STRUCTURE OF THE CURRICULUM

Each curriculum in the Mathematics Vision Project materials is composed of two main components, the **classroom experience**, which is designed around the implementation of a specific type of task and the aligned **"Ready, Set, Go!" homework assignment**. Each task is accompanied by a set of teacher notes. The teacher notes identify the purpose of the lesson and describe the steps the teacher can take during the classroom experience to ensure that students engage in a rich learning event. Tasks are to be done in class and should not be assigned as homework. There is an aligned "Ready, Set, Go!" homework assignment for each task. It is the independent practice. Homework serves the student as a type of formative assessment. It is while doing the homework that the student can discern for himself if the mathematics done in class can be performed independently.

The MVP **classroom experience** begins by confronting students with an engaging task and then invites them to grapple with solving it. As students' ideas emerge, take form, and are shared, the teacher orchestrates the student discussions and explorations towards a focused mathematical goal. As conjectures are made and explored, they evolve into mathematical concepts that the community of learners begins to embrace as effective strategies for analyzing and solving problems. These strategies are eventually solidified into a body of practices and mathematical habits that belong to the students, because they were developed by the students, as an outcome of their own creative and logical thinking. This is how students learn mathematics. They learn by doing mathematics. They learn by needing mathematics. They learn by verbalizing the way they see the mathematical ideas connect and by listening to how their peers perceived the problem. Students then own the mathematics because it is a collective body of knowledge that they have developed over time through guided exploration.

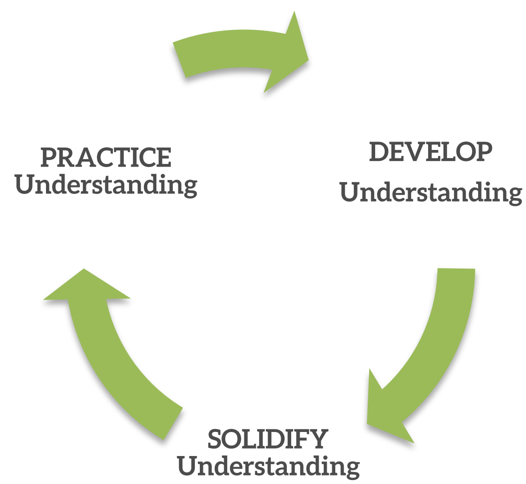
This process describes the **Learning Cycle**, an instructional framework that allows students to build mathematical knowledge over time. This framework is flexible. Every progression does not follow the pattern of develop, solidify, practice. For instance, the first module on quadratics begins with a Develop Understanding Task. Many aspects of the definition of a quadratic surface in that task. Five solidify tasks follow the first task. Each of the Solidify tasks extends one of the key concepts that surfaced in the beginning Develop Understanding Task. The module ends with a Practice Understanding Task that pulls all of the key concepts together into a complete definition of quadratic.

The Learning Cycle

The diagram at the right illustrates the Comprehensive Mathematics Instructional Framework (CMI) around which the MVP curriculum has been developed. Every task in the curriculum is identified as one of the following:

- Develop Understanding Task
- Solidify Understanding Task
- Practice Understanding Task

A learning cycle begins with a single term, *develop*, which refers to bringing student thinking to the surface by activating prior knowledge, intuition, and insights to make sense of a problem.

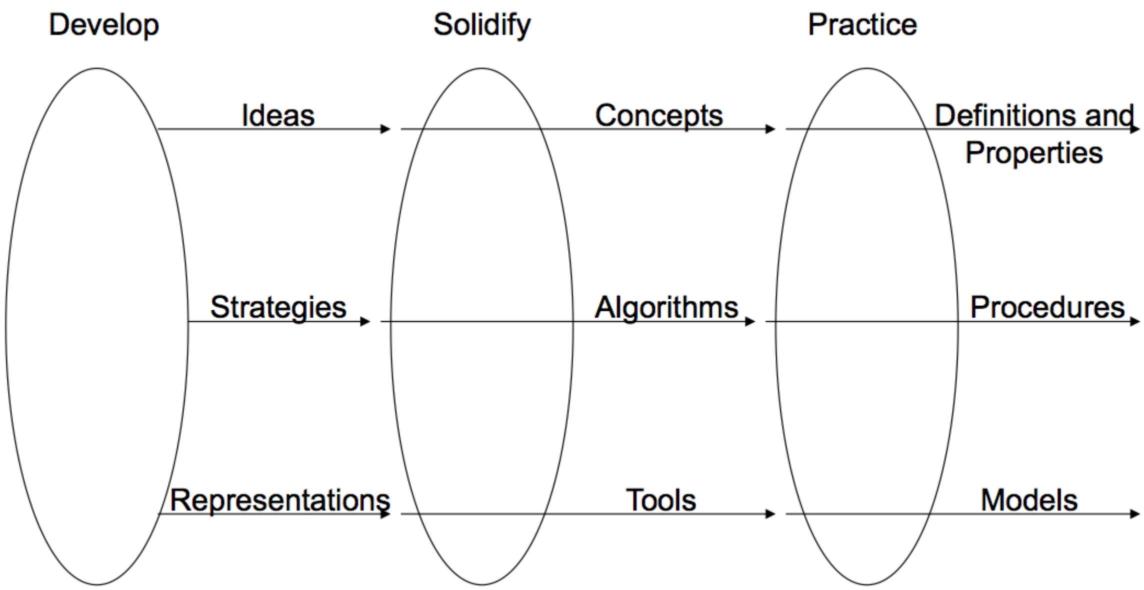


The Learning Cycle

Develop Understanding Tasks are intended to generate ideas, strategies, and representations related to a new mathematical topic. Develop tasks contain multiple entry points for students, so that all students are able to use their intuition and logic to make sense of the problem and devise a strategy for organizing the information. In the second phase of the learning cycle, students will engage in Solidify Understanding tasks that will allow them to examine and extend the mathematical thinking that rose to the surface in the Develop Understanding task. The learning cycle will conclude with a Practice Understanding Task. It focuses students' attention on becoming fluent with the mathematics of the unit and refining the mathematics into formal definitions, properties, procedures, and models that are consistent with practices that exist outside the classroom.

In the *CMI Framework* the progression of the mathematics through the *learning cycle* is mapped out along a continuum of conceptual, procedural and representational understandings using the *Continuum of Mathematical Understanding.*

Continuum of Mathematical Understanding



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Mathematical understanding encompasses at least three connected but distinct domains as represented by the horizontal lines of the continuum: conceptualizing mathematics, doing mathematics, and representing mathematics. Mathematical understanding progresses continually along this continuum, but it is useful to note three sets of distinct landmarks of progression along the continuum that are associated with each of the three phases of the *Learning Cycle*. Emerging mental images are fragile as they are surfaced during students' initial experiences with tasks designed to elicit those images (*Develop Understanding*). In the continuum we refer to these fragile images as ideas, strategies, and representations. These ideas, strategies and representations need to be examined for accuracy and completeness, as well as extended and connected through multiple exposures and experiences until they become more tangible, solid and useful (*Solidify Understanding*). In the *CMI Framework*, ideas that have been examined for the understanding they reveal are called concepts; strategies that can be articulated and replicated are called algorithms; and useful representations are called tools. Once understanding has been developed and solidified, it needs further refinement to become fluent and applicable to new situations and contexts (*Practice Understanding*). In the *CMI Framework* refined concepts become the definitions or properties of formal mathematics; algorithms that can be carried out flexibly and fluently are called procedures; and representations that embody essential mathematical understandings (either conceptual or procedural) are called models, such as "an area model for multiplication" or "the number line as a model of the set of real numbers." These definitions and properties, procedures, and models must be consistent with the broader mathematical "community of practice" that exists outside of the classroom.

