 4	89
	PLD 3	79
	PLD 2	69
	PLD 1	59

SAMPLE CONTENT RUBRIC[3] For Use During Independent Practice/Summary/Demonstration of Learning (DOL)				
SOLUTION • The student indicates that $284.99 should go to Mr. Aceves' class, $174.41 should go to Mrs. Baca's class, and $140.60 should go to Mr. Canyon's class and justifies the answer.				
Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**	**Level 1: No Command**
Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, the number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor computational error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor conceptual error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical, but incomplete, progression of steps • minor calculation errors • partial justification of a conclusion • a logical, but incomplete, progression of steps	Constructs and communicates an incomplete response based on concrete referents provided in the prompt such as diagrams, number line diagrams or coordinate plane diagrams, which may include: • a faulty approach based on a conjecture and/or stated assumptions • An illogical and Incomplete progression of steps • major calculation errors • partial justification of a conclusion	The student shows no work or justification.

	PLD	Genesis Conversion
Rubric Scoring	PLD 5	100
	PLD 4	89
	PLD 3	79
	PLD 2	69
	PLD 1	59

[3] During Independent Practice assignments, teacher should be monitoring students' progress toward meeting the written objective.



Don't judge. Teach. It's a learning process.

Dr. Carol Dweck, Mindset: The New Psychology of Success

MATH

COMMON CORE-ALIGNED WEB RESOURCES

MATH

Common Core-Aligned Web-based Resources

Note: Some links may be inactive. *Please report any inactive links to the Office of Mathematics and Science.*

GENERAL RESOURCES

The CCSS for Math
http://www.corestandards.org/Math/

Resources for Content
http://sites.google.com/site/opsmathcontent/

Common Core Tools
http://www.corestandards.org
http://commoncoretools.me/
http://www.ccsstoolbox.com/
http://www.achievethecore.org/steal-these-tools
http://turnonccmath.net/

Manipulatives
http://nlvm.usu.edu/en/nav/vlibrary.html
http://www.explorelearning.com/index.cfm?method=cResource.dspBrowseCorrelations&v=s&id=USA-000
http://www.thinkingblocks.com/

INSTRUCTIONAL RESOURCES
http://maccss.ncdpi.wikispaces.net/Elementary
http://maccss.ncdpi.wikispaces.net/Middle+School
http://maccss.ncdpi.wikispaces.net/High+School

EngageNY
https://www.engageny.org/common-core-curriculum

Greg Tang
http://gregtangmath.com/

PROBLEM SOLVING RESOURCES

Illustrative Math Project
http://illustrativemathematics.org/standards/k8
http://illustrativemathematics.org/standards/hs
The site contains sets of tasks that illustrate the expectations of various CCSS in grades K–8 grade and high school. More tasks will be appearing over the coming weeks. Eventually, the sets of tasks will include elaborated teaching tasks with detailed information about using them for instructional purposes, rubrics, and student work.

Inside Mathematics
http://www.insidemathematics.org/index.php/tools-for-teachers
Inside Mathematics showcases multiple ways for educators to begin to transform their teaching practices. On this site, educators can find materials and tasks developed by grade level and content area.

Mathematics Assessment Project (MAP)
Shell Centre/Mathematics Assessment Resource Services (MARS), University of Nottingham & UC Berkley
MAP formative assessment are anchored in the content described in the standards, focusing on the mathematical practices that are the major new challenge in the CCSS. The two complementary types are concept-focused lessons and problem-focused lessons. These lessons are designed to assess and develop students' capacity to apply their mathematics flexibly to non-routine unstructured problems, both from the real world and within pure mathematics.

Formative Assessment Lessons (High School)
http://map.mathshell.org/materials/lessons.php
http://map.mathshell.org.uk/materials/tasks.php

IXL
http://www.ixl.com/

New York City Department of Education
https://www.engageny.org/common-core-curriculum
NYC educators and national experts developed Common Core-aligned tasks embedded in units of study to support schools in the implementation of the CCSSM.

Gates Foundations Tasks
http://www.gatesfoundation.org/college-ready-education/Documents/supporting-instruction-cards-math.pdf

Minnesota STEM Teachers' Center
http://www.scimathmn.org/stemtc/frameworks/

Singapore Math Tests K-12
http://www.misskoh.info/index2006.html

Massachusetts Comprehensive Assessment System
www.doe.mass.edu/mcas/search

Performance Assessment Links in Math (PALM)
PALM is currently being developed as an on-line, standards-based, resource bank of mathematics performance assessment tasks indexed via the National Council of Teachers of Mathematics (NCTM).
http://palm.sri.com/

Mathematics Vision Project
http://www.mathematicsvisionproject.org/

Moby Max
http://www.mobymax.com

ASSESSMENT RESOURCES

Illustrative Math
http://illustrativemathematics.org/

PARCC Grade and Subject Specific PLDs
http://www.parcconline.org/math-plds

PARCC
http://www.parcconline.org/samples/item-task-prototypes

NJDOE
http://www.state.nj.us/education/modelcurriculum/math/ (username: model; password: curriculum)

DANA Center
http://www.ccsstoolbox.com/parcc/PARCCPrototype_main.html

New York
https://www.engageny.org/resource/released-2015-3-8-ela-and-mathematics-state-test-questions

Delaware
http://www.doe.k12.de.us/Page/512

TIMSS Released Assessment Items for Grades 4 & 8
https://nces.ed.gov/timss/educators.asp

Additional Instructional Resources
Howard County Public Schools
http://www.hcpss.org/academics/mathematics/curriculum/

North Carolina
http://maccss.ncdpi.wikispaces.net/

Georgia Public Schools
K-5: https://www.georgiastandards.org/Common-Core/Pages/Math-K-5.aspx
6-8: https://www.georgiastandards.org/Common-Core/Pages/Math-6-8.aspx
9-12: https://www.georgiastandards.org/Common-Core/Pages/Math-9-12.aspx

PROFESSIONAL DEVELOPMENT RESOURCES (Videos/Math Practices)
Edmodo
http://www.edmodo.com
Sign up is required
Enter the following code in the Course field: iibn34

Learner Express Modules for Teaching and Learning
http://www.learner.org/series/modules/express/videos/video_clips.html?type=1&subject=math

Videos
http://www.achieve.org/achieving-common-core
http://www.youtube.com/user/TheHuntInstitute/videos

Inside Mathematics
http://www.insidemathematics.org/index.php/commmon-core-math-intro
Also, see the ***Tools for Educators***

Mathematics Assessment Project
http://map.mathshell.org/materials/stds.php?id=1158

The Teaching Channel
https://www.teachingchannel.org

Learnzillion
https://www.learnzillion.com

Engage NY
http://www.engageny.org/video-library?f[0]=im_field_subject%3A19

COMMON CORE STATE STANDARDS PROGRESSIONS DOCUMENTS
http://www.achievethecore.org/page/254/progressions-documents-for-the-common-core-state-standards-for-mathematics
OR
http://ime.math.arizona.edu/progressions/

- Draft Front Matter
- Draft K–6 Progression on Geometry
- Draft K–5 Progression on Measurement and Data (measurement part)
- Draft K–5 progression on Measurement and Data (data part)
- Draft K–5 Progression on Number and Operations in Base Ten
- Draft K–5 Progression on Counting and Cardinality and Operations and Algebraic Thinking
- Draft 3–5 Progression on Number and Operations—Fractions
- Draft 6–8 Progression on Statistics and Probability
- Draft 6–8 Progression on Expressions and Equations
- Draft 6–8 Progression on The Number System; High School, Number
- Draft 6–7 Progression on Ratios and Proportional Relationships
- Draft High School Progression on Statistics and Probability
- DraftHighSchoolProgressiononAlgebra
- Draft High School Progression on Functions
- Draft High School Progression on Modeling

DISTRICT-WIDE ASSESSMENT STRUCTURE

Diagnostic Assessments (K - 12)
Assessment of readiness preceding the unit of study and found in the MIF, CMP3, and HS programs
Used September - June
Results inform the daily Do Now, Mini Lesson, etc.
Entered in Genesis with no weight

Checks for Understanding / Check Points (K - 12)
Small assessments found in the MIF, CMP3, and HS programs (ExamView-generated, Prob of the Lesson, CheckUps, Extra Practice Wkbk)
Used September - June
Graded/Scored and included in Genesis; Entered as a **Quiz** grade (20%)

Chapter or Unit Assessments (K - 12)
(Grades K – 2)** Summative, assessing multiple standards/skills; Interview-format w/anecdotal documentation and included in Portfolios
(Grades 3 – 12) Longer, more summative, assessing multiple standards/skills; includes mini unit assessments
September - March (Grades 3 – 12; District generated; tracker-aligned); (Grades K – 2; District generated; rubric-scored)
April – June (Developed using program components in conjunction with item banks provided in the unit plans)
The latter will be co-developed by grade level teachers during the CPTs
Graded/Scored and included in Genesis; Entered as a **Test** grade (25%)

Portfolio Assessments (K - 12)
September – March-- Aligned to SGO focus and rubric scored
Approximately 1 task per month aligned to either SGO #1 or SGO #2
Tasks reflective of "taught" content; September task reflect the prior year content and acts as an additional baseline measure
All tasks are "practice forward" (Closely aligned to the Standards for Mathematical Practice)
Tasks will be labeled as "Individual", "Partner/Group", and "Individual w/Opportunity for Student Interviews"
4 Additional tasks will be included in Student Reflection and will be labeled as such
Certain interview tasks will embed a technology-integrated component to allow teachers to ascertain students' comfort in using the tools of technology as well as the content
April – June -- Tasks shift from SGO focus to the In-depth Opportunities for each grade
All student work in folders is attached to a completed rubric
Graded/Scored and included in Genesis; Entered as an **Authentic Assessment** grade (25%)

COMMON CORE STATE STANDARDS

You have to apply yourself each day to becoming a little better. By applying yourself to the task of becoming a little better each and every day over a period of time, you will become a lot better.

The critical thing is to make a concrete, growth-oriented plan, and to stick to it.

Dr. Carol Dweck, Mindset: The New Psychology of Success

Mathematics | Grade K

In Kindergarten, instructional time should focus on two critical areas: (1) representing, relating, and operating on whole numbers, initially with sets of objects; (2) describing shapes and space. More learning time in Kindergarten should be devoted to number than to other topics.

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

Counting and Cardinality

- ■ Know number names and count sequence. (K.CC.1, K.CC.2, K.CC.3)
- ■ Count to tell the number of objects. (K.CC.4a-c, K.CC.5)
- ■ Compare numbers. (K.CC.6, K.CC.7)

Operations and Algebraic Thinking

- ■ Understand addition as putting together and adding to, and understand subtractions as taking apart and taking from. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)

Number and Operations in Base Ten

- ■ Work with numbers 11-19 to gain foundation for place value. (K.NBT.1)

Measurement and Data

- ○ Describe and compare measurable attributes. (K.MD.1, K.MD.2)
- ◘ Classify objects and count the number of objects in categories. (K.MD.3)

Geometry

- ○ Identify and describe shapes. (K.G.1, K.G.2, K.G.3)
- ○ Analyze, compare, create, and compose shapes. (K.G.4, K.G.5, K.G.6)

Mathematics | Grade 1

In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.

Key: ■ Major Clusters; ◻ Supporting Clusters; ○ Additional Clusters

Operation and Algebraic Thinking

- ■ Represent and solve problems involving addition and subtraction. (1.OA.1, 1.OA.2)
- ■ Understand and apply properties of operations and the relationship between addition and subtraction. (1.OA.3, 1.OA.4)
- ■ Add and subtract within 20. (1.OA.5, 1.OA.6)
- ■ Work with addition and subtraction equations. (1.OA.7, 1.OA.8)

Number and Operations in Base Ten

- ■ Extending the counting sequence. (1.NBT.1)
- ■ Understand place value. (1.NBT.2 a-c, 1.NBT.2, 1.NBT.3)
- ■ Use place value understanding and properties of operations to add and subtract. (1.NBT.4, 1.NBT.5, 1.NBT.6)

Measurement and Data

- ■ Measure lengths indirectly and by iterating length units. (1.MD.1, 1.MD.2)
- ○ Tell and write time. (1.MD.3)
- ◻ Represent and interpret data. (1.MD.4)

Geometry

- ○ Reason with shapes and their attributes. (1.G.1, 1.G.2, 1.G.3)

Mathematics | Grade 2

In Grade 2, instructional time should focus on four critical areas: (1) extending understanding of base-ten notation; (2) building fluency with addition and subtraction; (3) using standard units of measure; and (4) describing and analyzing shapes.

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

Operations and Algebraic Thinking

- ■ Represent and solve problems involving addition and subtraction. (2.OA.1)
- ■ Add and subtract within 20. (2.OA.2)
- ◘ Work with equal groups of objects to gain foundations for multiplication. (2.OA.3, 2.OA.4)

Number and Operations in Base Ten

- ■ Understand place value. (2.NBT.1a-b, 2.NBT.2, 2.NBT.3, 2.NBT.4)
- ■ Use place value understanding and properties of operations to add and subtract.(2.NBT.5, 2.NBT.6, 2.NBT.7, 2.NBT.8, 2.NBT.9)

Measurement and Data

- ■ Measure and estimate lengths in standard units. (2.MD.1, 2.MD.2, 2.MD.3, 2.MD.4)
- ■ Relate addition and subtraction to length. (2.MD.5, 2.MD.6)
- ◘ Work with time and money. (2.MD.7, 2.MD.8)
- ◘ Represent and interpret data. (2.MD.9, 2.MD.10)

Geometry

- ○ Reason with shapes and their attributes. (2.G.1, 2.G.2, 2.G.3)

Mathematics | Grade 3

In Grade 3, instructional time should focus on four critical areas: (1) developing understanding of multiplication and division and strategies for multiplication and division within 100; (2) developing understanding of fractions, especially unit fractions (fractions with numerator 1); (3) developing understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes.

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

Operations and Algebraic Thinking

- ■ Represent and solve problems involving multiplication and division. (3.OA.1, 3.OA.2, 3.OA.3, 3.OA.4)
- ■ Understand properties of multiplication and the relationship between multiplication and division. (3.OA.5, 3.OA.6)
- ■ Multiply and divide within 100. (3.OA.7)
- ■ Solve problems involving the four operations, and identify and explain patterns in arithmetic. (3.OA.8, 3.OA.9)

Number and Operations in Base Ten

- ○ Use place value understanding and properties of operations to perform multi-digit arithmetic. (3.NBT.1)

Number and Operations - Fractions

- ■ Develop understanding of fractions as numbers. (3.NF.1, 3.NF.2a-b, 3.NF.3a-d)

Measurement and Data

- ■ Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects. (3.MD.1, 3.MD.2)
- ◘ Represent and interpret data. (3.MD.3, 3.MD.4)
- ■ Geometric measurement: understand concepts of area and relate area to multiplication and to addition. (3.MD.5, 3.MD.6, 3.MD.7a-d)
- ○ Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and are measure. (3.MD.8)

Geometry

- ◘ Reason with shapes and their attributes. (3.G.1, 3.MD.2)

Mathematics | Grade 4

In Grade 4, instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

Operations and Algebraic Thinking

- ■ Use the four operations with whole numbers to solve problems. (4.OA.1, 4.OA.2, 4.OA.3)
- ◘ Gain familiarity with factors and multiples. (4.OA.4)
- ○ Generate and analyze patterns. (4.OA.5)

Number and Operations in Base Ten

- ■ Generalize place value understanding for multi-digit whole numbers. (4.NBT.1,4.NBT.2, 4.NBT.3)
- ■ Use place value understanding and properties of operations to perform multi-digit arithmetic. (4.NBT.4,4.NBT.5, 4.NBT.6)

Number and Operations - Fractions

- ■ Extend understanding of fraction equivalence and ordering. (4.NF.1,4.NF.2)
- ■ Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. (4.NF.3a-d,4.NF.4a-c)
- ■ Understand decimal notation for fractions, and compare decimal fractions.(4.NF.5,4.NF.6, (4.NF.7)

Measurement and Data

- ◘ Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. (4.MD.1,4.MD.2, 4.MD.3)
- ◘ Represent and interpret data. (4.MD.4)
- ○ Geometric measurement: understand concepts of angle and measure angles. (4.MD.5a-b, 4.MD.6, 4.MD.7)

Geometry

- ○ Draw and identify lines and angles, and classify shapes by properties of their lines and angles. (4.G.1, 4.G.2, 4.G.3)

Mathematics | Grade 5

In Grade 5, instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume.

