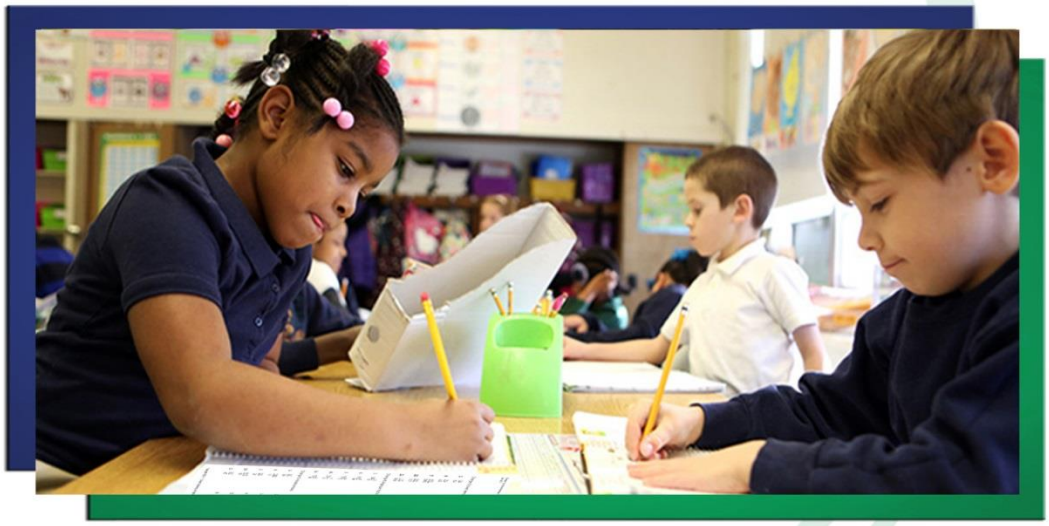
WINTON WOODS

DEPARTMENT OF TEACHING AND LEARNING

Ensuring *all students* achieve their highest potential

MATHEMATICS K-12 FRAMEWORK



WINTON WOODS
CITY SCHOOL DISTRICT

Ensuring *all students* achieve their highest potential

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Ensuring *all students* achieve their highest potential

Para asegurar que los estudiantes alcancen su maximo potencial *(Spanish)*
Nous voulons être sûr que les étudiants atteignons leur niveau le plus elevé *(French)*
Sabai bidyarthi haru le uniharuko uchhatam sambhaya pakka prapta garun *(Nepali)*
Min tabditina bikkoi makaranta fu hebi fu behapda fofai hajangirde *(Fulani)*

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Acknowledgements

Thank you to all Winton Woods City Schools Mathematics Teachers K-12 who provided feedback through online surveys, emails, professional development opportunities, and formal and informal discussions used to create this district mathematics framework. Thank you, as well, to the district leadership, parents, community, and students for ongoing dedication to high quality mathematics instruction.

Framework approved as of July 27, 2015

Introduction

The Department of Teaching & Learning offers professional guidance, support and resources to staff and stakeholders as we provide a quality education designed to meet the diverse needs of our learners from pre-kindergarten through grade twelve.

Winton Woods City Schools is committed to developing passionate readers, critical thinkers, effective communicators and literate individuals who can investigate the world, recognize the perspectives of others, take action within their community, and who will thrive in college and careers (ISSN Pillars). The district vision for high quality mathematics instruction is articulated throughout this framework and serves as a guide for how the district plans to accomplish high quality teaching and learning for all students. Focused on Ohio's New Learning Standards (ONLS) in Mathematics, this document integrates Visible Learning, Formative Instructional Practices (FIP), Mathematical Practices, research-based instructional strategies and intervention.