The *CMI Framework* supports teachers in enacting the NCTM effective teaching practice: *Build Procedural Fluency from Conceptual Understanding.* However, the framework implies that the end-goal of mathematical instruction is not just procedural fluency; it also includes a deeper conceptual understanding of the properties and definitions on which procedures are based, and an ability to draw upon mathematical models more flexibly and fluently when representing one's mathematical understanding. The *Learning Cycle* component of the framework supports teachers in making curricular decisions that move students from individually-constructed ideas, strategies and representations towards a community of shared definitions, properties, procedures and models. The *Continuum of Mathematical Understanding* component of the framework emphasizes that there are multiple domains of mathematical understanding that need to be developed, solidified and practiced: the conceptual domain, which provides students with *ways of thinking about mathematics*; the procedural domain, which provides students with *ways of doing mathematics*; and the representational domain, which provides students with *ways of making one's thinking visible*. Together, both components of the *CMI Framework* promote student thinking to the forefront of mathematics instruction and highlight the decision-making role of the teacher in effectively selecting and sequencing tasks that build mathematical understanding and fluency over time.

Each module in the **MVP** educational program has been carefully designed and sequenced with rich mathematical tasks that have been formulated to generate the mathematical concepts within the core curriculum. Careful attention has been placed upon the way mathematical knowledge emerges, is extended, and then becomes efficient, flexible, and accurate. Some tasks are developmental tasks while others are for solidifying or practicing the concepts. The sequencing of the tasks encourages students to notice relationships and make connections between the concepts. In this way, students perceive mathematics as a coherent whole.

While the classroom experience is predominantly geared towards improving students' reasoning and sense-making skills, MVP regards mathematical understanding and procedural skill as being equally important. Hence, the "**Ready, Set, Go**!" **homework assignments** are focused on students practicing procedural skills and organizing principles to add structure to the ideas developed during the classroom experience**.** As in any discipline, practice is the refining element that brings fluency and agility to the skills of the participant. The **Ready** and the **Go** sections of the homework assignments have been designed to spiral a review of content, while the **Set** section focuses on consolidating the mathematics addressed in class that day. Each time a student engages in the homework assignment, it is expected that he or she will have the opportunity to reflect on the new learning from class and will practice the retrieval of ideas from the body of learning that has been growing over the school year, and even prior to the current school year. Recent research on learning has identified reflection and retrieval practice as being two key ingredients for durable learning. True learning should be long lasting and should grow out of previous understandings, extending over years of study. Hence, the "**Go!"** sections of the **"Ready, Set, Go!" homework assignments** will contain topics from previous lessons and prior years of mathematics instruction. Together the **classroom experience** and the **"Ready, Set, Go!" homework assignments** offer a powerful blend of new learning and maintained proficiency.

The Teaching Cycle

The Learning Cycle depicts how students become proficient in the mathematics overtime. Each task represents at least one day of instruction. Therefore, a Learning Cycle may extend over several days or weeks of classroom instruction, however, each day the teacher is expected to frame the lesson around **The Teaching Cycle.** This cycle also has three components: **Launch, Explore**, and **Discuss.**

The Teaching Cycle may seem to be simple, but it involves careful preparation and then deliberate implementation by the instructor.

Launch: How will you . . .

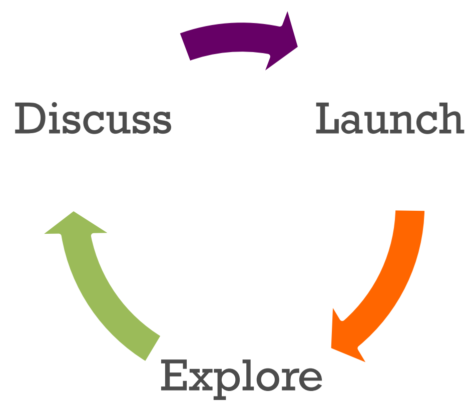
- hook and motivate students?
- provide schema for the task?
- describe the expectations for the finished task?

Explore: What will you . . .

- look for and listen for as you observe?
- accept as evidence of understanding?
- ask to stimulate, redirect, focus, and extend mathematical thinking?

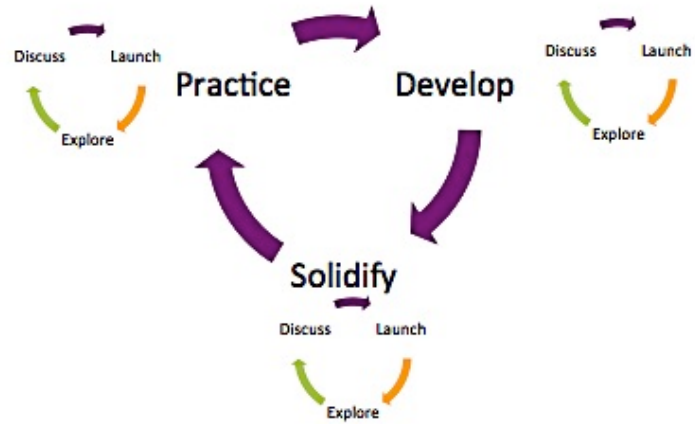
Discuss: How will you . . .

- select which students will present their solutions and strategies?
- determine what ideas to pursue?
- decide whether to contribute to the discourse or allow students to continue to struggle to make sense of a concept?



The Teaching Cycle

The diagram to the right depicts how the two instructional frameworks, the **Teaching Cycle** and the **Learning Cycle**, fit together. The **Teaching Cycle** occurs each day in the classroom, while the **Learning Cycle** extends over days and possibly weeks as the unit develops.