Key: ■ Major Clusters; ◻ Supporting Clusters; ○ Additional Clusters

Operations and Algebraic Thinking

- ○ Write and interpret numerical expressions. (5.OA.1, 5.OA.2)
- ○ Analyze patterns and relationships. (5.OA.3)

Number and Operations in Base Ten

- ■ Understand the place value system. (5.NBT.1, 5.NBT.2, 5.NBT.3a-b, 5.NBT.4)
- ■ Perform operations with multi-digit numbers and with decimals to hundredths. (5.NBT.5, 5.NBT.6, 5.NBT.7)

Number and Operations - Fractions

- ■ Use equivalent fractions as a strategy to add and subtract fractions. (5.NF.1, 5.NF.2)
- ■ Apply and extend previous understanding of multiplication and division to multiply and divide fractions. (5.NF.3, 5.NF.4a-b, 5.NF.5a-b, 5.NF.6, 5.NF.7a-c)

Measurement and Data

- ◻ Convert like measurement units within a given measurement system. (5.MD.1)
- ◻ Represent and interpret data. (5.MD.2)
- ■ Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition. (5.MD.3, 5.MD.4, 5.MD.5a-c)

Geometry

- ○ Graph points on the coordinate plan to solve real-world and mathematical problems. (5.G.1, 5.G.2)
- ○ Classify two-dimensional figures into categories based on their properties. (5.G.3, 5.G.4)

Mathematics | Grade 6

In Grade 6, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking.

Key: ■ Major Clusters; ◻ Supporting Clusters; ○ Additional Clusters

Ratios and Proportional Reasoning

- ■ Understand ratio concepts and use ratio reasoning to solve problems. (6.RP.1, 6.RP.2, 6.RP.3a-d)

The Number System

- ■ Apply and extend previous understandings of multiplication and division to divide fractions by fractions. (6.NS.1)
- ○ Compute fluently with multi-digit numbers and find common factors and multiples. (6.NS.2, 6.NS.3, 6.NS.4)
- ■ Apply and extend previous understanding of numbers to the system of rational numbers. (6.NS.5, 6.NS.6a-c, 6.NS.7a-d, 6.NS.8)

Expressions and Equations

- ■ Apply and extend previous understanding of arithmetic to algebraic expressions. (6.EE.1, 6.EE.2a-c, 6.EE.3, 6.EE.4)
- ■ Reason about and solve one-variable equations and inequalities. (6.EE.5, 6.EE.6, 6.EE.7, 6.EE.8)
- ■ Represent and analyze quantitative relationships between dependent and independent variables. (6.EE.9)

Geometry

- ◻ Solve real-world and mathematical problems involving area, surface area, and volume. (6.G.1, 6.G.2, 6.G.3, 6.G.4)

Statistics and Probability

- ○ Develop understanding of statistical variability. (6.SP.1, 6.SP.2, 6.SP.3)
- ○ Summarize and describe distributions. (6.SP.4, 6.SP.5a-d)

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.

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

Ratios and Proportional Reasoning

- ■ Analyze proportional relationships and use them to solve real-world mathematical problems. (7.RP.1, 7.RP.2a-d, 7.RP.3)

The Number System

- ■ Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers. (7.NS.1a-d, 7.NS.2a-d, 7.NS.3)

Expressions and Equations

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

Geometry

- ○ Draw, construct and describe geometrical figures and describe the relationships between them, (7.G.1, 7.G.2, 7.G.3)
- ○ Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. (7.G.4, 7.G.5, 7.G.6)

Statistics and Probability

- ■ Use random sampling to draw inference about a population. (7.SP.1, 7.SP.2)
- ○ Draw informal comparative inferences about two populations. (7.SP.3, 7.SP.4)
- ◘ Investigate chance processes and develop, use, and evaluate probability models. (7.SP.5, 7.SP.6, 7.SP.7a-b, 7.SP.8a-c)

Mathematics | Grade 8

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Key: ■ Major Clusters; ◻ Supporting Clusters; ○ Additional Clusters

The Number System

- ◻ Know that there are numbers that are not rational, and approximate them by rational numbers. (8.NS.1, 8.NS.2)

Expressions and Equations

- ■ Work with radicals and integer exponents. (8.EE.1, 8.EE.2, 8.EE.3, 8.EE.4)
- ■ Understand the connections between proportional relationships, lines, and linear equations. (8.EE.5, 8.EE.6)
- ■ Analyze and solve linear equations and pairs of simultaneous linear equations. (8.EE.7a-b, 8.EE.8a-c)

Functions

- ■ Define, evaluate, and compare functions. (8.F.1, 8.F.2, 8.F.3)
- ◻ Use functions to model relationships between quantities. (8.F.4, 8.F.5)

Geometry

- ■ Understand congruence and similarity using physical models, transparencies, or geometry software. (8.G.1a-c, 8.G.2, 8.G.3, 8.G.4, 8.G.5)
- ■ Understand and apply the Pythagorean Theorem. (8.G.6, 8.G.7, 8.G.8)
- ○ Solve real-world and mathematical problems involving volume of cylinders, cones and spheres. (8.G.9)

Statistics and Probability

- ◻ Investigate patterns of association in bivariate data. (8.SP.1, 8.SP.2, 8.SP.3, 8.SP.4)

Mathematics | Number and Quantity Overview

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

The Real Number System

- ◘ Extend the properties of exponents to rational exponents (N.RN.1, N. RN.2)
- ○ Use properties of rational and irrational numbers (N.RN.3)

Quantities

- ■ Reason quantitatively and use units to solve problems (N.Q.1, N.Q.2, N.Q.3)

The Complex Number System

- ◘ Perform arithmetic operations with complex numbers (N.CN.1, N. CN.2, N. CN.3)
- ○ Represent complex numbers and their operations on the complex plane (N.CN.4, N. CN.5, N. CN.6)
- ○ Use complex numbers in polynomial identities and equations (N.CN.7, N. CN.8, N. CN.9)

Vector and Matrix Quantities

- ○ Represent and model with vector quantities (N.VM.1, N. VM.2, N. VM.3)
- ○ Perform operations on vectors (N.VM.4a-c, N. VM.5a-b)
- ○ Perform operations on matrices and use matrices in applications (N.VM.6, N. VM.7, N. VM.8, N. VM.9, N. VM.10, N. VM.11, N. VM.12)

Mathematics | Algebra Overview

Key: ■ Major Clusters; ◘ Supporting Clusters; ○ Additional Clusters

Seeing Structure in Expressions

- ■ Interpret the structure of expressions (A.SSE.1a-b, A.SSE.2)
- ■ Write expressions in equivalent forms to solve problems (A.SSE.3a-c, A.SSE.4)

Arithmetic with Polynomials and Rational Expressions

- ■ Perform arithmetic operations on polynomials (A.APR.1)
- ■ Understand the relationship between zeros and factors of polynomials (A.APR.2, A.APR.3)
- ○ Use polynomial identities to solve problems (A.APR.4, A.APR.5)
- ○ Rewrite rational expressions (A.APR.6, A.APR.7)

Creating Equations

- ■ Create equations that describe numbers or relationships (A.CED.1, A.APR.2, A.APR.3, A.APR.4)

Reasoning with Equations and Inequalities

- ■ Understand solving equations as a process of reasoning and explain the reasoning (A.REI.1, A.REI.2)
- ■ Solve equations and inequalities in one variable (A.REI.3, A.REI.4a-b)
- ◘ Solve systems of equations (A.REI.5, A.REI.6, A.REI.7, A.REI.8, A.REI.9)
- ■ Represent and solve equations and inequalities graphically (A.REI.10, A.REI.11, A.REI.12)

Mathematics | Functions Overview

Key: ■ Major Clusters; □ Supporting Clusters; ○ Additional Clusters

Interpreting Functions

- □ Understand the concept of a function and use function notation (F.IF.1, F.IF.2, F.IF.3)
- ■ Interpret functions that arise in applications in terms of the context (F.IF.4, F.IF.5, F.IF.6)
- ■ Analyze functions using different representations (F.IF.7a-e, F.IF.8a-b, F.IF.9)

Building Functions

- ■ Build a function that models a relationship between two quantities (F.BF.1a-c, F.BF.2)
- ○ Build new functions from existing functions (F.BF.3, F.BF.4a-d, F.BF.5)

Linear, Quadratic, and Exponential Models

- ■ Construct and compare linear, quadratic, and exponential models and solve problems (F.LE.1a-c, F.LE.2, F.LE.3, F.LE.4)
- ■ Interpret expressions for functions in terms of the situation they model (F.LE.5)

Trigonometric Functions

- ○ Extend the domain of trigonometric functions using the unit circle (F.TF.1, F.TF.2, F.TF.3 F.TF.4)
- ○ Model periodic phenomena with trigonometric functions (F.TF.5, F.TF.6, F.TF.7)
- ○ Prove and apply trigonometric identities (F.TF.8, F.TF.9)

Mathematics | Geometry Overview

Key: ■ Major Clusters; □ Supporting Clusters; ○ Additional Clusters

Congruence

- □ Experiment with transformations in the plane (G.CO.1, G.CO.2, G.CO.3, G.CO.4, G.CO.5)
- □ Understand congruence in terms of rigid motions (G.CO.6, G.CO.7, G.CO.8)
- □ Prove geometric theorems (G.CO.9, G.CO.10, G.CO.11)
- ○ Make geometric constructions (G.CO.12, G.CO.13)

Similarity, Right Triangles, and Trigonometry

- □ Understand similarity in terms of similarity transformations (G.SRT.1a-b, G.SRT.2, G.SRT.3)
- □ Prove theorems involving similarity (G.SRT.4, G.SRT.5)
- □ Define trigonometric ratios and solve problems involving right triangles (G.SRT.6, G.SRT.7, G.SRT.8)
- ○ Apply trigonometry to general triangles (G.SRT.9, G.SRT.10, G.SRT.11)

Circles

- ○ Understand and apply theorems about circles (G.C.1, G.C.2, G.C.3, G.C.4)
- □ Find arc lengths and areas of sectors of circles (G.C.5)

Expressing Geometric Properties with Equations

- ■ Translate between the geometric description and the equation for a conic section (G.GPE.1, G.GPE.2, G.GPE.3)
- ■ Use coordinates to prove simple geometric theorems algebraically (G.GPE.4, G.GPE.5, G.GPE.6, G.GPE.7)

Geometric Measurement and Dimension

- ○ Explain volume formulas and use them to solve problems (G.GMD.1, G.GMD.2, G.GMD.3)

- Visualize relationships between two- dimensional and three-dimensional objects (G.GMD.4)

Modeling with Geometry

- Apply geometric concepts in modeling situations (G.MG.1, G.MG.2, G.MG.3)

Mathematics | Statistics and Probability Overview

Key: ■ Major Clusters; ◻ Supporting Clusters; ○ Additional Clusters

Interpreting Categorical and Quantitative Data

- ■ Summarize, represent, and interpret data on a single count or measurement variable (S.ID.1, S.ID.2, S.ID.3, S.ID.4)
- ■ Summarize, represent, and interpret data on two categorical and quantitative variables (S.ID.5, S.ID.6a-c)
- ■ Interpret linear models (S.ID.7, S.ID.8, S.ID.9)

Making Inferences and Justifying Conclusions

- ◻ Understand and evaluate random processes underlying statistical experiments (S.IC.1, S.IC.2)
- ■ Make inferences and justify conclusions from sample surveys, experiments and observational studies (S.IC.3, S.IC.4, S.IC.5, S.IC.6)

Conditional Probability and the Rules of Probability

- ○ Understand independence and conditional probability and use them to interpret data (S.CP.1, S.CP.2, S.CP.3, S.CP.4, S.CP.5)
- ○ Use the rules of probability to compute probabilities of compound events in a uniform probability model (S.CP.6, S.CP.7, S.CP.8, S.CP.9)

Using Probability to Make Decisions

- ○ Calculate expected values and use them to solve problems (S.MD.1, S.MD.2, S.MD.3, S.MD.4)
- ○ Use probability to evaluate outcomes of decisions (S.MD.5a-b, S.MD.6, S.MD.7)

COMMON CORE STATE STANDARDS FOR MATHEMATICAL PRACTICE

1. **CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.**

   Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.**

   Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. **CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.**

   Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. **CCSS.Math.Practice.MP4 Model with mathematics.**

   Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their 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.

5. **CCSS.Math.Practice.MP5 Use appropriate tools strategically.**

   Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. **CCSS.Math.Practice.MP6 Attend to precision.**

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

7. **CCSS.Math.Practice.MP7 Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can 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.

8. **CCSS.Math.Practice.MP8 Look for and express regularity in repeated reasoning.**

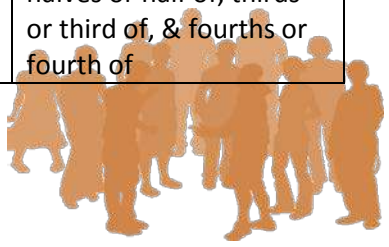
Mathematically proficient students notice when calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Summary of Standards for Mathematical Practice	Questions to Develop Mathematical Thinking
1. Make sense of the problems and persevere in solving them. Interpret and make meaning of the problem looking for starting points. Analyze what is given to explain to themselves the meaning of the problem. Plan a solution pathway instead of jumping to a solution. Can monitor their progress and change the approach if necessary. See relationships between various representations. Relate current situations to concepts or skills previously learned and connect mathematical ideas to one another. Can understand various approaches to solutions. Continually ask themselves; "Does this make sense?"	How would you describe the problem in your own words? How would you describe what you are trying to find? What do you notice about...? What information is given in the problem? Describe the relationship between the quantities. Describe what you have already tried. What might you change? Talk me through the steps you've used to this point. What steps in the process are you most confident about? What are some other strategies you might try? What are some other problems that are similar to this one? How might you use one of your previous problems to help you begin? How else might you organize...represent... show...?
2. Reason abstractly and quantitatively. Make sense of the quantities and their relationships. Are able to decontextualize (represent a situation symbolically and manipulate the symbols) and contextualize (make meaning of the symbols in a problem) quantitative relationships. Understand the meaning of quantities and are flexible in the use of operations and their properties. Create a logical representation of the problem. Attends to the meaning of quantities, not just how to compute them.	What do the numbers used in the problem represent? What is the relationship of the quantities? How is related to…? What is the relationship between and? What does mean this to you? (e.g. symbol, quantity, diagram) What properties might we use to find a solution? How did you decide in this task that you needed to use...? Could we have used another operation or property to solve this task? Why or why not?
3. Construct viable arguments and critique the reasoning of others. Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments. Justify conclusions with mathematical ideas. Listen to the arguments of others and ask useful questions to determine if an argument makes sense. Ask clarifying questions or suggest ideas to improve/revise the argument. Compare two arguments and determine correct or flawed logic.	What mathematical evidence would support your solution? How can we be sure that...? / How could you prove that...? Will it still work if...? What were you considering when...? How did you decide to try that strategy? How did you test whether your approach worked? How did you decide what the problem was asking you to find? (What was unknown?) Did you try a method that did not work? Why didn't it work? Would it ever work? Why or why not? What is the same and what is different about...? How could you demonstrate a counter-example?
4. Model with mathematics. Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize). Apply the math they know to solve problems in everyday life. Are able to simplify a complex problem and identify important quantities to look at relationships. Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation. Reflect on whether the results make sense, possibly improving or revising the model. Ask themselves, "How can I represent this mathematically?"	What number model could you construct to represent the problem? What are some ways to represent the quantities? What's an equation or expression that matches the diagram..., number line.., chart..., table..? Where did you see one of the quantities in the task in your equation or expression? Would it help to create a diagram, graph, table...? What are some ways to visually represent...? What formula might apply in this situation?

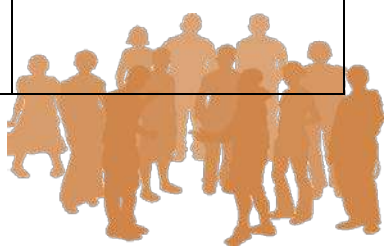
5. Use appropriate tools strategically. Use available tools recognizing the strengths and limitations of each. Use estimation and other mathematical knowledge to detect possible errors. Identify relevant external mathematical resources to pose and solve problems. Use technological tools to deepen their understanding of mathematics.	What mathematical tools could we use to visualize and represent the situation? What information do you have? What do you know that is not stated in the problem? What approach are you considering trying first? What estimate did you make for the solution? In this situation would it be helpful to use...a graph..., number line..., ruler..., diagram..., calculator..., manipulative? Why was it helpful to use...? What can using a show us, that _may not? In what situations might it be more informative or helpful to use...?
6. Attend to precision. Communicate precisely with others and try to use clear mathematical language when discussing their reasoning. Understand meanings of symbols used in mathematics and can label quantities appropriately. Express numerical answers with a degree of precision appropriate for the problem context. Calculate efficiently and accurately.	What mathematical terms apply in this situation? How did you know your solution was reasonable? Explain how you might show that your solution answers the problem. Is there a more efficient strategy? How are you showing the meaning of the quantities? What symbols or mathematical notations are important in this problem? What mathematical language...,definitions..., properties can you use to explain...? How could you test your solution to see if it answers the problem?
7. Look for and make use of structure. Apply general mathematical rules to specific situations. Look for the overall structure and patterns in mathematics. See complicated things as single objects or as being composed of several objects.	What observations do you make about...? What do you notice when...? What parts of the problem might you eliminate..., simplify...? What patterns do you find in...? How do you know if something is a pattern? What ideas that we have learned before were useful in solving this problem? What are some other problems that are similar to this one? How does this relate to...? In what ways does this problem connect to other mathematical concepts?
8. Look for and express regularity in repeated reasoning. See repeated calculations and look for generalizations and shortcuts. See the overall process of the problem and still attend to the details. Understand the broader application of patterns and see the structure in similar situations. Continually evaluate the reasonableness of their intermediate results.	Will the same strategy work in other situations? Is this always true, sometimes true or never true? How would we prove that...? What do you notice about...? What is happening in this situation? What would happen if...? Is there a mathematical rule for...? What predictions or generalizations can this pattern support? What mathematical consistencies do you notice?

APPROPRIATE NUMBER SYSTEMS (K-8)

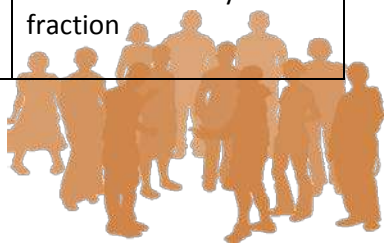
	K	1	2
Count	To 100	To 120	To 1000
Count Out	1-20 objects		
Count By/ Skip Count	1's, 2's, 5's, 10's	1's, 2's, 5's, 10's	1's, 2's, 5's, 10's, 100's
Count On	By 1's	By 2's, 10's	By 10 and 100 (mentally)
Determine 'how many'	To 10 (scattered objects) To 20 (arranged objects)		
Write	0-20		To 1000 (numerals, number names, expanded form)
Compare	1-10 (2 written numbers)	Two two-digit numbers using <, =, >	Two three-digit numbers using <, =, >
Add	Within 10 (using objects or drawings); to solve problems	Within 20 (using 'make 10' and counting on trategies); to solve problems; addition of 2 or 3 whole numbers Within 100 (using concrete models and number strategies; properties, relationship btw + / -)	Within 100 to solve problems; Add up to four two-digit numbers Within 1000 (using concrete models and number strategies; properties, relationship btw + / -)
Subtract	Within 10 (using objects or drawings); to solve problems	Within 20 Mentally; A Multiple of 10 from Two-digit number From 0-90 (Multiples of 10 from Multiples of 10)	Within 100 to solve problems Within 1000 (using concrete models and number strategies; properties, relationship btw +/ -)
Compose	To 10 (using numbers 1-9) 11-19 (using numbers 1's & 10's)		
Decompose	To 10 (using numbers 1-9) 11-19 (using numbers 1's & 10's)		
Fluently Add/Subtract	Within 5	Within 10	Within 20; From memory all sums of 2 one-digit numbers Within 100 Mentally add/subtract 10 or 100 to/from any number 100-900
Equal Partitioning		For partitioned ●'s and ■'s use the phrases half of, fourth of, quarter of	For partitioned●'s and■'s use the phrases halves or half of, thirds or third of, & fourths or fourth of



	3	4	5
Read/Write		Multi-digit whole numbers less than or equal to 1,000,000 (numerals, number names, expanded form)	Simple numerical expressions Decimals to thousandths (using numerals, number names, expanded form)
Fluently Add/Subtract	Within 1000 (using number strategies and algorithms based on place value; properties, relationship btw + / -)	Multi-digit whole numbers less than or equal to 1,000,000 (using standard algorithm)	
Multiply	Within 100 to solve problems By multiples of 10 up to 90 (multiplicand: one-digit whole numbers)	Multi-digit whole numbers (up to four digits by one digit) (using strategies based on place value and properties) Two-digit whole numbers by two-digit whole numbers (using strategies based on place value and properties) Conversion from a larger unit to a small unit (e.g. feet to inches)	
Divide	Within 100 to solve problems		Numbers up to four-digit dividends and two-digit divisors
Fluently Multiply/Divide	Within 100 Know from memory all products of two one-digit numbers.		Multi-digit whole numbers using standard algorithm (using strategies based on place value and properties, relationship between multiplication / division)
Round (to the nearest)	10 or 100	Multi-digit whole numbers less than or equal to 1,000,000; to any place	Decimals to any place
Fractions (conditions)	Denominators of 2, 3, 4, 6, 8 only	Denominators of 2, 3, 4, 5, 6, 8, 10, 12, 100 only	
Fractions (understanding)	Understanding Unit fractions (1/b) 1/b ⇨ Dividing 1 whole into b equal parts a/b ⇨ The quantity of a parts the size of 1/b	Understanding non-unit fractions (a/b) as a sum of unit fractions (1/b)	Understanding fractions (a/b) as a÷b.



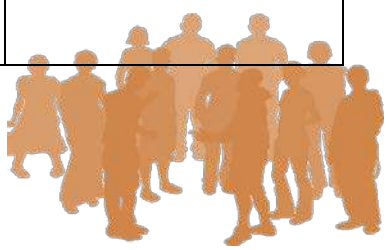
Fractions (understanding equivalence)	Equivalence⇨Same Size Equivalence⇨Same Point on Number line Whole numbers can be recognized as fractions (e.g. 3/1)	Equivalence⇨a/b = (nxa)/(nxb)	
Fractions /Decimals (comparing)	Comparing⇨Two fractions w/Same Denominator Comparing⇨Two fractions w/Same Numerator	Comparing⇨Two fractions Different Denominators Comparing⇨Two fractions Different Numerators (Using benchmark fractions) Compare two decimals to hundredths (same whole)	Compare two decimals to thousandths
Fractions (Addition/Subtraction)		Parts of the same whole Like denominators Mixed numbers w/like denominator (using equivalent fractions, properties, relationship btw +/-)	Unlike denominators Mixed numbers w/unlike denominators (using equivalent fractions)
Fractions (Composing/Decomposing)		Like denominators	
Fractions (Multiplication/Division)		Understanding a/b as a multiple of 1/b (using visual fraction models and equations) Multiply a fraction in the form of a/b by whole number (using visual fraction models and equations)	Understanding (a/b) x q = a x q ÷ b (using visual fraction models, area models, and contexts) and (a/b) x (c/d) =ac/db) (using visual fraction models, area models, and contexts) Multiply a fraction by a whole number or a fraction Divide a unit fraction by a whole number and a whole number by a unit fraction



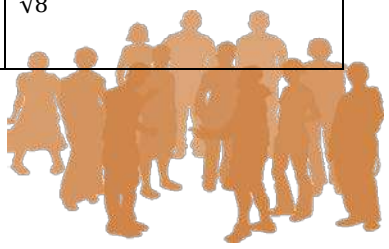
Fractions (Problem Solving)		Addition/Subtraction Parts of the same whole Like denominators (using visual fraction models and equations) Multiplication of a fraction in the form of a/b by whole number (using visual fraction models and equations)	Addition/Subtraction Parts of the same whole Unlike denominators (using visual fraction models and equations) Division of whole numbers leading to answers in the form of fractions or mixed numbers Multiplication of fractions and mixed numbers (using visual fraction models and equations) Division of a unit fraction by a whole number and a whole number by a unit fraction
Fractions (Decimal Notation)		Express a fraction with a denominator of 10 as an equivalent fraction with a denominator of 100. Add two fractions with denominators of 10 & 100 Use decimal notation for fractions with denominators of 10 or 100	
Equal Partitioning	Partition one shape into equal areas and recognize as 1/b.	Generate Line Plots (1/2's, 1/4's, 1/8's) Understand angle measure in reference to a circle (See 4.MD.5.a)	Generate Line Plots (1/2's, 1/4's, 1/8's); incorporating problem solving with operations on fractions
Number line		Locate decimals in 10^{ths} and 100^{ths}	Using a pair of perpendicular number lines to define a coordinate system Graphing points on the coordinate plane (first quadrant) in problem solving contexts

Measurement	Measuring lengths in ½'s and ¼'s		
4-Operations	To solve 2-step word problems; introduce letters for unknown quantity in an equation		Decimals to hundredths (using concrete models and number strategies; properties, relationship btw + / -); related strategy to written method.
Factors		Find all factor pairs in the range of 1-100	
Prime or Composite Numbers		1-100	

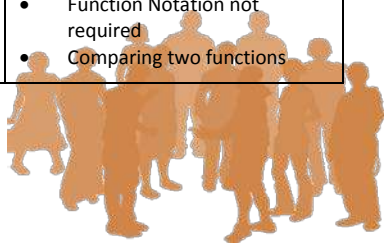
	6	7	8
Fluently Add/Subtract	Multi-digit decimals (using the standard algorithm)		
Fluently Multiply/Divide	Divide multi-digit whole numbers (using the standard algorithm) Multi-digit decimals (using the standard algorithm)		
Factors/Multiples	Find GCF: Two whole numbers ≤ 100 Find LCM: Two whole numbers ≤ 12 Use common factors to express sums of numbers ≤ 100		
Fractions (Multiplication/Division)	Divisions of fractions by fractions		
Fractions (Problem Solving)	Involving division of fractions by fractions (using visual fraction models, story contexts, equations, the relationship between x and ÷)		
Rational Numbers (understanding)	• To describe opposite direction or values • As a point on a number line • In relation to 0 • In the context of the coordinate plane • To compare & order • As magnitude (absolute value)	Apply previous understanding to • Add /Subtract* Making zero (additive inverse) Using the number line Appling properties of operations • Multiply/Divide* Extending understanding of fractions Appling properties of operations Understanding that quotients of integers are rational numbers Interpreting products/quotients in contexts Converting a rational number to a decimal *includes complex fractions	Understand that numbers not rational are irrational Use rational approximations to compare size of irrational numbers



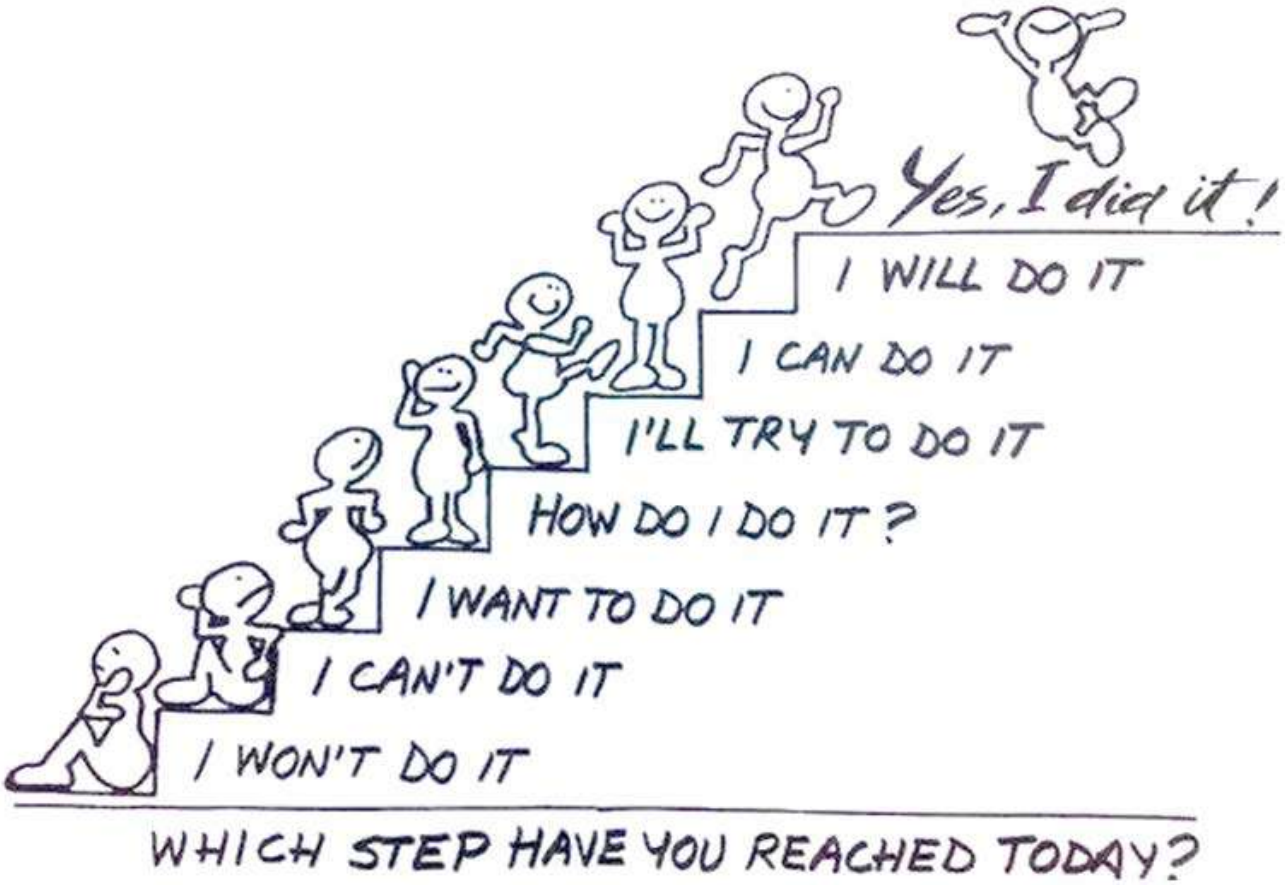
Rational Numbers (problem solving)	Graphing in all 4 quadrants Distance between points • w/same first coordinate • w/same second coordinate	Applying all 4 operations* *includes complex fraction	
Ratios (conditions)	Whole numbers and Non-complex fractions	Complex fractions ($^{a/b}/_{c/d}$)	
Ratios (understanding)	Concept of ratio Concept of unit rate as a/b		
Ratios (reasoning)	Using ratio and rate reasoning to reason about equivalence • Tables of equivalent ratios • Tape diagrams • Double number line diagrams • Equations • The coordinate plane Using ratio and rate reasoning to solve problem relating to • Unit Pricing • Constant Speed • Percent of a quantity (as a rate per 100) • Finding the whole when give a part and a % • Conversion of measurement units	Recognizing and representing proportional relationships • Tables of equivalent ratios • Identifying the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions) • Equations • Graphing on the coordinate plane (noting points (0,0) and (1, r ⇨ where r is the unit rate) Using proportional reasoning to solve problem relating to • Multistep Problems • Simple interest • Tax • Markups/markdowns • Gratuities/commissions • Fees • Percent increase/decrease • Percent error	
Numerical Expressions (Read/Write/Evaluate)	w/whole number exponents (e.g. 5^3)	w/positive and negative rational numbers in any form (whole numbers, fractions, decimals) *in multi-step real life and mathematical problem solving contexts	w/integer exponents and radicals, square and cube roots, scientific notation examples $3^2 \times 3^{-5}$ 7×10^9 $\sqrt[3]{8}$



Algebraic Expressions (Read/Write/Evaluate)	Applying • All 4 operations • Knowledge of terms *(sum, term, product, factor, quotient, coefficient)* • Specific values for variables • Whole number exponents • Order of operations		
Algebraic Expressions (Equivalence)	Applying • The properties of operations determine equivalence* *Whole number coefficients	Applying • The properties of operations to add, subtract, factor, expand* Rewriting • Using the properties of operations to show relationships between different forms of an expression *Rational coefficients	
Equations and Inequalities (Problem Solving) **Dependent and Independent Variables**	Equation Forms • x + p = q • px = q p, q, x ⇨are non-negative Rational Numbers Inequality Forms • x < c • x > c Using variables to represent quantities that change in relationship to	Constructing simple equations • px + q = r • p(x + q) = r p, q, x Are specific Rational Numbers Solve fluently Compare algebraic solution to arithmetic solution Inequality Forms • px + q < r • px + q > r p, q, x ⇨ are specific Rational Numbers Graph the solution set Interpret in context	Graphing Proportional Relationships • interpreting unit rate as slope • comparing two different proportional relationships • Using similar triangles to explain slope • Deriving the equation y=mx; y=mx + b Solve linear equations • w/rational coefficients Solving Systems of linear equations (in one variable) • One solution • Infinite solutions • No solutions Solving Systems of linear equations (in two variables) Functions • Input/output • Function Notation not required • Comparing two functions



	one another.		(algebraically, graphically, numerically in tables, verbally) • Interpret y = mx + b as linear • Recognize non-linear functions • Model linear relationships (determine rate or change and initial value) • Describe qualitative features of a functional relationship (increasing, decreasing, linear, non-linear) • Sketch a graph based on the qualitative features


Yes, I did it!
I WILL DO IT
I CAN DO IT
I'LL TRY TO DO IT
HOW DO I DO IT?
I WANT TO DO IT
I CAN'T DO IT
I WON'T DO IT
WHICH STEP HAVE YOU REACHED TODAY?