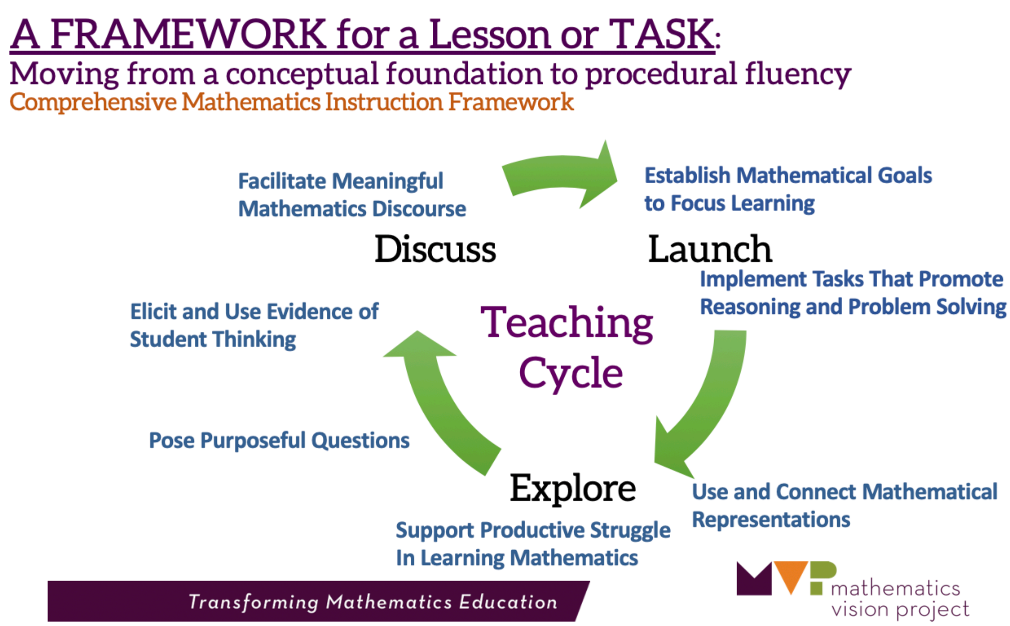


The MVP curriculum and the CMI instructional framework together reflect current research on teaching and learning. Research in both cognitive science and mathematics education supports changes in the roles of the learner and the teacher. During instruction, students need to be developing specific reasoning habits that will serve them in other disciplines, real life, and their future careers. It is the teacher's role to provide opportunities for students to develop these skills. The CMI model provides a framework for both the teacher and the student to improve teaching and learning in the classroom.

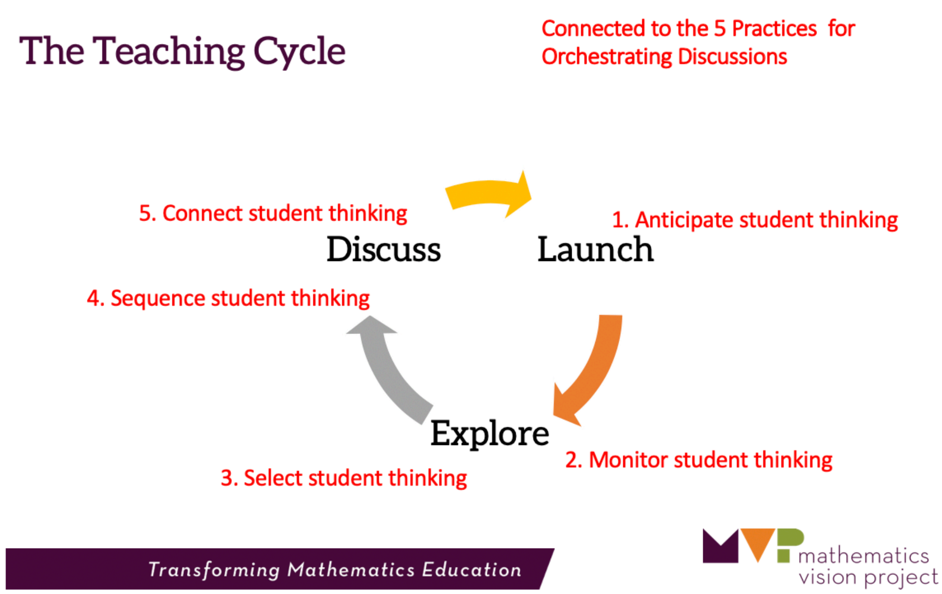
The Comprehensive Mathematics Instruction Model		
	Teacher's role	**Student's role**
Develop Understanding	Focus learning on the goal of the task; provide experiences using rich tasks; support productive struggle; elicit and use evidence of student thinking to orchestrate discussions using the 5 practices*	Make sense of the context, organize information, notice patterns, make conjectures, invent strategies, create arguments, engage in mathematical discourse
Solidify Understanding	Focus learning on the goal of the task; provide experiences using rich tasks; support productive struggle; elicit and use evidence of student thinking to orchestrate discussions using the 5 practices*	See structure; see regularities; attend to precision; create and critique arguments; adopt strategies, use multiple representations, engage in mathematical discourse
Practice Understanding	Provide a vehicle for practice; provide feedback; clarify misconceptions; confirm mathematical and symbolic language; elicit and use evidence of student thinking to orchestrate discussions using the 5 practices*	Reason quantitatively; work towards efficiency, flexibility, accuracy; apply (model with mathematics)

**Five Practices for Orchestrating Productive Mathematical Discussion* – 2nd Edition, Margaret S. Smith and Mary K. Stein, NCTM, 2018

The eight effective teaching practices, as articulated in the NCTM publication *Principles To Actions, Ensuring Mathematical Success for All* (2014), describe a framework for improving instructional practice. The following figure shows how these eight practices can be incorporated into the Teaching Cycle. Note that seven of the practices fit naturally around the Teaching Cycle and can be implemented during each day of instruction, while building procedural fluency from conceptual understanding is a curriculum practice that describes the process of creating deep learning over time.



The *Launch, Explore, Discuss* sequence of the Teaching Cycle is the visible form of the daily, classroom experience. Yet, to make deep learning occur in the classroom, the teacher must carefully prepare for each aspect of the lesson. During the *Launch* the teacher must set the stage by informing students of the situation and the expectations of the task. During the *Explore* phase, as students are reasoning through the task, the teacher is busy moving from student to student, clarifying student questions and encouraging student work. As the teacher monitors student effort, he is also selecting and sequencing which work will move student thinking towards the purpose of the lesson. During the *Discuss* phase, selected students share their mathematical thinking and strategies, while members of the class listen, question, and record strategies and key concepts. Throughout the lesson, it is the obligation of the teacher to connect the mathematics so that students leave class with the big ideas of the intended mathematical lesson. The following figure depicts how the framework of the five practices for orchestrating discourse fit within the Teaching Cycle. (Adapted from *Five Practices for Orchestrating Productive Mathematical Discussion* – Second Edition, Margaret S. Smith and Mary K. Stein, NCTM, 2018)



Five Practices for Orchestrating Productive Mathematical Discussion – 2nd Edition, Margaret S. Smith and Mary K. Stein, NCTM, 2018

FEATURES

Each module begins with an **annotated table of contents** which identifies the key concepts that will be the focus of the module and the core standards that will be addressed. A set of teacher notes accompanies each task. The teacher notes outline each step of the lesson while following the framework of the **Teaching Cycle**. All of the teacher notes follow the same basic outline as described below:

The Enhanced Teacher Notes include:

Purpose: Paying attention to the purpose of the task will help the teacher stay true to the progression of the module and refrain from trying to accomplish too much within the task.

Core Standards Focus: The MVP authors have taken a "multi-tasking approach" to the standards. While one task may focus on more than one standard, several tasks may hi-light a single standard. In this way a set of interrelated ideas or a sequence of strategies and skills can be fused into a meaningful whole. This "multi-tasking approach" to the standards also gives students multiple opportunities to master the standards.

Related Standards: The focus of a lesson may be on a specific standard, yet doing the mathematics may require students to draw on related standards.

Standards for Mathematical Practice: It is possible and even likely that students will implement all of the Standards for Mathematical Practice within a given lesson, however, different types of tasks naturally elicit certain practices. Those that seem to be the most likely to be drawn upon in the lesson have been identified in the teacher notes.