MATH

Course Proficiencies

(Kindergarten – High School)

Course Proficiencies

K-8

Within this section, the K-8 Common Core State Standards have been organized into course proficiencies that provide a strong foundation elementary, middle and high school success.

High School

At the high school level, the Common Core State Standards (CCSS) for Mathematics are organized by conceptual category (number and quantity, algebra, functions, geometry, modeling and probability and statistics), showing the body of knowledge students should learn in each category to be college and career ready, and to be prepared to study more advanced mathematics (*See the Common Core State Standards for Mathematics*, 2010). The inclusion of certain proficiencies within their respective courses is based largely upon the CCSS's recommended Model Traditional Pathway for Algebra I, Algebra II, and Geometry.

While all standards figure in a mathematical education leading to college and career readiness, a few (+) standards have been included that reflect the additional mathematics that students should learn in order to take advanced courses such as Calculus, Advanced Statistics or Discrete Mathematics. While these standards have been included to increase coherence, they are not necessarily expected to be addressed on high stakes assessments. Proficiencies assessed on end-of-course assessments are shown by an asterisk (*).

While the focus of this section is on organizing the Standards for Mathematical Content into bounded courses leading to college and career readiness, the content standards must be connected to the Standards for Mathematical Practice to ensure that the skills needed for later success are developed. In particular, Modeling (defined by a ★) is an important avenue for motivating students to study mathematics, for building their understanding of mathematics, and for preparing them for future success.

Kindergarten

Course Proficiencies

The student will be able to:

- Count to 100 by ones and by tens.
- Count forward beginning with a given number (other than one) between two and 100.
- Represent a number of objects with a written numeral between 0 and 20.
- Connect counting to cardinality.
- Count to answer "how many" up to 20 objects.
- Compare the number of objects, up to 20, in two different groups as being: $=$, $>$, or $<$.
- Compare written numerals between 1 and 10 as being: $=$, $>$, or $<$.
- Recognize addition as putting together or adding too, and subtraction taking apart or taking from.
- Solve real world problems in addition and subtraction (up to 10), using objects, drawings, etc.
- Find the integer needed to reach 10 when given an integer between 1 and 9.
- Use objects or drawings to compose or decompose numbers from 11 to 19 into ten ones and some further ones.
- Compare height and weight of two different objects as: $=$, $>$, or $<$.
- Describe several measurable attributes of a single object (e.g. such as length, weight, size, and color)
- Classify objects into given categories: count the numbers of objects in each category and sort the categories by count.
- Identify objects in the environment by shape, naming the shape of each.
- Recognize that the size does not affect the name of the shape.
- Identify both two-dimensional and three-dimensional shapes by name.
- Model well-known shapes by building components.
- Compose simple shapes to forms larger shapes.
- Fluently add and subtract within 5.
- Decompose numbers less than or equal to 10 into pairs in more than one way.

First Grade

Course Proficiencies

The student will be able to:

- From a word problem, replace a symbol with a whole number by addition or subtraction within 20.
- Solve multistep word problems that call for addition of three whole numbers whose sum is less than or equal to 20.
- Apply the commutative and associative properties of addition as a strategy.
- Understand the relationship between addition and subtraction.
- Relate counting to addition and subtraction.
- Fluently add and subtract within 10.
- Add within 100.
- Determine if equations involving addition and subtraction are true or false.
- Find the value of any whole number that is missing in an addition or subtraction equation.
- Count to 120, given any starting integer between 1 and 120.
- Explain the concept of place value (tens and ones).
- Compare two two-digit numbers based on meanings of the tens and ones digits, and record the comparison as: $=$, $>$, or $<$.
- Add combinations of multi- or single-digit numbers to 100.
- Mentally add 10, or subtract 20, to/from a given number.
- Mentally add multiples of 10, or subtract multiples of 10, from a given number.
- Order multiple objects by length and compare the length of two objects to the length of a third.
- Tell time to the hour and half-hour (analog and digital).
- Organize, represent, and interpret data based on data comparison.
- Identify defining attributes of particular shapes.
- Build or draw shapes based on the defining attributes of that shape.
- Use, identify and define two-dimensional and three-dimensional shapes to create a composite shape.
- Partition two-dimensional shapes into various amounts of equal parts.

Second Grade

Course Proficiencies

The student will be able to:

- Solve one- and two-step word problems by addition and subtractions within 100.
- Mentally add and subtract within 20 all sums of one-digit numbers.
- Determine if a number is odd or even, up to 20.
- Find the total number of objects in a rectangular array up to 5 rows and 5 columns.
- Explain that a three-digit number has a hundreds, tens and ones place.
- Count to 100 by ones, fives, tens and hundreds.
- Read and write numbers to 1000.
- Compare two three-digit numbers and record the comparison as : $=$, $>$, or $<$.
- Mentally add or subtract within 100.
- Add up to four two-digit numbers using strategies based on place value and properties of operations.
- Use models or drawings and strategies based on place value to add and subtract within 1000.
- Mentally add or subtract 10 or 100 to a given number.
- Explain why place value works when adding or subtracting multi-digit numbers.
- Appropriately measure objects using measuring tools.
- Measure a particular object in two different units of length and explain the difference in the numerical lengths.
- Estimate lengths in standard and metric units.
- Determine the difference in the length of two objects .
- Solve word problems involving lengths using addition and subtraction.
- Represent whole number lengths on a number line diagram finding sums and differences up to 100.
- Tell time to the nearest five minutes
- Solve word problems involving all denominations of money using $ and ¢.
- Identify and draw specific two-dimensional shapes based on their attributes.
- Partition a rectangle into rows and columns of same-size squares and count the squares.
- Partition a circle into two, three or four equal shares and identify each part as a half, third, fourth, etc.

Third Grade

Course Proficiencies

The student will be able to:

- Describe an example that will result in the multiplication of whole numbers.
- Interpret partitioning as dividing objects into equal shares.
- Solve word problems that involve multiplication or division within 100.
- Use drawings and equations with a symbol for unknown quantities in situations involving groups, arrays or measurement quantities.
- Determine an unknown whole number in a multiplication or division problem.
- Use a property of operation as a strategy in multiplication and division.
- Multiply and Divide within 100 from memory.
- Represent the unknown in a word problem by a letter (variable) and solve a two-step work problem.
- Use properties of operations to identify arithmetic patterns.
- Round whole numbers to the nearest 10 or 100.
- Use strategies and algorithms on place value and properties of operations to add and subtract within 1000.
- Describe a fraction as a quantity partitioned into equal parts, the number of parts corresponding to the denominator.
- Apply the concept of the unit fraction.
- Identify any fraction as a point on the number line.
- Compare equivalent fractions and explain why they are equivalent in all cases.
- Solve word problems within one minute that involve addition and subtraction of time intervals.
- Solve one-step word problems involving masses or volumes given in the same units that involve any of the four operations.
- Explain the concept of area as a “square unit”.
- Find area of plane figures using addition or multiplication.
- Solve word problems by finding perimeters of polygons.
- Recognize which attributes any two given quadrilaterals may share in common.
- Partition shapes into parts with equal areas.

Fourth Grade

Course Proficiencies

The student will be able to:

- Recognize a verbal statement as a multiplicative comparison and convert it to a multiplication equation.
- Solve word problems involving multiplicative comparisons.
- Solve multistep word problems involving integers with integral answers using all four mathematical operations.
- Factor all number up to 100, identify each factor pair.
- Determine if a number between 1 – 100 is composite or prime.
- Generate a number of shape patterns that follows a specific rule and identify the apparent features of that pattern.
- Explain the difference between the ones – tens place; tens-hundreds place; etc. as the number on the left being ten times what it represents on the right.
- Correctly use the symbols: $=$, $>$, and $<$.
- Round multi-digit whole number to any place.
- Add and subtract multi-digit whole numbers using the standard procedure.
- Multiply up to a four digit number by another number of one or two digits.
- Divide four digit numbers by a one digit division in whole numbers with remainders.
- Explain equivalent fractions by modeling.
- Determine : $=$, $>$, or $<$ between any two fractions with different numerators and denominators.
- Justify the decomposition of a fraction using the same denominator.
- Add and subtract fractions with like denominators.
- Add and subtract mixed numbers with like denominators.
- Solve word problems involving fractions or mixed numbers with like denominators.
- Convert fractions with denominators of 10 or 100 to decimals.
- Compare decimals to hundredths by reasoning about their size and determine the comparison as : $=$, $>$, or $<$.
- Relate measurement units in both the standard and metric scale.

Fourth Grade

Course Proficiencies (continued)

- Solve word problems involving distance, time-intervals, liquid volume, mass of objects, and money, with both fractions and decimals, using the basic four mathematical operations.
- Find area and perimeter of rectangles in real world situations.
- Develop a line plot with fractional data, then show addition and subtraction of fractions using the line plot.
- Explain the measure of an angle as part of a circle
- Determine the number of degrees in an angle using a protractor.
- Decompose an angle recognizing that the whole is equal to the sum of its parts.
- Identify lines or line segments that are parallel or perpendicular.
- Identify angles that are right, acute or obtuse.
- Explain the concept of symmetry as a line that divides a figure into matching parts.

Fifth Grade

Course Proficiencies

The student will be able to:

- Simplify the distributive property of multiplication.
- Recognize “grouping symbols” as indicators of multiplication.
- Form ordered pairs using two different rules.
- Explain that, in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.
- Compare decimals to thousandths.
- Round decimals to any place.
- Multiply multi-digit whole numbers
- Find whole number quotients with multi-digit dividends and divisors.
- Use models or drawings to add, subtract, multiply and divide decimals to hundredths.
- Add and subtract fractions and mixed numbers with unlike denominators.
- Solve word problems involving the addition and subtraction of fractions and mixed numbers.
- Explain that a fraction is the division of the numerator by the denominator.
- Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.
- Multiply whole numbers or fractions by a fraction.
- Find the area of rectangles with fractional side lengths.
- Explain why multiplying a number by a proper fraction results in a product smaller than the multiplicand, and why multiplying a number by an improper fraction results in a product greater than the multiplicand.
- Use visual fraction models or equations to solve real world problems involving multiplication of fractions and mixed numbers.
- Divide whole numbers by fractions, and fractions by whole numbers.
- Solve real world problems involving division of fractions and whole numbers.
- Solve multi-step real world problems involving the conversion of standard measurement units within a given measurement system.

Fifth Grade

Course Proficiencies (continued)

- Develop a line chart to represent data presented as fractions.
- Recognize that volume relates to solid figures, and “one cubic unit” is used to measure volume.
- Find the volume of a specific solid.
- Solve real world and mathematical problems relating to volume by using multiplication and division.
- Identify and label all major parts of a coordinate axes system, recognizing that the first and second number in an ordered pair indicate how from to travel from the origin both horizontally and vertically.
- Graph points in the first quadrant of the coordinate plane and relate them to real world and mathematical problems.
- State equivalent parts of two-dimensional figures and arrange them in a hierarchy based on properties.

Grade 6

Course Proficiencies

The student will be able to:

- Understand the concept of ratio and use accurate language to describe a ratio relationship between two quantities.
- Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$
- Use ratio and rate reasoning to solve real-world and mathematical problems.
- Make tables of equivalent ratios relating quantities with whole number measurements, compare ratios and find missing values
- Plot the pairs of values on the coordinate plane.
- Solve unit rate problems including those involving unit pricing and constant speed
- Find a percent of a quantity as a rate per 100
- Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
- Interpret and compute quotients of fractions
- Solve word problems involving division of fractions by fractions
- Fluently divide multi-digit numbers using the standard algorithm.
- Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
- Find the greatest common factor of two whole numbers less than or equal to 100
- Find the least common multiple of two whole numbers less than or equal to 12.
- Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values
- Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
- Understand a rational number as a point on the number line.
- Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

Grade 6

Course Proficiencies

- Understand ordering and absolute value of rational numbers.
- Interpret statements of inequality.
- Write, read, and evaluate expressions in which letters stand for numbers.
- Apply the properties of operations to generate equivalent expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.
- Solve real-world and mathematical problems involving area, surface area, and volume.
- Represent three-dimensional figures using nets of rectangles and triangles, and use the nets to find the surface area of these figures.
- Develop understanding of statistical variability.
- Summarize and describe distributions.

Grade 7

Course Proficiencies

The student will be able to:

- Use ratios of lengths, areas and other quantities to compute unit rates associated with ratios of fractions.
- Recognize and represent proportional relationships between quantities.
- Identify a constant of proportionality.
- Represent proportional relationships by equations.
- Solve multi-step ratio and percent problems.
- Add and subtract rational numbers.
- Represent addition and subtraction on a horizontal or vertical number line diagram.
- Understand that a number added to its “additive inverse” results in zero.
- Apply properties of operations as strategies to add and subtract rational numbers.
- Multiply and divide rational numbers.
- Explain products of rational numbers by describing real world situations.
- Understand that all integers can be divided provided the divisor is not zero, and that the quotient will be a rational number.
- Convert a rational number to a decimal by using long division.
- Solve real world and mathematical problems involving the four operations with rational numbers.
- Add, subtract, factor, and expand liner expressions with rational coefficients.
- Solve multi-stem real world 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 computations and estimation strategies.
- Use variables to represent quantities and construct equations and inequalities to solve problems about quantities.
- Compute actual lengths and areas of a geometric figure from scale drawings and reproductions of the figure.
- Draw geometric shapes with specific given conditions.
- Describe the two-dimensional figures that result from slicking three-dimensional figures, as in a plane section of the three-dimensional figure.
- Solve problems using the formulas for area and circumference of a circle.

Grade 7

Course Proficiencies (continued)

- Use knowledge of supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
- Solve real world problems involving area, volume and surface area.
- Use random sampling results to make generalizations about a population.
- Determine if generalizations about a population are valid based on random samplings.
- Determine informal comparative inferences about two populations based on the differences between the centers.
- Understand that all probability is a number between zero and one.
- Predict the probability of an event based on the relative frequency of that event.
- Develop a probability model.
- Use an organized list, a table, a tree diagram or a simulation to find the probability of a compound event.

Grade 8

Course Proficiencies

The Student will be able to:

- Explain the difference between a rational and an irrational number.
- Approximate an irrational number to compare irrational numbers and give it a location on the number line.
- Simplify expressions using the properties of exponents.
- Solve equations that result in a square root or a cube root.
- Express very large or very small numbers in scientific notation and perform operations with scientific notation numbers.
- Graph a proportional relationship as the slope of a line.
- Explain why the slope is the same between any two distinct points on a non-vertical line in the coordinate plane.
- Solve linear equations in one-variable.
- Solve systems of equations in two-variables.
- Solve real world and mathematical problems leading to two linear equations in two variables.
- Explain that a function has exactly one output for each input.
- Compare properties of two functions.
- Evaluate a linear function.
- Use functions to model relationships between quantities.
- Explain experimentally the properties of rotations, reflections, and translations.
- Explain how two two-dimensional figures are congruent if the first can be taken to the second by a sequence of rotations, reflections, and translations.
- Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
- Explain how two two-dimensional figures are similar if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations.

Grade 8

Course Proficiencies (continued)

- Explain about the angle sum and exterior angles of triangles; about angle formed by parallel lines cut by a transversal; and the angle-angle criteria for similarity of triangles.
- Explain a proof of the Pythagorean Theorem and its converse.
- Find the sides of a right triangle using the Pythagorean theorem.
- Use the Pythagorean Theorem to find the distance between two points in a coordinate system.
- Solve real world problems involving the volume of cones, cylinders, and spheres.
- Investigate patterns of association between two quantities by interpreting scatter plots for bivariate measurement data.
- Use a “best-fit-line” on a scatter plot to judge the relationship between two quantitative variables.
- Solve problems by interpreting the slope and intercepts in a linear model.
- Use a two-way table to display frequencies and relative frequencies based on patterns of association.

Algebra I

Prerequisite: None

Course Description: Algebra 1 includes the study of real number properties, relationships between quantities, expressions, equations and inequalities, systems of equations, and solving and graphing linear and quadratic equations. Problem-solving techniques are stressed.