Essential question for students: Since all of the tasks are inquiry based, the essential question has been formulated to direct students' attention towards the purpose of the lesson without explicitly revealing the key ideas and strategies they should be producing.

The Teaching Cycle:

Launch (whole class): Suggestions for introducing the lesson to the students. Sometimes this is relating a story, while other times it's working the first problem together. The prompts for the tasks often involve a lot of reading. It is the teacher's obligation to make sure that students understand what they are expected to do or produce during the Explore stage of the learning.

Explore (small groups): While students are exploring, the teacher will be monitoring the individual students and groups, looking for student strategies that will promote the discussion about the mathematics of the task. This is also a time during which the teacher can assess what previously learned skills the students are bringing to the task. The teacher notes will make suggestions of what the teacher should be looking for during the Explore session.

Discuss: Here the teacher will find suggestions for orchestrating the discussion in order to achieve the purpose of the lesson. This is the time when key connections need to be made.

Exit ticket for students: An exit slip can aid the teacher in checking for understanding. The items in the exit ticket could also be used as a warm-up in the subsequent lesson.

Instructional Supports

ELL and equity suggestions: Equitable mathematics teaching maintains high standards of learning for all students. Instruction should affirm students' mathematical identities by honoring the multiple resources of mathematical learning present in the classroom. By following the plan of instruction included in the teacher notes, students' different mathematical strengths are used as a resource for learning. Additional strategies for providing equal opportunities for learning are offered where appropriate.

Interventions: These suggestions may lower the threshold for the task to accommodate students who don't know how to begin thinking about the task.

Challenge activity: The challenge activity is to provide a "high ceiling" for students who have finished early or need to be encouraged to think more deeply about the mathematics. Sometimes the last question in the task provides that extension, and it is not essential that it be completed by all students.

Additional Resources for Teachers: This could be a variety of things depending on the lesson. For instance, an app using GeoGebra has been developed for the rubber-band activity in the first task of Module 2 in the geometry course.

Sentence frame cards are available as an aid for students. The cards are intended to assist students in becoming self-directed thinkers by guiding their thinking and prompting the language needed for discourse about their mathematical work. The cards are structured around the Eight Student Practices for Mathematical Thinking. The cards are intended to support all learners, but they are particularly useful in supporting learners who struggle with language.

Answer Key for each task:

The suggested mathematical approach for some of these tasks may require teachers to look at the mathematics from a different perspective than they have ever done before. The best way to prepare to teach a task is to work the problem from the standpoint of the student. The answer key is provided as reassurance for the teacher.

Answer Key for each Ready, Set, Go! Homework assignment

Additional Resources for Teachers and Students

The website www.rsgsupport.org contains a support video to match each Ready, Set, Go Homework assignment.

The Helps, Hints, and Explanations book provides an explanation for each type of homework problem and usually a worked example or two with annotation. Each "Ready, Set, Go!" homework assignment has an accompanying explanation in the Helps, Hints, and Explanations book.

Assessments and Tools for the PLC

The assessment resources provide a more complete assessment package including: quick quizzes, self-assessments, performance tasks, and a bank of items that cover the topics of the module. When these tools are combined with the exit tickets and the formative assessment available from listening to students as they work on the tasks, teachers can really know what their students understand and can do.

The assessment book includes per module:

- Quick quizzes (mid-unit checks for understanding)
- Student self-assessments (identifies what the student should know and be able to do as he progresses through the module)
- A Module test
- A Performance task with teacher notes and a scoring rubric

The **quick quizzes** are short, multiple-choice and short answer assessments that give a snapshot of what students have learned in the module. They are designed to be given after a learning cycle is completed (in most cases), so the number of quick quizzes in a module varies. The quick quizzes should be just that: quick. They can be given at the beginning or end of a period, still allowing time for other work to occur.

The **self-assessments** are a tool designed to help students know what they should be learning and to reflect on their progress. Like the quizzes, the self-assessments usually occur at the end of each learning cycle. They identify the mathematics that students should have learned and ask students to provide evidence (from their homework, their work on tasks, or problems from other assessments) that shows how well they have learned it, and to write what they will do to increase their understanding. The idea is to help students develop a growth mindset and gain ownership of their learning.

The **Module Tests**, provide a bank of items that can be used to design a summative assessment that reflects the work of the class. Some teachers like to create tests that have both the performance task and some more traditional items to ensure that all the standards of the module are assessed. There are about as many ways to assess as there are teachers, and most of the methods have merit. The key is to use all assessments as checkpoints to make instructional adjustments that will increase student learning.

The final tool is the **performance task**. There is one performance task provided for each module. This task incorporates the most important ideas of the module and asks students to use them flexibly. These tasks also provide an opportunity for students to communicate mathematically, using proper vocabulary and notation. An answer key and grading rubric are provided for each task, along with instructions for launching the task so that the task is accessible for each and every student. Some teachers like to give students the opportunity to work these tasks in pairs, mirroring the classroom experience. Others prefer to ask students to work individually to ensure that the results give a clear picture of what each student can do on their own.

The PLC tools include **The Essentials Tracker** and **The Power of the Module**.

> **The Essentials Tracker** is a grid connecting the standards and the tasks. When a standard is addressed in a task, it is indicated with one of three letters, *D* for developing, *S* for solidifying, or *P* for practicing. This helps teachers to see that the standards are addressed in more than one task. It also helps teachers to set an appropriate level of

expectation for students relative to the standard. *D*, for developing, indicates students' first exposure to the ideas and/or procedures of the standard, so teachers can expect new ideas to surface, although students may lack the notation or vocabulary that will be developed later. At the *S* level, for solidifying, students will be sorting through ideas that have previously been surfaced, with support for examining and extending their understanding and clarifying their procedures. If the standard is addressed at the *P* level, for practice, then students should be working on becoming efficient, accurate, and flexible as they demonstrate mastery of the standard.

The Power of the Module shows the focus or target for each task in the module and the topics of each section of the homework: *Ready* (to prepare for upcoming tasks), *Set* (to solidify the work done in the task), and *Go* (to reinforce previously-learned skills). This tool can help teachers see the opportunities for recall and rehearsal built into the program, along with the progression of mathematical ideas in the tasks. It also provides a "quick glance" or overview of the module, which will help teachers anticipate upcoming mathematical content. By working the tasks, then creating and discussing the **Power of a Module** outlines as a team, teachers will come to trust the materials and understand the progressions of mathematics that students will have the opportunity learn.

TECHNOLOGY

Technology is an important tool to be used as part of the MVP curriculum. In their description of the CCSS Standard for Mathematical Practice 5, "Use appropriate tools strategically," the core authors specifically name graphing calculators, computer algebra systems, statistical packages, and dynamic geometry software. They suggest that these tools could be used by students to explore and deepen their understanding of concepts, analyze graphs of functions, visualize mathematical models, and test various assumptions and compare predictions with data. Tasks in MVP provide opportunities for using technological tools in each of the ways described. The use of calculators may also help students to quickly make calculations so that their attention remains focused on the analytical work of the task. The curriculum is designed so that students may use technology that is widely available including graphing calculators or free computer apps such as Desmos or Geogebra. Making technology an integral tool for mathematical thinking enriches the work and provides students with opportunities to engage with SMP 5.