Course Proficiencies/Student Outcomes:

Relationships between Quantities and Reasoning with Equations

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.*
2. Define appropriate quantities for the purpose of descriptive modeling.*
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*
4. Interpret expressions that represent a quantity in terms of its context.★*
    a. Interpret parts of an expression, such as terms, factors, and coefficients.
    b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P.*
5. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.**
6. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
7. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.**
8. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.**
9. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.*
10. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*

Linear and Exponential Relationships

1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.
3. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.*
4. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*
5. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).*
6. Explain why the x-coordinates of the points where the graphs of the equations *y = f(x)* and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f(x)* and/or *g(x)* are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★∗
7. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.*
8. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x)*.*
9. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.*
10. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.**
11. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★∗
12. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★∗
13. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★∗
14. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★
15. Distinguish between situations that can be modeled with linear functions and with exponential functions.*
    a. Prove that linear functions grow by equal differences over equal intervals; and that exponential functions grow by equal factors over equal intervals.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

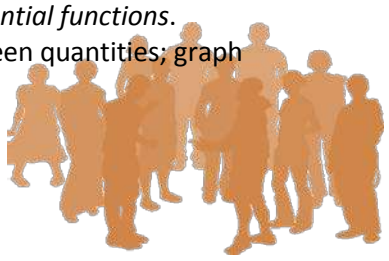
16. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*
17. Interpret the parameters in a linear or exponential function in terms of a context.*

Descriptive Statistics

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).*
2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.*
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).*
4. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.*
5. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.*
    a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.
    b. Informally assess the fit of a function by plotting and analyzing residuals.
    c. Fit a linear function for a scatter plot that suggests a linear association.
6. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
7. Compute (using technology) and interpret the correlation coefficient of a linear fit.*
8. Distinguish between correlation and causation.*

Expressions and Equations

1. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*
2. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★*
    a. Factor a quadratic expression to reveal the zeros of the function it defines.
    b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
    c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
3. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.*
4. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*.
5. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*



6. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
7. Solve quadratic equations in one variable.*
    a. Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
    b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers *a* and *b*.
8. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.*

Quadratic Functions and Modeling

1. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
2. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★
3. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★
4. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★
5. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★*
    a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
    b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
6. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.*
    a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
    b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.*
7. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.**
8. Write a function that describes a relationship between two quantities.★

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.*
b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

9. Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx),* and *f(x + k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.**

10. Find inverse functions.
    a. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, f(x) = 2 x3 or f(x) = (x+1)/(x-1) for x ≠ 1.*

11. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

A poem…

Today was the absolute worst day ever

And don't try to convince me that

There's something good in every day

Because, when you take a closer look,

This world is a pretty evil place.

Even if

Some goodness does shine through once in a while

Satisfaction and happiness don't last.

And it's not true that

It's all in the mind and heart

Because

True happiness can be attained

Only if one's surroundings are good

It's not true that good exists

I'm sure you can agree that

The reality

Creates

My attitude

It's all beyond my control

And you'll never in a million years hear me say

Today was a very good day

Now read it from bottom to top, the other way,

And see the power of perspective…

Algebra II

Prerequisite: Algebra I

Course Description: Algebra 2 expands the study of algebra to include complex numbers, quadratics, and logarithms. Topics include the study of linear, quadratic, polynomial, exponential and logarithmic functions, each integrating technology and real world applications.

Course Proficiencies/Student Outcomes:

Polynomial, Rational, and Radical Relationships

1. Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form $a + bi$ with *a* and *b* real.*
2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.*
3. Solve quadratic equations with real coefficients that have complex solutions.*
4. Interpret expressions that represent a quantity in terms of its context.★
    a. Interpret parts of an expression, such as terms, factors, and coefficients.
    b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*
5. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.*
6. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★∗
7. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.*
8. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number *a*, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only *if* $(x - a)$ is a factor of p(x).*
9. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.*
10. Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.*
11. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.*
12. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.*
13. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★∗
14. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★∗

a. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

15. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
16. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x– 2i)$.
17. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
18. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

Trigonometric Functions

1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.*
2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.*
3. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★∗
4. (+) Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin (θ), cos (θ), or tan (θ), given sin (θ), cos (θ), or tan (θ), and the quadrant of the angle.*

Modeling with Functions

1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*
2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.**
4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*
5. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★
6. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★
7. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★∗
8. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★

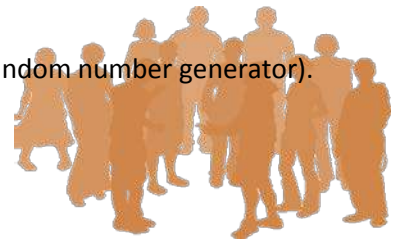
a) Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

b) Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*

9. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
10. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
11. Write a function that describes a relationship between two quantities.*
    a. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.**
12. Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx)*, and *f(x + k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.*
13. Find inverse functions.
    a. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, f(x) = 2 x^3 or f(x) = (x+1)/(x-1) for x ≠ 1.*
14. For exponential models, express as a logarithm the solution to a $x\ b^{ct} = d$ where *a, c,* and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.*
15. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
16. (+) Interpret the parameters in a linear or exponential function in terms of a context.

Inferences and Conclusions from Data

1. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
2. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.*
3. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?**
4. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.*
5. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.*
6. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.*
7. Evaluate reports based on data.*
8. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).



9. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
10. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
11. (+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Note: In this course, students recognize arithmetic and geometric sequences (and as special cases of linear and exponential functions, respectively), which completes these standards. Students use their knowledge of sequences to study series, focusing on arithmetic series (and treating the sequence of partial sums as an example of a quadratic function) and on geometric series, as in A-SSE.4.

Geometry

Prerequisite: Algebra I

Course Description: Geometry includes the study of plane and three-dimensional figures. Logical thinking is explored through deductive and inductive methods. Topics include the geometry of points, lines, and planes, properties of congruence and similarity, circles and spheres, coordinate geometry, area, and volume.

Course Proficiencies/Student Outcomes:

Congruence, Proof, and Construction

1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.*
2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).*
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.*
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.*
5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.*
6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.*
7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.*
8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.*
9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.**
10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.**
11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.**
12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment;*

*copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.**

13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.*

Similarity, Proof, and Trigonometry

1. Verify experimentally the properties of dilations given by a center and a scale factor.*
    a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
    b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.*
3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.*
4. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.*
5. Explain and use the relationship between the sine and cosine of complementary angles.*
6. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.★∗
7. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*
8. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
9. (+) Derive the formula $A = 1/2\ ab\ \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.
11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Extending to Three Dimensions

1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's Principle, and informal limit arguments.**
2. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★∗
3. Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.*
4. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*

Connecting Algebra and Geometry through Coordinates

1. Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*
2. Prove the slope criteria for parallel and perpendicular lines and uses them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).*
3. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.*
4. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.★*
5. Derive the equation of a parabola given a focus and directrix.

Circles With and Without Coordinates

1. Prove that all circles are similar.*
2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.**
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.*
4. Identify and describe relationships among inscribed angles, radii, and chords. *
5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.*
6. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.*
7. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*
8. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
9. (+) Construct a tangent line from a point outside a given circle to the circle.

Applications of Probability

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
3. Understand the conditional probability of *A* given *B* as *P(A* and *B)/P(B)*, and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are

independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*
6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.
7. Apply the Addition Rule, *P(A* or *B) = P(A) + P(B) – P(A* and *B)*, and interpret the answer in terms of the model.
8. (+) Apply the general Multiplication Rule in a uniform probability model, *P(A* and *B) = P(A)P(B|A) = P(B)P(A|B)*, and interpret the answer in terms of the model.
9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.
10. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
11. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Pre-Calculus

Prerequisite: Algebra I, Geometry, Algebra II

Course Description: Precalculus includes polynomial, exponential, logarithmic, rational and trigonometric functions: expressed numerically, graphically, algebraically and analytically. Emphasis in the trigonometry portion of the course includes analysis and graphic interpretation of the six trigonometric functions. Series, sequences, conic sections and their applications are developed and applied. Limits of continuous functions are defined and applied as a foundation for calculus.

Course Proficiencies/Student Outcomes:

1. Apply concepts of linear relations, functions, and inverses.
2. Graph polynomial and rational functions.
3. Apply basic concepts of analytical geometry.
4. Perform operations with functions.
5. Analyze trigonometric and logarithmic functions using different representations.
6. Solve system of equations.
7. Define and sketch graphs of the six circular functions.
8. Solve triangles using the appropriate trigonometric ratio, Law of Sines, or Law of Cosines.
9. Define, evaluate, and graph trigonometric functions and their inverses.
10. Identify, simplify, and verify trigonometric identities.
11. Solve trigonometric equations algebraically and graphically.
12. Perform basic operations with geometric and algebraic vectors.
13. Perform basic operations on complex numbers expressed in rectangular or polar form.
14. Graph polar coordinates and polar equations, and identify and graph classical curves.
15. Use De Moivre's Theorem to find powers and roots of complex numbers.
16. Graph, write, and identify equations of conic sections.
17. Evaluate exponential and logarithmic expressions.
18. Solve exponential and logarithmic equations algebraically and graphically.
19. Calculate expected values and use them to solve problems.
20. Use probability to evaluate outcomes of decisions.
21. Explain volume formulas and use them to solve problems.
22. Perform operations on matrices and use matrices in applications.
23. Find the nth term of an arithmetic or geometric sequence.
24. Determine the sum of a finite arithmetic or geometric series, and of an infinite geometric series.
25. Evaluate limits of polynomial and rational functions.
26. Determine the slope of a curve.
27. Evaluate the limit of sequences, and functions at infinity.
28. Determine the area under a curve using the area of rectangles.

29. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes.
30. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
31. (+) Solve problems involving velocity and other quantities that can be represented by vectors.
32. (+) Add and subtract vectors:
    a) Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
    b) Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.
    c) Understand vector subtraction $v - w$ as $v + (-w)$, where $-w$ is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.
33. (+) Multiply a vector by a scalar.
    a) Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise.
    b) Compute the magnitude of a scalar multiple cv using $||cv|| = |c|v$. Compute the direction of $c\boldsymbol{v}$ knowing that when $|c|v \neq 0$, the direction of cv is either along v (for $c > 0$) or against v (for $c < 0$).
34. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
35. (+) Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
36. (+) Interpret the parameters in a linear or exponential function in terms of a context.
37. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
38. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
39. (+) Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
40. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
41. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
42. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.
43. (+) Derive the equation of a parabola given a focus and directrix.
44. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Calculus

Prerequisite: Algebra I, Geometry, Algebra II, Precalculus

Course Description: Calculus is a full-year course in elementary functions, in which both differential and integral calculus concepts are explored. Topics include limits, functions (polynomial, rational, radical, and transcendental), rate of change, curve sketching, optimization, anti-derivatives and indefinite integrals, and the application of the rules of differentiation and integration.

Course Proficiencies/Student Outcomes:

1. Work with functions represented in a variety of ways: graphical, numerical, analytical, and verbal; understand the connections among these representations.
2. Understand the meaning of the derivative and use derivatives to solve a variety of problems.
3. Understand the meaning of both definite and indefinite integrals, and use definite and indefinite integrals to solve a variety of problems.
4. Understand and apply the Fundamental Theorem of Calculus to definite integrals; understand the relationship between the derivative and the definite integral as expressed in the Fundamental Theorem of Calculus.
5. Communicate mathematics, both orally and in well-written sentences and explain solutions to problems.
6. Model a written description of a physical situation with a function or an integral.
7. Use technology to help solve problems, experiment with data, interpret results, and verify conclusions.
8. Determine the plausibility of solutions, including sign, size, relative accuracy, and units of measurement.
9. Develop an appreciation of calculus as a coherent body of knowledge, connected to other disciplines outside of mathematics.

AP Calculus (AB)

Prerequisite: Algebra l, Geometry, Algebra ll, and Pre-Calculus

Course Description: AP Calculus is a double-period course intended for students who have a thorough knowledge of college preparatory mathematics including algebra, axiomatic geometry, trigonometry, and analytic geometry. This course provides an opportunity for students to receive credit for college level course work.

Course Proficiencies/Student Outcomes:

1. Analyze graphs to both predict and to explain the observed local and global behavior of a function.
2. Demonstrate an understanding of the limiting process.
3. Calculate limits using algebra.
4. Estimate limits from graphs or tables of data.
5. Describe asymptotes in terms of graphical behavior.
6. Describe asymptotic behavior in terms of limits involving infinity.
7. Compare relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth).
8. Demonstrate an intuitive understanding of continuity (the function values can be made as close as desired by taking sufficiently close values of the domain).
9. Determine continuity in terms of limits.
10. Use geometric applications of continuous functions such as the Intermediate Value Theorem and the Extreme Value Theorem.
11. Represent derivatives graphically, numerically, and analytically.
12. Interpret derivatives as instantaneous rates of change.
13. Define a derivative as the limit of the difference quotient.
14. Demonstrate an understanding of the relationship between differentiability and continuity.
15. Find the slope of a curve at a point.
16. Use the derivative at a point to find the tangent line to a curve at a point and local linear approximation.
17. Find the instantaneous rate of change as the limit of average rate of change.
18. Find the approximate rate of change from graphs and tables of values.
19. Demonstrate an understanding of the corresponding characteristics of the graphs of ƒ and ƒ’.
20. Determine the relationship between the increasing and decreasing behavior of ƒ and the sign of ƒ’.
21. Use the Mean Value Theorem and its geometric interpretation to find ƒ’.
22. Translate verbal descriptions into equations involving derivatives and vice versa
23. Demonstrate an understanding of the corresponding characteristics of the graphs of ƒ, ƒ’, and ƒ’’.
24. Determine the relationship between the concavity of *f* and the sign of *f* ’’.
25. Use the points of inflection to determine where concavity changes.

26. Use derivatives to analyze curves, including the notions of monotonicity and concavity.
27. Optimize both absolute (global) and relative (local) extrema.
28. Model rates of change, including related rates problems.
29. Use implicit differentiation to find the derivative of an inverse function.
30. Interpret the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration.
31. Use slope fields and the relationship between slope fields and solution curves for differential equations to find the geometric interpretation of differential equations.
32. Find the derivative of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions.
33. Find the derivative of a function using the derivative rules for sums, products, and quotients of functions.
34. Demonstrate an understanding of the Chain rule and implicit differentiation.
35. Use Riemann sums to find the definite integral.
36. Apply the understanding of Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:

$$\int_a^b f'(x)dx - f(b) - f(a)$$

37. Use basic properties of definite integrals (examples include additivity and linearity).
38. Use integrals in a variety of applications to model physical, biological, or economic situations.
39. Evaluate definite integrals using the Fundamental Theorem.
40. Represent a particular antiderivative, and the analytical and graphical analysis of functions so defined using the Fundamental Theorem.
41. Use derivatives of basic functions to find antiderivatives.
42. Use substitution of variables (including change of limits for definite integrals) to find antiderivatives.
43. Use initial conditions, including applications to motion along a line to find specific antiderivatives.
44. Solve separable differential equations and use them in modeling (including the study of the equation y' = ky and exponential growth).
45. Use Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values.

AP Calculus (BC)

Prerequisite: Algebra l, Geometry, Algebra ll, and Pre-Calculus

Course Description: Calculus BC is an extension of Calculus AB and includes the application of parametric polar and vector functions, applications and derivatives and integrals and polynomial approximations and series.

Course Proficiencies/Student Outcomes:

1. Analyze graphs to both predict and to explain the observed local and global behavior of a function.
2. Demonstrate an understanding of the limiting process.
3. Calculate limits using algebra.
4. Estimate limits from graphs or tables of data.
5. Describe asymptotes in terms of graphical behavior.
6. Describe asymptotic behavior in terms of limits involving infinity.
7. Compare relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth).
8. Demonstrate an intuitive understanding of continuity (the function values can be made as close as desired by taking sufficiently close values of the domain).
9. Determine continuity in terms of limits.
10. Use geometric applications of continuous functions such as the Intermediate Value Theorem and the Extreme Value Theorem.
11. Analyze planar curves given in parametric form, polar form, and vector form.
12. Represent derivatives graphically, numerically, and analytically.
13. Interpret derivatives as instantaneous rates of change.
14. Define a derivative as the limit of the difference quotient.
15. Demonstrate an understanding of the relationship between differentiability and continuity.
16. Find the slope of a curve at a point.
17. Use the derivative at a point to find the tangent line to a curve at a point and local linear approximation.
18. Find the instantaneous rate of change as the limit of average rate of change.
19. Find the approximate rate of change from graphs and tables of values.
20. Demonstrate an understanding of the corresponding characteristics of the graphs of ƒ and ƒ'.
21. Determine the relationship between the increasing and decreasing behavior of ƒ and the sign of ƒ'.
22. Use the Mean Value Theorem and its geometric interpretation to find ƒ'.
23. Translate verbal descriptions into equations involving derivatives and vice versa
24. Demonstrate an understanding of the corresponding characteristics of the graphs of ƒ, ƒ', and ƒ''.
25. Determine the relationship between the concavity of *f* and the sign of *f* ''.
26. Use the points of inflection to determine where concavity changes.