The Secondary Mathematics I course is written to align with the first of three courses in the integrated pathway of the Common Core State Standards, as described in Appendix A. Like all courses in the integrated pathway, it contains standards from each of the conceptual categories in the standards, including:

- Number and quantity;
- Algebra;
- Functions;
- Geometry; and
- Statistics and probability.

The major purpose of Secondary Math I is to formalize and extend the mathematics that students learned in the middle grades, working with linear and exponential functions, using transformations to understand symmetries and congruence, solving systems of equations and inequalities, and analyzing data. The Mathematical Practice Standards apply throughout each course and, together with the content standards, create mathematical learning experiences based upon reasoning and sensemaking, building perseverance and problem-solving skills, and rich in mathematical discourse.

The standards indicated in the CCSS with a (+) sign are addressed with additional tasks in Secondary Math I Honors. The Honors version of the course includes all the same tasks as Secondary Math I, with the additional tasks embedded into the modules where they fit conceptually.

Standards specified in the Widely Accepted Prerequisites (WAP's) included in the High School Publishers Criteria for the Common Core State Standards for Mathematics constitute the bulk of the curriculum in Secondary Math I. The F-IF standards for interpreting functions are extensively addressed in Modules 1-3. Module 6 is foundational for all the Geometry standards, G-CO.1 G-CO.9 G-CO.10 G-SRT.B G-SRT.C, although all but G-CO-1 are topics of Secondary Math II. G-CO.1 describes understanding precise definitions of angle, circle, perpendicular line, parallel line, and line segment, which are used extensively throughout the two geometry units in Secondary Math I. Students develop a rich understanding of these terms as they use them to reason about transformations, construction, and features of triangles and quadrilaterals. All of the domains in the Algebra Conceptual Category are included in the WAP's. These domains constitute allof the work in Modules 4 and 5.

In the narrative that follows, the specific approach and details of the mathematics in the curriculum is described by conceptual category in roughly the same order as the categories are addressed in the curriculum. The additional work of the Honors course is clearly identified.

Conceptual Category: Functions

In seventh grade, students did extensive work in proportional relationships including representing them in tables, graphs, and equations, along with identifying the unit rate and determining if two quantities are proportional. In eighth grade, this work was extended as students learned to construct a function to model a linear relationship and identifying the rate of change. They graphed linear relationships, learning that the slope of the line is the same as the rate of change. They connected tables, graphs, and equations in the form $y = mx + b$.

Module 1, Sequences, picks up where students left off in eighth grade, using diagrams and story contexts to introduce arithmetic sequences, identified by a constant difference, or rate of change, between terms. Arithmetic sequences are immediately contrasted with geometric sequences which have a constant ratio between terms. Module 1 is written as two intertwined learning cycles that begin by alternating from arithmetic sequence to geometric sequences, so students can compare and contrast features as they represent both types of sequences with tables, graphs, story contexts, diagrams, and equations. Students learn that both types of sequences can be increasing or decreasing, the graph of an arithmetic sequence is a line and the graph of a geometric sequence is a curve. They learn both types of sequences can be thought of recursively using the relationship from one output to the next, or explicitly using the relationship between an input and its output. The different ways of thinking of the relationships leads to different forms for the equations. Toward the end of the first module, the two types of sequences are often mixed together so that students learn to distinguish between them and represent them appropriately. They use their understanding of the different types of change in the two sequences to find missing terms.

Module 2, Linear and Exponential Functions, begins with a learning cycle that introduces contexts with continuous domains and defining linear functions as having a constant rate of change and exponential functions as having a constant ratio over equal intervals. Discrete and continuous contexts are discussed and compared so that students eventually see that arithmetic and geometric sequences are discrete linear and exponential functions. As the module continues with the second learning cycle, students compare how the different rates of growth in linear and exponential functions result in increasing exponential functions far exceeding increasing linear functions. Students are also introduced to point-slope form and learn to use different equation forms to work fluently across representations including table, graph, equation, and story context. In the Honors task in Module 2 students calculate and interpret the average rate of change of functions, using secant lines to visualize the slopes.

Module 3, Features of Functions, is the culminating functions module in Secondary Math I. In this module, students broaden their thinking about functions to relationships that are not either linear or exponential. They formalize the definition of function as a relationship where each input has a unique output. Students work with all the representations for many different functions, learning to identify features such as:

- x and y intercepts;
- Domain and range;
- Continuity;
- Intervals of increase and decrease; and
- Maxima and minima.

Modules 1, 2, and 3 form the foundation for understanding functions in all three courses in the integrated pathway. Some general concepts about functions that are established in Secondary Math 1 and used throughout the curriculum are:

1. Functions are categorized by their rates of change.
2. The key features of functions (as listed above) are tools for analysis.
3. Different forms of functions have purpose in different situations.

In Math II, students will learn two more general concepts about functions that will help them to develop a "catalog" of function types that they can work with fluently and flexibly, recognizing consistencies and differences among functions.

Conceptual Category: Number and Quantity

In eighth grade, students learned about the properties of exponents and were introduced to integer exponents. Although there are no new standards relating to exponents, the work with geometric sequences and exponential functions in Modules 1 and 2 provides opportunity to reinforce students understanding of integer exponents and increase their skill in using them. Continuous exponential functions provide a context for beginning to think about the outputs that lie between integer exponents, which will be further explored when students are introduced to rational exponents in Secondary Math II.

Students in eighth grade learn about square roots in the context of finding sides of a right triangle using the Pythagorean Theorem. They learn that numbers that are not rational, such as $\sqrt{2}$, are irrational. In Secondary Math I, Module 8, students will again use the Pythagorean Theorem to derive the distance formula and square roots to describe distances.

The three standards in the Numbers and Quantity conceptual category in Secondary Math I focus on using and interpreting units, defining quantities for modeling, and using appropriate levels of accuracy, based on measurement limitations. These three standards are touched upon throughout Modules 1 and 2 as students model various contexts with linear and exponential functions. Working with units and defining quantities are directly addressed in Module 4, Equations and Inequalities, where students use units in combinations to define new variables for use in modeling with equations and inequalities, and interpret expressions that are the result of combining units.

The last learning cycle in Module 4, Equations and Inequalities, of the Honors course contains additional tasks that involve students in organizing information in matrices. The operations of addition, subtraction, and multiplication with matrices are imbedded in story contexts that help students to understand the appropriate dimensions for each operation and why the operations on matrices work as they do.

In the Honors course, Module 8 contains five additional tasks about vectors and matrices. Quantities that can be represented using vectors are introduced. Multiplication and addition properties of matrices are explored. Students learn to find determinants and use matrix multiplication to rotate vectors and images.

Conceptual Category: Algebra

The grade 8 standards provide extensive background for students in solving single variable equations, including those that require multiple steps and using the Distributive Property. Module 4, Equations and Inequalities, builds on students' experience solving equations that have numeric solutions to solve literal equations, with one variable in terms of another. The approach to algebra throughout the curriculum is to motivate algebraic work through context. In the first learning cycle of Module 4, Equations and Inequalities, story context is used to support students in reasoning about what algebraic steps would be appropriate and why the steps make sense. The story contexts that have been provided in Module 4 help students to meet the standards which require them to solve literal equations and to justify each step in solving an equation or inequality. In the second learning cycle of module 4, story contexts are used to reason about the rules for solving inequalities, writing inequalities, and to provide a means for discussion about common misconceptions in writing and using single variable inequalities.

Module 5, Systems of Equations and Inequalities, has two learning cycles, built around a common story context that is used throughout the module. The first learning cycle begins by making the representations, tables, graphs, equations, and diagrams, needed for the rest of the module available. The learning cycle proceeds by carefully developing the concepts and associated procedures for finding solutions to linear inequalities. The meaning of a constraint, the idea that the solutions to a linear inequality form a half plane, and interpreting and using standard form of the equation of a line to graph boundaries are addressed in this learning cycle. Extending these ideas to consider two linear inequalities as a system and the idea that the solutions to a system of inequalities must meet all constraints is explored in the second learning cycle. Students find solutions to systems of inequalities and write a system of inequalities given a solution.

The third learning cycle of Module 5 addresses solving systems of linear equations. The conceptual development for the meaning of a solution to a system of equations is provided in eighth grade, along with some experience in solving a simple linear system algebraically with substitution and by finding the intersection of two lines. The third learning cycle in Module 5 builds on this experience to develop the procedure for solving a system of equations by elimination. The procedure is developed using a story context related to the rest of the module so that students think about matching one of the unknown quantities in the two equations and then finding the difference between what is left to get a solution for one of the variables. The process is carefully built conceptually and then reinforced to be a procedure that students can perform fluently. The final task of the module explores systems of equations that are inconsistent or dependent, giving each of the terms meaning in the story context. In the Honors course, there are two additional tasks in Module 5 that introduce solving systems of equations using row reduction of matrices.

Conceptual Category: Geometry

The standards for geometry in the integrated pathway are carefully designed to allow students to experiment and construct general ideas about shapes and how they transform in eighth grade, moving towards formalizing definitions of rigid transformations and congruence in Secondary Math I through reasoning with diagrams, and then proving theorems and formalizing definitions of dilation and similarity in Secondary Math II. True to the vision of the standards, the MVP curriculum takes a transformational approach to the standards, developing transformations and construction as tools for reasoning and proof that are used in addition to the traditional axiomatic tools of geometry. The curriculum provides students many opportunities to use their intuitive understanding about geometry and experiment with compass, protractor, patty paper, rulers, graph paper, dynamic geometry software and other physical tools to make and justify conjectures.

Module 6, Transformations and Symmetry, builds on students' experiences with rigid motion in earlier grades to formalize the definitions of translation, rotation, and reflection. In the first learning cycle which focuses on the definitions of the rigid transformations, students discover features such as:

- In a translation, the corresponding points from the pre-image to the image form segments that are congruent and parallel.
- In a rotation, corresponding points from the pre-image to the image lie along concentric arcs.
- In a reflection, the line of reflection is the perpendicular bisector of corresponding points from the pre-image to the image.

Students use these features to perform translations and to determine what translations have been performed, given an image and corresponding pre-image. Students' observations about the rigid transformations give purpose and meaning to vocabulary words such as parallel, perpendicular, bisect, concentric, etc.

In the second learning cycle of Module 6, students use their understanding of rigid transformations to find the rotations and reflections that carry a figure onto itself. The explore the symmetries and diagonals of quadrilaterals and regular polygons, making and justifying conjectures about the relationship between the number of lines of symmetry and the number of sides of a regular polygon. At the end of the learning cycle, students make conjectures and classify quadrilaterals based upon symmetries and see that the classifications turn out to be the same as when the quadrilaterals are classified by angles and sides. Students justify their conjecture using their knowledge of the transformations.

Module 7, Congruence, Construction, and Proof, begins by developing constructions as another tool to be used to reason about figures and to justify properties of shapes. Individual constructions are not taught for the sake of memorizing a series of steps, but rather to reason using known properties of shapes such as circles. Many of the constructions, such as the angle bisector, the perpendicular bisector, and the midpoint, flow from constructing a rhombus in the first task. In the second task, students reason to perform the construction of a parallelogram, an inscribed hexagon, and a square. At the end of the module students use triangle congruence and rigid transformation to examine and justify why given compass and straight-edge constructions result in the desired figures.

Students enter Secondary Math I with experience from grade 8 in using rigid transformations to experimentally determine if two figures are congruent. The work with congruence in Module 7 begins with students experimenting to find a general sequence of rigid transformations that will map a figure onto another if they are congruent. Students find that they can generally translate to get a pair of matching vertices, rotate to make a pair of corresponding sides coincide, then reflect to make the rest of the figure coincide. As the learning cycle continues, students use this sequence of transformations (or an equivalent sequence that they have found) to show the triangle congruence properties of ASA, AAS, SSS, and SAS. They also learn that two consecutive sides and an angle (SSA) are not enough to guarantee congruence between two triangles. After determining the congruence criteria of triangles, students use the criteria along with the rigid transformations to justify properties of quadrilaterals, such as the diagonals of a rectangle are congruent.

In Module 8, Connecting Algebra and Geometry, students use the Pythagorean Theorem to find the distance between two points and to derive the distance formula. The idea that parallel lines have the same slope and the slopes of perpendicular lines are negative reciprocals is introduced in Module 6, and then proven in Module 8. Students use the distance formula, their knowledge of slopes, and the features of quadrilaterals, to prove that a given figure is a particular type of quadrilateral, like a parallelogram. Module 8 concludes with a learning cycle that introduces the idea that functions, like geometric figures, can be transformed. In Secondary Math I, students learn about vertical translations of functions; other transformations such as reflection, dilation, and horizontal translations are added in Secondary Math II. The idea that all functions can be transformed in the same, predictable way is one of the big ideas about functions that is introduced in Secondary Math I and used consistently throughout the curriculum.

Conceptual Category: Statistics and Probability

The first learning cycle in Module 9, Modeling Data, addresses representing data in dot plots, histograms, and box plots, and analyzing the data with appropriate summary statistics for center, shape, and spread and identifying the existence of extreme data points. They compare data sets to draw conclusions and justify arguments based upon story context. This work extends the experience that students had in grades 6-8 where they informally described both center and spread.

The module progresses to using two-way frequency tables for bivariate data, analyzing joint and marginal relative frequencies to draw conclusions about the data. Students work with scatter plots and technology to construct meaning for the correlation coefficient, recognizing that as the correlation coefficient becomes closer to 1 or -1, the relationship is more linear. Students learn about the line of best fit and interpret the meaning of the slope and y-intercept of the line of best fit in context. As part of this work, they encounter situations that show that correlation is not the same as causation. The second learning cycle ends with students learning about residuals and how residual plots help to determine if a linear model is the most appropriate for the data. The tasks in Module 9 are designed to promote argumentation based on reasoning and statistical principles, involving students in interesting contexts using real data.