27. Use derivatives to analyze curves, including the notions of monotonicity and concavity.
28. Use derivatives to analyze planar curves given in parametric form, polar form, and vector form, including velocity and acceleration.
29. Optimize both absolute (global) and relative (local) extrema.
30. Model rates of change, including related rates problems.
31. Use implicit differentiation to find the derivative of an inverse function.
32. Interpret the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration.
33. Use slope fields and the relationship between slope fields and solution curves for differential equations to find the geometric interpretation of differential equations.
34. Use Euler's method to find numerical solution of differential equations.
35. Use L'Hospital's Rule to solve derivatives, including its use in determining limits and convergence of improper integrals and series.
36. Find the derivative of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions.
37. Find the derivative of a function using the derivative rules for sums, products, and quotients of functions.
38. Demonstrate an understanding of the Chain rule and implicit differentiation.
39. Find the derivatives of parametric, polar, and vector functions.
40. Use Riemann sums to find the definite integral.
41. Apply the understanding of Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:

$$\int_a^b f'(x)dx - f(b) - f(a)$$

42. Use basic properties of definite integrals (examples include additivity and linearity).
43. Use integrals in a variety of applications to model physical, biological, or economic situations.
44. Evaluate definite integrals using the Fundamental Theorem.
45. Represent a particular antiderivative, and the analytical and graphical analysis of functions so defined using the Fundamental Theorem.
46. Use derivatives of basic functions to find antiderivatives.
47. Use substitution of variables, parts, and simple partial fractions (nonrepeating linear factors only) to find antiderivatives .
48. Use of Improper integrals to find antiderivatives.
49. Use initial conditions, including applications to motion along a line to find specific antiderivatives.
50. Solve separable differential equations and use them in modeling (including the study of the equation y' = ky and exponential growth).
51. Solve logistic differential equations and use them in modeling.

52. Use Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values.
53. Use technology to explore convergence and divergence of series.
54. Create motivating examples of series of constants, including decimal expansion.
55. Demonstrate an understanding of Geometric series with applications.
56. Demonstrate an understanding of the harmonic series.
57. Demonstrate an understanding of Alternating series with error bound.
58. Determine the terms of a series as areas of rectangles and their relationship to improper integrals, including the integral test and its use in testing the convergence of p-series.
59. Use the ratio test for convergence and divergence.
60. Compare series to test for convergence or divergence.
61. Demonstrate an understanding of Maclaurin series and the general Taylor series centered at $x = a$.
62. Demonstrate an understanding of Maclaurin series for the functions e^x, sin x, cos x, and $\frac{1}{1-x}$.
63. Manipulate Taylor series and shortcuts to computing Taylor series, including substitution, differentiation, antidifferentiation, and the formation of new series from known series.
64. Define functions by power series.
65. Find the radius and interval of convergence of power series.
66. Find Lagrange error bound for Taylor polynomials.

STUDENT GROWTH OBJECTIVES

Student Growth Objectives (SGO) Sample and Rationale

MATH

AchieveNJ: Student Growth Objectives in 2015-16

What Are Student Growth Objectives (SGOs)?

SGOs are measures of student learning included in the evaluations of all teachers, principals, and assistant/vice principals in New Jersey. Well-designed SGOs provide the following benefits:

- **For Students**: SGOs promote reflective and collaborative teaching practices, alignment among standards, instruction, and assessment, and improvements in student learning.
- **For Teachers** : SGOs provide a method by which teachers can improve their practice while clearly demonstrating their effectiveness through student progress.
- **For Principals/APs/VPs** : Administrators share in the SGO results of their teachers and can use the SGO process to help ensure each student receives the best possible education within their school environment.

SGO Requirements

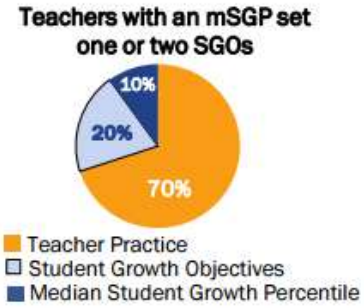
SGOs must be:

- Specific and measurable academic goals that are aligned to state academic standards;
- Based on student growth and/or achievement using available student learning data;
- Developed by a teacher in consultation with his or her supervisor; and
- Approved and scored by a teacher's supervisor.

The number of required SGOs varies depending upon the grade(s) and subject area(s) taught:

- Teachers who receive a median Student Growth Percentile (mSGP) score must create **one or two** SGOs, as determined by the district superintendent. *Note: The Department recommends that teachers of 4th-8th grade Language Arts/4th-7th-grade Math set 2 SGOs if they have 25 students or fewer (30 or fewer in districts where student mobility is high).*
- Teachers who do not receive an mSGP score must create **two** SGOs.

SGOs account for 20% of a teacher's summative rating. Percentages may change in future years as the system evolves and educators share feedback.



MATH

Student Growth Objective Form

(DISTRICT-DEVELOPED SAMPLE SGO for GRADE 7 MATH: *1 of 1*)

Name	School	Grade	Course/Subject	Number of Students	Interval of Instruction
		7	Math		Sept. 2014 – Feb. 2015

Standards, Rationale, and Assessment Method

Critical Area(s): (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations.

Mathematics | Grade 7

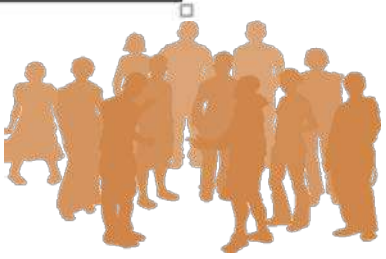
Rationale:

Critical areas are designed to bring focus to the standards in grade 7 by describing the big ideas that teachers may build their instruction upon them. This SGO refle
Grade 7:

Critical Areas reflect the Major Work/Major Clusters of the grad/course and account for a larger % of points on the PARCC Assessment.

(1) Students extend their understanding of ratios and dev
solve single- and multi-step problems. Students u
proportionality to solve a wide variety of percent proble
interest, taxes, tips, and percent increase or decreas
drawings by relating corresponding lengths between
relationships of lengths within an object are preserved
proportional relationships and understand the unit rate info
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 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.



7th Grade SGO Standards

CCSS.MATH.CONTENT.7.NS.A.3
Solve real-world and mathematical problems involving the four operations with rational numbers.[3]

CCSS.MATH.CONTENT.7.RP.A.2
Recognize and represent proportional relationships between quantities.

CCSS.MATH.CONTENT.7.RP.A.2.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.

CCSS.MATH.CONTENT.7.RP.A.2.B
Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

CCSS.MATH.CONTENT.7.RP.A.2.C
Represent proportional relationships by equations.

CCSS.MATH.CONTENT.7.RP.A.2.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.

The SGO standards support the Critical Areas and in turn support the Major Work/Major Clusters for the grade/course.

CCSS.MATH.CONTENT.7.EE.A.1
Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

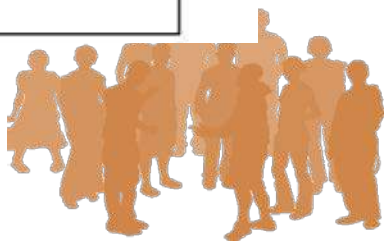
CCSS.MATH.CONTENT.7.EE.A.2
Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.

CCSS.MATH.CONTENT.7.EE.B.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.

CCSS.MATH.CONTENT.7.EE.B.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.

CCSS.MATH.CONTENT.7.EE.B.4.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.

CCSS.MATH.CONTENT.7.EE.B.4.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.



Assessment Method: Authentic Assessments (Assessment Portfolio) will be used as a tool to measure students' growth. The assessment portfolio incorporates carefully selected practice-forward tasks that reflect higher levels of cognitive complexity. All tasks included in the portfolio will be "practice forward" and rubric-scored.

Authentic assessments, dispensed over time, serve as the measure of student growth.

Starting Points and Preparedness Groupings
Student tiers will be determined using a 4-data point system to develop a
assigned a target command level.

Data Measures used to Establish Baselines
2013-2014 Post SGO Score (Fluency); weight (.10)
2013-2014 Post SGO Score (Major Work); weight (.10)
2013-2014 Unit 3 Score; weight (.30)
2013-2014 NJASK6 Score; weight (.50)

Multiple measures, past and present, are used to establish student baselines. Baselines are presented as a Baseline Index. Measures are weighted in some cases to ensure validity.

Preparedness Group	Baseline Score
Tier I	< 0.35
Tier 2	0.35 – 0.55
Tier 3	0.55 – 0.75
Tier 4	> 0.75

Student Growth Objective

By February2015, 70% of nts in each preparedness group will meet their assigned target command level for full attainment of the o as shown in the scoring plan.

Tiers and tier ranges were established based on statistical analyses. See the Tier System document.

Prepared (e.g.	tudents in Each Group	Target Command Level on SGO Assessment Portfolio
Tier 1		2
Tier 2		3
Tier 3		4
Tier 4		5

Scoring Plan

State the projected scores for each group and what percentage/number of students will meet this target at each attainment level. Modify the table as needed.

Preparedness Group	Student Target Command Level	Teacher SGO Score Based on Percent of Students Achieving Target Score			
		Exceptional (4) >80	Full (3) 70-80	Partial (2) 50-69	Insufficient (1) <50
Tier 1	2				
Tier 2	3				
Tier 3	4				
Tier 4	5				

Expectations for growth (Student Target Command Levels) are indicated and expressed as PARCC PLD performance. See the Tier System document.

Approval of Student Growth Obj

Administrator approves scoring plan

Teacher _____ S Submitted_____

Evaluator _____ Signature _____ Date Approved _____

Results of Student Growth Objective

Summarize results using weighted average as appropriate. Delete and add columns and rows as needed.

Preparedness Group	Students at Target Score	Teacher SGO Score	Weight (based on students per group)	Weighted Score	Total Teacher SGO Score
Tier 1					
Tier 2					
Tier 3					
Tier 4					

Notes

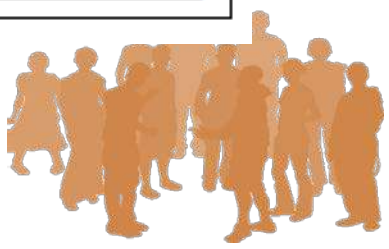
Describe any changes made to SGO after initial approval, e.g. because of changes in student population, other unforeseen circumstances, etc.

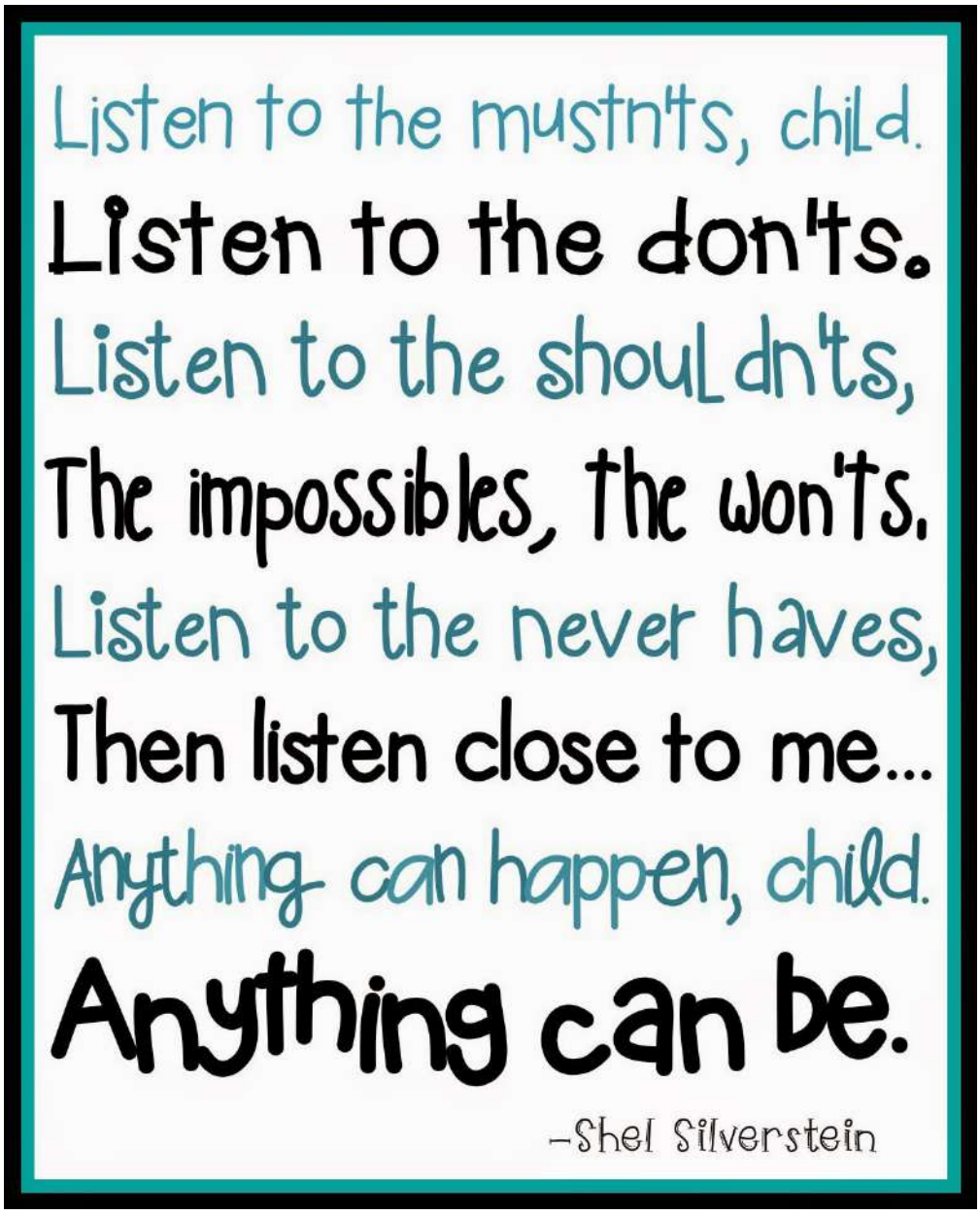
Review SGO at Annual Conference

Describe successes and challenges, lessons learned from SGO about teaching and student learning, and steps to improve SGOs for next year.

Teacher _____ Signature _____ Date _____

Evaluator _____ Signature _____ Date _____




Listen to the mustn'ts, child.
Listen to the don'ts.
Listen to the shouldn'ts,
The impossibles, the won'ts.
Listen to the never haves,
Then listen close to me...
Anything can happen, child.
Anything can be.
-Shel Silverstein

The SMART Objective

An instructional objective is the focal point of a lesson plan. It is a description of an intended learning outcome and is the basis for the rest of the lesson. It provides criteria for constructing an assessment for the lesson, as well as for the instructional procedures the teacher designs to implement the lesson. Without an instructional objective, it is difficult, if not impossible to determine exactly what a particular lesson is supposed to accomplish. Instructional objectives are derived from the standards. In order to write an instructional objective, one should begin with an understanding of the particular content to which the objective will relate. Understanding in more than one way the content to be learned should be a goal of teachers as well as students. This implies that teachers or others who prepare objectives as part of lesson plans or curriculum documents and guides should have more than superficial knowledge of the appropriate content.

The purpose of an instructional objective is to communicate. Therefore, a well-constructed instructional objective should leave little room for doubt about what is intended. A well-constructed instructional objective describes an intended learning outcome. SMART Objectives are specific, reflecting a student outcome from Bloom Taxonomy, measureable, attainable and results-oriented, relevant and based on grade appropriate standards, and time-bound.

For more information, visit:

https://www.youtube.com/watch?v=_woMKwBxhwU

THE MATH NOTEBOOK

Math Notebook Guidelines

The general purpose of the Math notebook is to give students the opportunity to track and reflect on their progress, demonstrate evidence of understanding, and to capture and document learning.

What could be included into a Math Notebook?

- A Table of Contents
- The Do-Now
- Classwork and practice
  - Evidence of solutions
  - Evidence of complete thoughts
  - Use of complete sentences
- Homework (grades 6-12)
  - Answers and work shown
  - Evidence of corrections
- Fluency Practice (grades K-12)
- Daily board notes
- Summary statements, reflections and journal entries
- Group and individual activities
- Academic vocabulary
- A math notebook rubric
- The Daily Demonstration Of Learning (DOL)
- Specific and general rubrics
- Teacher Feedback
- Revisions and second attempt at select problems

THE MATH PORTFOLIO (K-12)

Math Portfolio Guidelines

DESCRIPTION

The Student Assessment Portfolios for Mathematics are used as a means of documenting and evaluating students' academic growth and development over time and in relation to the CCSS-M. This is the only portfolio needed for students in the area of Mathematics. **Student Assessment Portfolios** differ from student work folders in that they will contain tasks aligned specifically to the SGO focus. The September task entry(-ies) will reflect the prior year content and *can serve* as an additional baseline measure. All tasks contained within the **Student Assessment Portfolios** are "practice forward" (closely aligned to the Standards for Mathematical Practice). Four (4) or more additional tasks will be included in the **Student Assessment Portfolios** for Student Reflection and will be labeled as such. In March – June, the months extending beyond the SGO window, tasks will shift from the SGO focus to a focus on the In-depth Opportunities for each grade.