Module 1 Sequences	**4 weeks of instruction**
1.1 Checkerboard Borders – A Develop Understanding Task Defining quantities and interpreting expressions (N.Q.2, A.SSE.1)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.2 Growing Dots – A Develop Understanding Task Representing arithmetic sequences with equations, tables, graphs, and story context (F.LE.1, F.LE.2, F.LE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.3 Growing, Growing Dots – A Solidify Understanding Task Representing geometric sequences with equations, tables, graphs and story context (F.BF.1, F.LE.1a, F.LE.1c, F.LE.2, F.LE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.4 Scott's Workout – A Solidify Understanding Task Arithmetic Sequences: Constant difference between consecutive terms, initial values (F.BF.1,F.LE.1a, F.LE.1c, F.lE.2, F.LE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
1.5 Don't Break the Chain – A Solidify Understanding Task Geometric Sequences: Constant ration between consecutive terms, initial values (F.BF.1, F.LE.1a, F.LE.1c, F.LE.2, F.LE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.6 Something to Chew On – A Solidify Understanding Task Arithmetic Sequences: Increasing and decreasing at a constant rate (F.BF.1, F.LE.1a, F.LE.1b, F.LE.2, F.LE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.7 Chew on This! – A Solidify Understanding Task Comparing rates of growth in arithmetic and geometric sequences (F.BF.1, F.LE.1, F.LE.2)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.8 What Comes Next? What Comes Later? – A Practice Understanding Task Recursive and explicit equations for arithmetic and geometric sequences (F.BF.1, F.LE.1, F.LE.2)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
1.9 What Does it Mean? – A Solidify Understanding Task Using rate of change to find missing terms in a an arithmetic sequence (A.REI.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

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1.10 Geometric Meanies – A Solidify and Practice Understanding Task Using a constant ratio to find missing terms in a geometric sequence (A.REI.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
1.11 I Know… What Do You Know? – A Practice Understanding Task Developing fluency with geometric and arithmetic sequences (F.LE.2)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Module 1 Assessment and Performance Assessment	**1 – 45 to 50 minute period each**

Module 2 Linear and Exponential Functions	**4 weeks of instruction**
2.1 Piggies and Pools – A Develop Understanding Task Introducing continuous linear and exponential functions (F.IF.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
2.2 Shh! Please Be Discreet (Discrete!) – A Solidify Understanding Task Connecting context with domain and distinctions between discrete and continuous functions (F.IF.3, F.BF.1a, F.LE.1, F.LE.2)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
2.3 Linear Exponential or Neither – A Practice Understanding Task Distinguishing between linear and exponential functions using various representations (F.LE.3, F.LE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
2.4 Getting Down to Business– A Solidify Understanding Task Connecting rational exponents with radicals (N.RN.1, A.REI.10)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
2.5 Making My Point – A Solidify Understanding Task Reasoning with positive and negative rational exponents (N.RN.1, A.REI.10)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
2.6 Form Follows Functions – A Solidify Understanding Task Verifying the properties of rational exponents (N.RN.1, N.RN.2, A.SSE.3, F.IF.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

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Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
2.7 I Can See, Can't You – A Practice Understanding Task Using rules of exponents to simplify radical and rational exponents (N.RN.1, N.RN.2, A.SSE.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Module 2 Test & Performance Assessment	**1 – 45 to 50 minute period each**

Module 3 Features of Functions	**3 weeks of instruction**
3.1 Getting Ready for a Pool Party – A Develop Understanding Task Using a story context to graph and describe key features of functions (F.IF.4)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
3.2 Floating Down the River – A Solidify Understanding Task Using tables and graphs to interpret key features of functions (F.IF.4, F.IF.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
3.3 Features of Functions – A Practice Understanding Task Working to achieve fluency with the identification of feature of functions from various representations (F.IF.4, F.IF.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
3.4 The Water Park – A Solidify Understanding Task Interpreting functions and their notation (F.IF.2, F.IF.4, F.IF.5, F.IF.7, A.REI.11, A.CED.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
3.5 Pooling it Together – A Solidify Understanding Task Combining functions and analyzing contexts using functions (F.BF.1b, F.IF.2, F.IF.4, F.IF.5, F.IF.7, A.REI.11, A.CED.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
3.6 Interpreting Functions – A Practice Understanding Task Using graphs to solve problems when given function notation (F.BF.1b, F.IF.2, F.IF.4, F.IF.5, F.IF.7, A.REI.11, A.CED.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

3.7 To Function or Not to Function – A Practice Understanding Task Identify whether or not a relation is a function given various representations (F.IF.1, F.IF.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
Module 3 Test & Performance Assessment	**1 – 45 to 50 minute period each**

Module 4 Equations & Inequalities	**4 weeks of instruction**
4.1 Cafeteria Actions and Reactions – A Develop Understanding Task Explaining each step in the process of solving an equation (A.REI.1)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
4.2 Elvira's Equations – A Solidify Understanding Task Rearranging formulas to solve for a variable (N.Q.1, N.Q.2, A.REI.3, A.CED.4)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
4.3 Solving Equations Literally – A Practice Understanding Task Solving literal equations (A.REI.1, A.REI.3, A.CED.4)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
4.4 Greater Than – A Develop Understanding Task Reasoning about inequalities and the properties of inequalities (A.REI.1, A.REI.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
4.5 May I Have More, Please? – A Solidify Understanding Task Applying the properties of inequalities to solve inequalities (A.REI.1, A.REI.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
4.6 Taking Sides – A Practice Understanding Task Solving linear inequalities and representing the solution (A.REI.1, A.REI.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
4.7H Cafeteria Consumption and Cost – A Develop Understanding Task Organizing data into rectangular arrays or matrices (N.VM.6, N.VM.7, N.VM.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

4.8H Eating Up the Lunchroom Budget – A Solidify Understanding Task Multiplying matrices (N.VM.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
4.9H The Arithmetic of Matrices – A Practice Understanding Task Practicing the arithmetic of matrices (N.VM.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 3 & Self-Assessment (formative)	**20 minutes**
Module 4 Test & Performance Assessment	**1 – 45 to 50 minute period each**

Module 5 Systems of Equations and Inequalities	**5 weeks of instructions**
5.1 Pet Sitters – A Develop Understanding Task An introduction to representing constraints with systems of inequalities (A.CED.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.2 Too Big or Not Too Big, That is the Question – A Solidify Understanding Task Writing and graphing linear inequalities in two variables (A.CED.2, A.REI.12)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.3 Some of One, None of the Other – A Solidify Understanding Task Writing and solving equations in two variables (A.CED.2, A.CED.4)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.4 Pampering and Feeding Time – A Practice Understanding Task Writing and graphing inequalities in two variables to represent constraints (A.CED.2, A.CED.3, A.REI.12)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
5.5 All for One, One for All – A Solidify Understanding Task Graphing the solution set to a linear system of inequalities (A.CED.3, A.REI.12)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.6 More or Less – A Practice Understanding Task Solving systems of linear inequalities and representing their boundaries (A.REI.12, A.CED.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

5.7 Get to the Point – A Solidify Understanding Task Solving systems of linear equations in two variables (A.REI.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
5.8 Shopping for Cats and Dogs – A Develop Understanding Task An introduction to solving systems of linear equations by elimination (A.REI.5, A.REI.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.9 Can You Get to the Point, Too? – A Solidify Understanding Task Solving systems of linear equations by elimination (A.REI.5, A.REI.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.10 Taken Out of Context – A Practice Understanding Task Working with systems of linear equations, including inconsistent and dependent systems (A.REI.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 3 & Self-Assessment (formative)	**20 minutes**
5.11H To Market with Matrices – A Develop Understanding Task An introduction to solving systems of linear equations using matrices (A.REI.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
5.12H Solving Systems with Matrices – A Solidify Understanding Task *Solving systems of linear equations using matrices* (A.REI.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Module 5 Test & Performance Assessment	**1 – 45 to 50 minute period each**

Module 6 Transformation & Symmetry	**3 Weeks of Instruction**
6.1 Leaping Lizards! – A Develop Understanding Task Developing the definitions of the rigid-motion transformations: translations, reflections and rotations (G.CO.1, G.CO.4, G.CO.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
6.2 Is It Right? – A Solidify Understanding Task Examining the slope of perpendicular lines (G.CO.1, G.GPE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

6.3 Leap Frog – A Solidify Understanding Task Determining which rigid-motion transformations will carry one image onto another congruent image (G.CO.4, G.CO.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
6.4 Leap Year– A Practice Understanding Task Writing and applying formal definitions of the rigid-motion transformations: translations, reflections and rotations (G.CO.1, G.CO.2, G.CO.4, G.GPE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
6.5 Symmetries of Quadrilaterals– A Develop Understanding Task Finding rotational symmetry and lines of symmetry in special types of quadrilaterals (G.CO.3, G.CO.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
6.6 Symmetries of Regular Polygons – A Solidify Understanding Task Examining characteristics of regular polygons that emerge from rotational symmetry and lines of symmetry (G.CO.3, G.CO.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
6.7 Quadrilaterals Beyond Definition – A Practice Understanding Task Making and justifying properties of quadrilaterals using symmetry transformations (G.CO.3, G.CO.4, G.CO.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Module 6 Test & Performance Assessment	**1 – 45 to 50 minute period each**
Module 7 Structures of Expressions	**3 weeks of instruction**
7.1 Under Construction – A Develop Understanding Task Exploring compass and straightedge constructions to construct rhombuses and squares (G.CO.12, G.CO.13)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
7.2 More Things Under Construction – A Solidify Understanding Task Exploring compass and straightedge constructions to construct parallelograms, equilateral triangles and inscribed hexagons (G.CO.12, G.CO.13)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
7.3 Can You Get There From Here? – A Develop Understanding Task Describing a sequence of transformations that will carry congruent images onto each other (G.CO.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
7.4 Congruent Triangles– A Solidify Understanding Task Establishing the ASA, SAS and SSS criteria for congruent triangles (G.CO.6, G.CO.7, G.CO.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
7.5 Congruent Triangles to the Rescue– A Practice Understanding Task Identifying congruent triangles and using them to justify claims (G.CO.7, G.CO.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
7.6 Justifying Constructions – A Practice Understanding Task Examining why compass and straightedge constructions produce the desired results (G.CO.12, G.CO.13)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
Module 7 Test & Performance Assessment	**1 – 45 to 50 minute period each**

Module 8 More Functions, More Features	**3 weeks of instruction** **5 weeks for Honors**
8.1 Go the Distance – A Develop Understanding Task Using coordinates to find distances and determine the perimeter of geometric shapes (G.GPE.7)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.2 Slippery Slopes – A Solidify Understanding Task Proving slope criteria for parallel and perpendicular lines (G.GPE.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.3 Prove It! – A Practice Understanding Task Using coordinates to algebraically prove geometric theorems (G.GPE.4)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
8.4 Training Day– A Solidify Understanding Task Writing the equation f(t) = m(t) + k by comparing parallel lines and finding k (F.BF.3, F.BF.1, F.IF.9)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

8.5 Training Day Part II – A Practice Understanding Task Determining the transformation from one function to another (F.BF.3, F.BF.1, F.IF.9)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.6 Shifting Functions – A Practice Understanding Task Translating linear and exponential functions using multiple representations (F.BF.3, F.BF.1, F.IF.9)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
8.7H The Arithmetic of Vectors – A Solidify Understanding Task Defining and operating with vectors as quantities with magnitude and direction (N.VM.1, N.VM.2, N.VM.3, N.VM.4, N.VM.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.8H More Arithmetic of Matrices – A Solidify Understanding Task Examining properties of matrix addition and multiplication, including identity and inverse properties (N.VM.8, N.VM.9)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.9H The Determinant of a Matrix – A Practice Understanding Task Finding the determinant of a matrix and relating it to the area of a parallelogram (N.VM.10, N.VM.12)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.10H Solving Systems with Matrices, Revisited – A Solidify Understanding Task Solving a system of linear equations using the multiplicative inverse matrix (A.REI.1, MVP Honors Standard: Solve systems of linear equations using matrices)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.11H Transformations with Matrices – A Solidify Understanding Task Using matrix multiplication to reflect and rotate vectors and images (N.VM.11, N.VM.12)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
8.12H Plane Geometry – A Practice Understanding Task Solving problems involving quantities that can be represented by vectors (N.VM.3, N.VM.4a, N.VM.12)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 3 & Self-Assessment (formative)	**20 minutes**
Module 8 Test & Performance Assessment	**1 – 45 to 50 minute period each**

Module 9 Modeling Data	**4 Weeks of Instruction**
9.1 Texting by the Numbers – A Solidify Understanding Task Use context to describe data distribution and compare statistical representations (S.ID.1, S.ID.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
9.2 Data Distribution – A Solidify/Practice Understanding Task Describe data distributions and compare two or more data sets (S.ID.1, S.ID.3)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 1 & Self-Assessment (formative)	**20 minutes**
9.3 After School Activity – A Solidify Understanding Task Interpret two way frequency tables (S.ID.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
9.4 Relative Frequency – A Solidify/Practice Understanding Task Use context to interpret and write conditional statements using relative frequency tables (S.ID.5)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
Quick Quiz 2 & Self-Assessment (formative)	**20 minutes**
9.5 Connect the Dots – A Develop Understanding Task Develop an understanding of the value of the correlation co-efficient (S.ID.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
9.6 Making More $ – A Solidify Understanding Task Estimate correlation and lines of best fit. Compare to the calculated results of linear regressions and the correlation co-efficient (S.ID.7, S.ID.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
9.7 Getting Schooled – A Solidify Understanding Task Use linear models of data and interpret the slope and intercept of regression lines with various units (S.ID.6, S.ID.7, S.ID.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
9.8 Rocking the Residuals – A Develop Understanding Task Use residual plots to analyze the strength of a linear model for data (S.ID.6)	**1 - 80 minute period** **2 – 45 to 50 minute periods**
9.9 Lies and Statistics – A Practice Understanding Task Use definitions and examples to explain understanding of correlation coefficients, residuals, and linear regressions (S.ID.6, S.ID.7, S.ID.8)	**1 - 80 minute period** **2 – 45 to 50 minute periods**

Quick Quiz 3 & Self-Assessment (formative)	**20 minutes**
Module 9 Test & Performance Assessment	**1 – 45 to 50 minute period each**