K-12 GENERAL PORTFOLIO REQUIREMENTS

- As a part of last year's end of year close-out process, we asked that student portfolios be 'purged'; retaining a few artifacts and self-reflection documents that would transition with them to the next grade. In this current year, have students select 2-3 pieces of prior year's work to file in the **Student Assessment Portfolio.**
- Tasks contained within the **Student Assessment Portfolios** are "practice forward" and denoted as "Individual", "Partner/Group", and "Individual w/Opportunity for Student Interviews[4].
- Each **Student Assessment Portfolio** should contain a "Task Log" that documents all tasks, standards, and rubric scores aligned to the performance level descriptors (PLDs).
- Student work should be attached to a completed rubric; teacher feedback on student work is expected.
- Students will have multiple opportunities to revisit certain standards. Teachers will capture each additional opportunity "as a new and separate score" in the task log and in Genesis.
- A 2-pocket folder for each **Student Assessment Portfolio** is *recommended.*
- All **Student Assessment Portfolio** entries should be scored and recorded in Genesis as an Authentic Assessment grade (25%)[5].

[4] The Mathematics Department will provide guidance on task selection, thereby standardizing the process across the district and across grades/courses.
[5] The Mathematics Department has propagated gradebooks with appropriate weights.

- All **Student Assessment Portfolios** must be clearly labeled, maintained for all students, inclusive of constructive teacher and student feedback and accessible for administrator review

GRADE LEVEL REQUIREMENTS

GRADES K – 2

- Portfolio will contain Math in Focus Chapter Test Prep; Benchmark Assessments; and Pre-Test (grades 1 and 2 only)
- Portfolio will contain a minimum of 4 reflections
- Teacher anecdotal notes from "Let's Talk" (Kindergarten only)

GRADES 3 – 5

- 1-2 Portfolio tasks will be given each month
- Any optional/additional tasks will be graded and counted in addition to the required tasks (initial scores will not be replaced)
- Portfolio will contain a minimum of 4 reflections

GRADES 6 – 8

- 1-5 Portfolio tasks will be given per unit
- Any optional/additional tasks will be graded and counted in addition to the required tasks (initial scores will not be replaced)
- Portfolio will contain a minimum of 4 reflections
- Overall performance is the average command level of all tasks

GRADES 9 – 12

Algebra 1, Agile mind, and Algebra 2

- Minimum of 2 student reflections per unit
- Include the Unit 1 Diagnostic task in the Student Assessment Portfolio
- Designate 2 separate areas of the Student Assessment Portfolio for each of the type of task

Geometry, Pre Calc, AP Calc, Modeling & Functions

- Students must still have a Student Assessment Portfolio containing artifacts that demonstrate performance on standards for this course
- Artifacts must be a form of authentic/performance assessment

MATHEMATICS PORTFOLIO
END OF YEAR REQUIREMENTS

At the start of the school year, you were provided with guidelines for helping students maintain their **Mathematics Portfolios** whereby students added artifacts that documented their growth and development over time. Included in the portfolio process was the opportunity for students to reflect on their thinking and evaluate what they feel constitutes "quality work." As a part of the end of year closeout process, we are asking that you work with your students to help them 'purge' their current portfolios and retain the artifacts and self-reflection documents that will transition with them to the next grade.

GRADES K-2

Purging and Next-Grade Transitioning

During the third (3rd) week of **June**, give students the opportunity to review and evaluate their portfolio to date; celebrating their progress and possibly setting goals for future growth. During this process, students will retain ALL of their current artifacts in their Mathematics Portfolios. The Student Profile Sheet from the end of year assessment should also be included in the student math portfolio. In the upcoming school year, after the new teacher has reviewed the portfolios, students will select 1-2 pieces to remain in the portfolio and take the rest home

GRADES 3 – 8

Purging and Next-Grade Transitioning

During the third (3rd) week of **June**, give students the opportunity to review and evaluate their portfolio to date; celebrating their progress and possibly setting goals for future growth. During this process, students will retain the following artifacts in their Mathematics Portfolios:

- ✓ All authentic assessment tasks (department issued rubric scored) w/ 2 respective Self-Reflection Sheet(s).

GRADES 9-12

Purging and Next-Grade Transitioning

During the third (3rd) week of **June**, give students the opportunity to review and evaluate their portfolio to date; celebrating their progress and possibly setting goals for future growth. During this process, students will retain ALL of their current artifacts in their Mathematics Portfolios. Please use the High School Portfolio Guidelines to aid in this process. *DO NOT purge portfolios of students who fail the course.

End of 3rd week in June: Forward all portfolios to next year's receiving teachers or the designated point persons at OPA or OHS.

PARCC
Partnership for Assessment of Readiness for College and Careers

Overview of Task Types

- The PARCC assessments for mathematics will involve three primary types of tasks: Type I, II, and III.
- Each task type is described on the basis of several factors, principally the purpose of the task in generating evidence for certain sub claims.

Task Type	Description of Task Type
I. Tasks assessing *concepts, skills and procedures*	• Balance of conceptual understanding, fluency, and application • Can involve any or all mathematical practice standards • Machine scorable including innovative, computer-based formats • Sub-claims A and B
II. Tasks assessing *expressing mathematical reasoning*	• Each task calls for written arguments / justifications, critique of reasoning, or precision in mathematical statements (MP.3, 6). • Can involve other mathematical practice standards • May include a mix of machine scored and hand scored responses • Sub-claim C
III. Tasks assessing *modeling / applications*	• Each task calls for modeling/application in a real-world context or scenario (MP.4) • Can involve other mathematical practice standards • May include a mix of machine scored and hand scored responses • Sub-claim D

Claims Structure*:
Mathematics – Grades 3 - 8

Master Claim: On-Track for college and career readiness. The degree to which a student is college and career ready (or "on-track" to being ready) in mathematics. The student solves grade-level /course-level problems in mathematics as set forth in the Standards for Mathematical Content with connections to the Standards for Mathematical Practice.

Sub-Claim A: Major Content[1] with Connections to Practices
The student solves problems involving the Major Content[1] for her grade/course with connections to the Standards for Mathematical Practice.
26 - 31 points

Sub-Claim B: Additional & Supporting Content[2] with Connections to Practices
The student solves problems involving the Additional and Supporting Content[2] for her grade/course with connections to the Standards for Mathematical Practice.
9 - 14 points

Sub-Claim C: Highlighted Practices MP.3,6 with Connections to Content[3] (expressing mathematical reasoning)
The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.
14 points

Sub-Claim D: Highlighted Practice MP.4 with Connections to Content (modeling/application)

The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), *engaging particularly in the Modeling practice*, and where helpful making sense of problems and persevering to solve them (MP. 1),reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).
12 points

Total Exam :

66 points

[1] For the purposes of the PARCC Mathematics assessments, the Major Content in a grade/course is determined by that grade level's Major Clusters as identified in the *PARCC Model Content Frameworks v.3.0* for Mathematics. Note that tasks on PARCC assessments providing evidence for this claim will sometimes require the student to apply the knowledge, skills, and understandings from across several Major Clusters.

[2] The Additional and Supporting Content in a grade/course is determined by that grade level's Additional and Supporting Clusters as identified in the *PARCC Model Content Frameworks v.3.0* for Mathematics.

[3] Sub-Claim C includes only Major Content.

*Updated September 2014. All points from fluency items in Grades 3 – 6 were reallocated to Sub-Claim A or Sub-Claim B. Updated July 2015 to reflect the shortened test design.

Claims Structure*:
Mathematics – High School

Master Claim: On-Track for college and career readiness. The degree to which a student is college and career ready (or "on-track" to being ready) in mathematics. The student solves grade-level /course-level problems in mathematics as set forth in the Standards for Mathematical Content with connections to the Standards for Mathematical Practice.

Sub-Claim A: Major Content[1] with Connections to Practices
The student solves problems involving the Major Content[1] for her grade/course with connections to the Standards for Mathematical Practice.

21 – 30 points

Sub-Claim B: Additional & Supporting Content[2] with Connections to Practices
The student solves problems involving the Additional and Supporting Content[2] for her grade/course with connections to the Standards for Mathematical Practice.

14 – 21 points

Sub-Claim C: Highlighted Practices MP.3 and 6 with Connections to Content (expressing mathematical reasoning)
The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

14 points

Sub-Claim D: Highlighted Practice MP.4 with Connections to Content (modeling/application)

The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), *engaging particularly in the Modeling practice*, and where helpful making sense of problems and persevering to solve them (MP. 1),reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

18 points

Total Exam :

81 points[3]

[1] For the purposes of the PARCC Mathematics assessments, the Major Content in a grade/course is determined by that grade level's Major Clusters as identified in the *PARCC Model Content Frameworks v.3.0* for Mathematics. Note that tasks on PARCC assessments providing evidence for this claim will sometimes require the student to apply the knowledge, skills, and understandings from across several Major Clusters.

[2] The Additional and Supporting Content in a grade/course is determined by that grade level's Additional and Supporting Clusters as identified in the *PARCC Model Content Frameworks v.3.0* for Mathematics.

[3] There are an additional 0-9 points from integrated tasks that will be reported in the Master Claim.

* Updated July 2015 to reflect the shortened test design.

PARCC
Partnership for Assessment of Readiness for College and Careers

Assessment Reference Sheet

Grades 5

1 mile = 5,280 feet
1 mile = 1,760 yards

1 pound = 16 ounces
1 ton = 2,000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 liter = 1000 cubic centimeters

Right Rectangular Prism	$V = Bh$ or $V = lwh$

Grade 6

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5,280 feet
1 mile = 1,760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilograms
1 kilogram = 2.2 pounds
1 ton = 2,000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 3.785 liters
1 liter = 0.264 gallons
1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$
Right Rectangular Prism	$V = Bh$ or $V = lwh$

PARCC
Partnership for Assessment of Readiness for College and Careers

High School Assessment Reference Sheet

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5,280 feet
1 mile = 1,760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilograms
1 kilogram = 2.2 pounds
1 ton = 2,000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 3.785 liters
1 liter = 0.264 gallons
1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$
Circle	$A = \pi r^2$
Circle	$C = \pi d$ or $C = 2\pi r$
General Prisms	$V = Bh$
Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n-1)d$
Geometric Sequence	$a_n = a_1 r^{n-1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Radians	$1\ radian = \frac{180}{\pi}\ degrees$
Degrees	$1\ degree = \frac{\pi}{180}\ radians$
Exponential Growth/Decay	$A = A_0\, e^{k(t - t_0)} + B_0$

PARCC Calculator Policy for Calculator Sections of the Mathematics Assessments

Originally Released July 2012, Updated February 2016[1]

Allowable Calculators

- Grades 3-5: No calculators allowed, except for students with an approved calculator accommodation (see below)
- Grades 6-7: Four-function with square root and percentage functions
- Grade 8: Scientific calculators
- High school: Graphing calculators (with functionalities consistent with TI -84 or similar models)

Additionally, schools must adhere to the following additional guidance regarding calculators:

- No calculators with Computer Algebra System (CAS) features are allowed.
- No tablet, laptop (or PDA), or phone-based calculators are allowed during PARCC assessments.
- Students are not allowed to share calculators within a testing session.
- Test administrators must confirm that memory on all calculators has been cleared before and after the testing sessions.
- Calculators with "QWERTY" keyboards are **not** permitted.
- If schools or districts permit students to bring their own hand-held calculators for PARCC assessment purposes, test administrators must confirm that the calculators meet PARCC requirements as defined above.

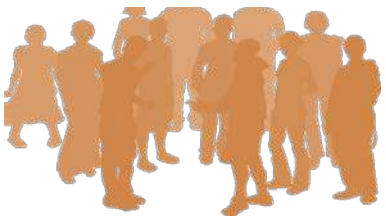
Calculator Accommodations:

For students who meet the guidelines in the *PARCC Accessibility Features and Accommodations Manual* for a calculation device, this accommodation allows a calculator be used on non-calculator sections of any PARCC mathematics assessment. The following are allowable calculators for the accommodation on non-calculator sections:

- Grades 3-5: Four-function with square root and percentage functions
- Grades 6-7: Four-function with square root and percentage functions
- Grade 8: Scientific calculators (Student may also bring a four-function with square root and percentage functions in addition to grade-level calculator.)
- High School: Graphing calculators with functionalities consistent with TI-84 or similar models. (Student may also bring a scientific calculator or a four-function with square root and percentage functions.)

If a student needs a calculator as part of an accommodation in the non-calculator section, the student will need a hand-held calculator because an online calculator will not be available. If a student needs a specific calculator (e.g., large key, talking), the student can also bring his or her own, provided it is specified in his or her approved IEP or 504 Plan.

[1] Calculator specifications were released July 2012. One addition was made July 2014 to allow four function calculators with square root AND percentage functions. Additional guidance on allowable calculators for accommodations for grades was included September 2014. Additional clarification was added to the FAQs December 2015. Additional clarification was added to the FAQs February 2016.



Frequently Asked Questions about PARCC's Calculator Policy

1. ***Can students use hand-held calculators for computer-based assessments?***

Yes. Students may use hand-held calculators on computer-based Mathematics PARCC assessments on sections where a calculator is allowable (grades 6 through high school), if they prefer. All hand-held calculators must meet PARCC requirements as defined in PARCC's Calculator Policy.

It is recommended that schools identify which students prefer to use a hand-held calculator prior to administration to ensure that a sufficient number of calculators is available. Hand-held calculators are required for paper-based testing. Test administrators are responsible for ensuring hand-held calculators meet specifications, including ensuring the memory is cleared before and after administration.

2. ***Can students use their own calculators on PARCC assessments?***

Yes. However, test administrators must confirm that the calculators meet PARCC requirements as defined in PARCC's Calculator Policy.

3. ***Can students use calculators on PARCC assessments that are allowable for higher or lower grade level assessments?***

In general, no. In order to provide comparability across schools in the consortium, students must only use calculators that are allowable for their grade/course assessment. PARCC assessment items were developed with PARCC's Calculator Policy in mind. Allowing for the use of a calculator that is designated for a lower or higher grade level assessment may unfairly disadvantage or advantage students and is, therefore, not allowed. Exception: Students with a disability that severely limits or prevents their ability to perform basic calculations may receive the Calculation Device and Mathematics Tools accommodation that permits the use of a calculator designated for a lower grade assessment on Calculator Sections and Non-Calculator Sections of Mathematics Assessments according to a student's IEP or 504 plan. However, students should also have access to calculators that are allowable for their grade/course assessment. Please review pages 39-40 of the PARCC Accessibility Features and Accommodation Manual (fourth edition) for the specific lower grade level calculators allowed.

4. ***If a student takes an Algebra I course where a graphing calculator is used, but the student is taking a grade 8 PARCC assessment where a scientific calculator is used, which calculator should they use?***

Calculator usage is assessment specific, regardless of the student's grade level (e.g., a student who takes the assessment for a specific grade or course must use the calculator required by PARCC's Calculator Policy for that assessment). In this example, the student should use a scientific calculator, since the student is taking the grade 8 PARCC assessment. A student taking the Algebra I assessment would use the graphing calculator for this assessment regardless of the student's grade level. Schools should ensure students have ample opportunity to practice with the allowable calculator for their PARCC grade/course assessment.

PARCC
Partnership for Assessment of Readiness for College and Careers

5. Does my school have to buy new calculators?

Maybe. All schools participating in computer-based PARCC assessments will be provided an online calculator through the computer-based delivery platform. If a student chooses to use a hand-held calculator, he or she may either bring their own calculator or the school may provide the calculator. For paper-based assessments, all students in grades 6 and higher must have a hand-held calculator for the calculator portion of the assessment. Either schools must ensure they have a sufficient number of the appropriate calculators available or allow students to bring their own. All calculators must meet PARCC requirements defined in PARCC's Calculator Policy.

6. If a student has the Calculation Device and Mathematics Tools (on Non-Calculator Sections of Mathematics Assessments) accommodation, what allowable mathematics tools can be used?

A student with the calculation device and mathematics tools (on non-calculator sections of the mathematics assessments) accommodation may only use the following mathematics tools to aid in calculation:

- Arithmetic tables (e.g., addition charts, subtraction charts, multiplication charts; division charts)
- Two-color chips (e.g., single-sided or double-sided)
- Counters and counting chips
- Square tiles
- Base 10 blocks
- 100s chart

7. Can students use the TI-Nspire (non-CAS) calculator on PARCC high school assessments?

Yes. The TI-Nspire (non-CAS) calculator meets PARCC requirements as defined in PARCC's Calculator Policy.

8. Do memories have to be cleared on every handheld calculator?

Yes. Calculator memories need to be cleared/reset before and after each testing session.

9. When are the memories reset on the online graphing calculator?

The online graphing calculator resets to its default settings after each unit. However, within a unit, the screen display on the online graphing calculator will carry from item to item.

10. In what mode, radians or degrees, is the online graphing calculator set?

The default mode of the online graphing calculator at the beginning of each unit is radians.

APPENDIX

Math 180 Promotion & Grading

Assessment Specifications

<table>
<tr><th></th><th>Grading Weight</th><th>Assessment Tool</th><th>Description</th><th>Scoring</th><th>Gradebook</th><th>Naming Convention</th></tr>
<tr><td>Test</td><td>25%</td><td>Scholastic Math Inventory (SMI)</td><td>• Computer-based adaptive assessment</td><td>• Assessment results are instantly and automatically reported as a Quantile Measure in Scholastic Central and in SMI data reports</td><td>• Quantile measures are to be entered in Genesis
• Quantile Measure above a 999 are left blank
• The actual score would be entered as an individual note for the student</td><td>District propagated assessment</td></tr>
<tr><td>Authentic Assessment</td><td>25%</td><td>mSPace Performance Tasks</td><td>• Multistep extended response problems</td><td>• Evaluate and manually score students' responses using a 0-3 rubric scale
• Rubrics for each task are included within the Math 180 program</td><td>• Refer to the chart below:
<table><tr><th></th><th>Score</th><th>Genesis Conversion</th></tr><tr><td rowspan="4">Rubric Scoring</td><td>3</td><td>100</td></tr><tr><td>2</td><td>85</td></tr><tr><td>1</td><td>70</td></tr><tr><td>0</td><td>50</td></tr></table></td><td>Block _#_ Performance Task</td></tr>
<tr><td>Quiz</td><td>20%</td><td>mSkills Assessment</td><td>• Two part online assessment
• 20 Computer Scored Questions
• 2 Constructed Response Items</td><td>• Computer scored questions are auto-scored
• Constructed Response items are manually scored using a 0-3 rubric scale 0-3
• Use Student Digital Portfolio in Scholastic Central to enter scores</td><td>• Students' grades will be determined based on their overall performance on both parts of the assessment
• Use traditional scoring to establish students' scores out of 26 points
• Enter the resulting percentage into Genesis</td><td>Block _#_ mSkills Assessment</td></tr>
<tr><td>Classwork</td><td>20%</td><td>Exit Ticket</td><td>• Daily at the conclusion of each teacher-facilitated lesson</td><td>• Manually scored using Math 180 scoring rubric:
<table><tr><th>Score</th><th>Criteria</th></tr><tr><td>2</td><td>Complete and accurate response</td></tr><tr><td>1</td><td>Partial response</td></tr><tr><td>0</td><td>Incorrect or no response</td></tr></table></td><td>• Refer to the chart below:
<table><tr><th></th><th>Score</th><th>Genesis Conversion</th></tr><tr><td rowspan="3">Rubric Scoring</td><td>2</td><td>100</td></tr><tr><td>1</td><td>75</td></tr><tr><td>0</td><td>50</td></tr></table></td><td>Concept Based

Example:

Estimate & Compare</td></tr>
<tr><td>Homework</td><td>10%</td><td>Brain Arcade (optional)</td><td>• Assesses strategic thinking and flexibility with numbers and operations in an engaging and motivating</td><td>• Math 180 software tracks students' usage
• Data can be used to monitor student engagement and math practice outside of the classroom</td><td>• Grading is based on teacher-discretion</td><td>Teacher-Discretion</td></tr>
</table>

Math 180 Promotion & Grading

Promotion Policy

In order to be eligible for promotion, Math 180 students must first meet the following requirements:

1. SMI Score

- Students' most current SMI performance level and quantile score must be a minimum of:

Grade Level	SMI Performance Level	SMI Quantile Score
5	Proficient	870Q
6	Proficient	950Q
7	Proficient	1030Q
8	Proficient	1140Q

2. Attendance

- Students must maintain a good attendance standing of 4 absences or less per marking period

3. Grade

- Students must maintain a grade of 75% or greater in their Math180 course

Student promotion will be considered at the close of each marking period

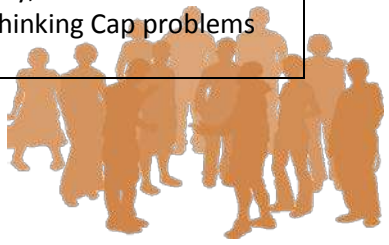
2016-2017 MARKING PERIOD AND INTERIM DATES	
Thursday, September 8, 2016	**Opening of School**
Thursday, September 8, 2016	Interim Start
Friday, October 7, 2016	Interim End
Thursday, September 8, 2016	Start of Marking Period 1
Wednesday, November 9, 2016	End of Marking Period 1
Monday, November 14, 2016	Interim Start
Thursday, December 15, 2016	Interim End
Monday, November 14, 2016	Start of Marking Period 2
Thursday, January 26, 2017	End of Marking Period 2
Friday, January 27, 2017	Interim Start
Monday, March 6, 2017	Interim End
Friday, January 27, 2017	Start of Marking Period 3
Thursday, April 6, 2017	End of Marking Period 3
Friday, April 7, 2017	Interim Start
Monday, May 15, 2017	Interim End
Friday, April 7, 2017	Start of Marking Period 4
Thursday, June 22, 2017	End of Marking Period 4
Monday, June 19, 2017	**End of School**

MATH

MATH IN FOCUS LESSON STRUCTURE

	Math in Focus LESSON STRUCTURE	RESOURCES	COMMENTS
PRE TEST	**Chapter Opener** Assessing Prior Knowledge *The Pre Test serves as a diagnostic test of readiness of the upcoming chapter*	**Teacher Materials** Quick Check Pretest (Assessm't Bk) Recall Prior Knowledge **Student Materials** Student Book (Quick Check); Copy of the Pre Test; Recall prior Knowledge	Recall Prior Knowledge (RPK) can take place just before the pre-tests are given and can take 1-2 days to front load prerequisite understanding Quick Check can be done in concert with the RPK and used to repair student misunderstandings and vocabulary prior to the pre-test; Students write Quick Check answers on a separate sheet of paper Quick Check and the Pre Test can be done in the same block *(See Anecdotal Checklist; Transition Guide)* Recall Prior Knowledge – Quick Check – Pre Test
DIRECT ENGAGEMENT	**Direct Involvement/Engagement** Teach/Learn *Students are directly involved in making sense, themselves, of the concepts – by interacting the tools, manipulatives, each other, and the questions*	**Teacher Edition** 5-minute warm up Teach; Anchor Task **Technology** Digi **Other** Fluency Practice	• The Warm Up activates prior knowledge for each new lesson • Student Books are CLOSED; Big Book is used in Gr. K • Teacher led; Whole group • Students use concrete manipulatives to explore concepts • A few select parts of the task are explicitly shown, but the majority is addressed through the hands-on, constructivist approach and questioning • Teacher facilitates; Students find the solution
GUIDED LEARNING	**Guided Learning and Practice** Guided Learning	**Teacher Edition** Learn **Technology** Digi **Student Book** Guided Learning Pages Hands-on Activity	Students-already in pairs /small, homogenous ability groups; Teacher circulates between groups; Teacher, anecdotally, captures student thinking **Small Group w/Teacher circulating among the groups** Revisit Concrete and Model Drawing; Reteach Teacher spends a majority of time with struggling learners; some time with one level, and less time with advanced groups Games and Activities can be done at this time

INDEPENDENT PRACTICE	**Independent Practice** *A formal formative assessment*	**Teacher Edition** Let's Practice **Student Book** Let's Practice **Differentiation Options** All: Workbook Extra Support: Reteach On Level: Extra Practice Advanced: Enrichment	**Let's Practice** determines readiness for Workbook and small group work and is used as formative assessment; Students not ready for the Workbook will use Reteach. The Workbook is continued as Independent Practice. Manipulatives **CAN** be used as a communications tool as needed. Completely Independent On level/advance learners should finish all workbook pages.
ADDITIONAL PRACTICE	**Extending the Lesson**	Math Journal Problem of the Lesson Interactivities Games	
	Lesson Wrap Up	Problem of the Lesson Homework (Workbook, Reteach, or Extra Practice)	Workbook or Extra Practice Homework is only assigned when students fully understand the concepts (as additional practice) Reteach Homework (issued to struggling learners) should be checked the next day
POST TEST	**End of Chapter Wrap Up and Post Test**	**Teacher Edition** Chapter Review/Test Put on Your Thinking Cap **Student Workbook** Put on Your Thinking Cap **Assessment Book** Test Prep	Use Chapter Review/Test as "review" for the End of Chapter Test Prep. Put on your Thinking Cap prepares students for novel questions on the Test Prep; Test Prep is graded/scored. The Chapter Review/Test can be completed • Individually (e.g. for homework) then reviewed in class • As a 'mock test' done in class and doesn't count • As a formal, in class review where teacher walks students through the questions Test Prep is completely independent; scored/graded Put on Your Thinking Cap (green border) serve as a capstone problem and are done just before the Test Prep and should be treated as Direct Engagement. By February, students should be doing the Put on Your Thinking Cap problems on their own.



TRANSITION LESSON STRUCTURE (No more than 2 days)

- **Driven by Pre-test results, Transition Guide**
- **Looks different from the typical daily lesson**

Transition Lesson – Day 1 **Objective:**	
CPA Strategy/Materials	**Ability Groupings/Pairs (by Name)**
Task(s)/Text Resources	**Activity/Description**

Mathematics

Classroom Artifact Self-Assessment

Classroom artifacts such as instructional tasks and student work are highly correlated with observed instruction and can serve as a stable indicator of classroom practice. These artifacts become visible evidence that teachers are practicing reform-based methodologies aligned to the mission and vision of both the school and district. Classroom artifacts become a useful method of supplying information about classroom practice and are a viable source of information for Administrative walk-throughs and formal and informal observations. Below is a list of artifacts that should be evident in your classroom.

	Word Walls		Section for student Journals/Notebooks		Homework chart
	Designated section for writing the daily objective		Designated section for writing the daily lesson agenda/itinerary		Designated section for Warm ups/Do Nows/Launches
	Designated section for Notebooks, Classwork, Journals, Assignments, Attendance, etc.)		Designated section for student resources (calculators, reference sheets, manipulatives, etc.)		Student Homework / Classwork Folders
	Anchor Charts		Student work (Rubric-scored against a specific rubric – min. 3 distinct samples)		Collection/Distribution Bins
	Learning Center Set Ups (Complete with Assignments, Folders, Tracking Logs)		Center/Blended Learning Rotation Charts; Seating/Grouping Charts		Technology Centers (Complete with sample websites, center-related assignments, rules of usage)
	Evidence of Goal Setting/progress monitoring for students		Grads 3 – 5 Calendar Counts Section		Content-related Visuals (Posters, Charts, Strategies, etc.)
	School / District Mission Statement		Class Rules/Consequences/ Incentives		An FYI section containing policies, procedures, calendars, due dates

Total Checks: _____

Mathematics

Supervisor Walk-Through Template

School: _____ **Teacher:** _____ **Grade:** _____ **# students:** _____

MONTH FOCUS AREA: *See* Highlighted Section(s); Specific: *See* Lesson Component

General

- ☐ Using the Unit Plan, Lesson Plan, and DOL to guide instruction (all are available on the desk) Y/N
- ☐ Grade-appropriate, CCSSM-aligned materials with appropriate pacing and levels of cognitive demand Y/N
- ☐ Use of District-approved Program materials {Math in Focus, Go Math, CMP3, Carnegie, Agile Mind, Pearson's Algebra II, etc.} Y/N
- ☐ Use of the Ideal Math Block Structure Y/N
- ☐ Accessible Vocabulary support (math word wall/vocabulary lists)
- ☐ Ample student work that includes revisions, revision explanations, justifications, and reflections
- ☐ Relevant and current artifacts (i.e. content-specific visuals, anchor charts, routines, etc.)
- ☐ Danielson 3B: Using Questioning and Discussion Techniques [4, 3, 2, 1, N/A]
- ☐ Danielson 3C: Engaging Students in Learning [4, 3, 2, 1, N/A]

Lesson Component

GETTING READY
- o Do Now
- o Homework Review
- o Morning Routine

The Teacher is…
- ☐ Asking students to justify their thinking/answers {MP 2,3}
- ☐ Encouraging students for precision in their explanations {MP 6}

The Students are…
- ☐ Recording their work in their booklets/notebooks/binders {MP 6}

Supervisor Comments:

Teacher's Response:

LAUNCHING THE LESSON
(Whole Group)
- o Launch/Opener
- o Mini Lesson
- o Teach/Learn (MIF)

The Teacher is…
- ☐ Predicting patterns of error
- ☐ Using visual models to relay concepts {MP 4,5}
- ☐ Asking questions that prompt higher-level thinking {MP 1,2,3}
- ☐ Prompting students to use academic language in their explanations/discussions {MP 6}
- ☐ Asking students to justify their own and each other's responses {MP 2,3}

The Students are…
- ☐ Recording their work in their booklets/notebooks/binders {MP 6}
- ☐ Talking about their thinking {MP 2,3,6}

Supervisor Comments:

Teacher's Response:

STUDENT EXPLORATION (Small Group) o Partner/Group Work o Investigation o Hands-on, Game-based Activity o Guided Practice o Let's Explore (MIF)	**The Teacher is…** ☐ Asking students to justify their own and each other's responses {MP 2,3} ☐ Asking questions that prompt higher-level thinking {MP 1,2,3} ☐ Encouraging students to use precision in their written explanations {MP 6} **The Students are…** ☐ Working on tasks with others, as well as working independently ☐ Recording their work in their booklets/notebooks/binders {MP 6} ☐ Using manipulatives and other tools to appropriate solve problems {MP 1,4,5} ☐ Sharing strategies including mental math and problem solving methods {MP 2,3} ☐ Talking about each other's thinking {MP 2,3} **Supervisor Comments:** **Teacher's Response:**
INDEPENDENT PRACTICE (Individual) o Individual Practice o Enrichment o Let's Practice (MIF)	**The Students are…** ☐ Working independently ☐ Use visual models to explain their thinking {MP 4,5} ☐ Able to justify their answers {MP 2,3} ☐ Using academic language in their explanations {MP 6} ☐ Using precision in their written explanations {MP 6} o clear definitions, specified units of measure, clearly labeled quantities **Supervisor Comments:** **Teacher's Response:**
SUMMARY (Whole Group) o Connection to concept o Student Reflection	**The Students are…** ☐ Using summary statements, evidence of solutions and conclusions {MP 2,7} ☐ Recording their work in their booklets/notebooks/binders {MP 6} ☐ Able to identify what they are learning and how they are doing {All} **Supervisor Comments:** **Teacher's Response:**
DOL o Exit Ticket	**The Students are…** ☐ Able to persevere in solving the task {All} ☐ Using summary statements, evidence of solutions and conclusions {MP 2,7} **Supervisor Comments:** **Teacher's Response:**

OVERALL FEEDBACK

Strengths:

Suggestions:

Focus for next class visitation:

LESSON PLAN REVIEW

Date:

- ☐ Danielson 1A: Demonstrating Knowledge of Content and Pedagogy [4, 3, 2, 1, N/A]
- ☐ Danielson 1D: Demonstrating Knowledge of Resources [4, 3, 2, 1, N/A]
- ☐ Danielson 1E: Designing Coherent Instruction [4, 3, 2, 1, N/A]

Comments:

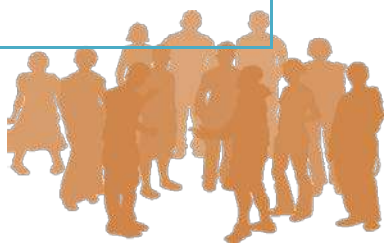
GRADEBOOK REVIEW

Date:

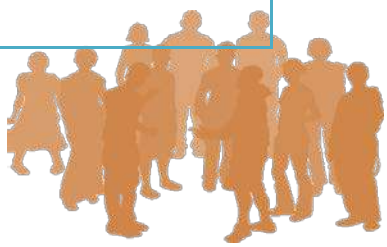
Comments:

WALK-THROUGH ADMINISTRATORS: _____ **DATE:** _____

NOTES



NOTES



NOTES