Philosophy of Teaching and Learning in Mathematics

Winton Woods City Schools is committed to providing high quality academics and preparing each child for the future with a 21st century education. The district vision for high quality mathematics teaching and learning is articulated through this framework and is the plan for how the district plans to accomplish high quality teaching and learning for all students. Mathematics understanding is essential for our students to be successful whether pursuing college or career goals. Mathematics knowledge and success are necessary for every aspect of life, including citizenship. This document coordinates curriculum, instruction, assessment, and professional development around the development of mathematics proficiency, using the Ohio's New Learning Standards (ONLS) in Mathematics and Mathematical Practices, and drives mathematics teaching and learning improvement efforts. The ONLS in Mathematics and the Mathematical Practices address conceptual understanding, procedural skill, fluency, rigor, and application. The ONLS in Mathematics represent what students should know and be able to do. The pillars on which this Mathematics Framework is based are: Equity, Teaching, Learning, Assessment, and Technology. These pillars support the district's mathematics program while the ONLS in Mathematics, the Mathematical Practices, and a professional growth-mindset serve as the foundation on which these pillars stand. A professional growth-mindset is essential because it maximizes the capacity and potential strength within each pillar. Although Equity stands as an independent pillar, the influence of equity in mathematics is foundational within each pillar and can be directly connected to the professional growth-mindset because all students can learn mathematics, deserve to learn mathematics, and must learn mathematics. An effective mathematics program is based on standards that are coherent, focused, and articulated across grade levels. Articulation ensures that there are connections between lessons, units, courses, and grade levels, and that the connections make possible the increasingly rigorous development of ideas (Sutton & Krueger, 2002, p.48). Coherence means the "mile-wide, inch-deep" curriculum will have fewer topics with greater breadth and depth. It allows students to have more than one entry point at a "just right" level, and allows all students access to participate in spite of their gaps of prior knowledge.

Pillar 1: Equity

Equity in mathematics is rooted in the belief that all students can learn, deserve to learn, and must learn worthwhile mathematics. *The Principles and Standards for School Mathematics* (NCTM, 2000) states the following:

> All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study-and support to learn-mathematics. Equity does not mean that every

> student receives identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students (p.12).

This is an important yet challenging goal. In order to make this vision a reality for all Winton Woods students in pre-Kindergarten through Grade 12 requires that we raise expectations of student learning, provide students and teachers with needed resources, and have systematic efforts to support student learning. Equity requires resources and support for all classrooms, accommodating differences, and high expectations and worthwhile mathematical tasks for all (NCTM, 2000).

In *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*, John Hattie (2009) asserts that teacher expectations as a contributing factor to student achievement has an effect size (*d*) = 0.43, which equates to just over a year of learning gains. In order to develop and support equity in mathematics, educators must have high expectations for all students and must provide high-quality mathematics instruction for all students (Sutton & Krueger, 2002). Educators are expected to use best practices for teaching and learning. These practices can be linked to Formative Instructional Practices (FIP). The four key components to FIP include clearly communicated learning targets, evidence of student learning, effective feedback, and students' ownership of learning. By establishing and implementing high expectations and high-quality instruction for all students, educators are working to support equity in mathematics for all students.

Pillar 2: Teaching

Teachers play an important and critical role in the implementation of the mathematics framework. We know that Winton Woods' teachers are committed to the district's students and are willing to implement progressive change initiatives, such as the Academy of Global Studies and the expansion of New Tech to the entire high school, as well as the 1-to-1 technology initiative. Accomplished teachers know there is an art to teaching. This art encompasses using conventional methods in unexpected ways or unconventional methods to further mathematical understanding (National Board for Professional Teaching Standards, 1996). They allow students to have more control or choice in a task, or design an activity without having all of the answers themselves. They are not afraid of failure and are willing to take calculated risks to create better educational opportunities. They employ various strategies to explore, discover, and use mathematical ideas such as, whole class discussion, cooperative (small) group work, and individual study. They engage students in projects, games, experiments, demonstrations, presentations and make sound judgments about the use of time, pacing and know when to change or maintain a classroom format to optimize learning.

Teaching strategies can be used in isolation or in tandem with other strategies. Some teaching strategies are known as high-yield strategies, meaning they have an effect size of 0.40 (Hattie, 2009) or higher where noted.

Inquiry-Based Learning - starts by posing questions or problems and allows students to identify and research problems and questions to develop knowledge or solutions. This often includes problem-based (*d* = 0.31) and project-based learning.

Project-Based Learning - Projects can be framed around compelling problems, issues, or challenges that require critical thinking and prompt students to craft reasoned arguments in response to the driving question. Students work in collaborative teams that employ the skills of all group members and are often interdisciplinary.

Direct Instruction (*d* = 0.59) - This is not to be confused with Didactic Teaching. The teacher makes explicit the learning goal and the criteria for success, models them, evaluates understanding, and ties it together with closure (Hattie, 2009).

Cooperative Learning (*d* = 0.41) - Students work together in various group formations to collaborate through structured positive interdependence.

Metacognition Strategies (*d* = 0.67) **-** This relates to thinking about thinking. Metacognitive strategies facilitate learning how to learn. Metacognition assists a person with taking control of his or her own learning and fosters forethought and self-reflection.

Feedback (*d* = 0.72) **-** The best feedback is corrective and timely and involves an explanation of what is correct and what is incorrect and allowing them to keep working until they succeed.

Concept Mapping (*d* = 0.57) - This helps students to create a mental picture or graphic representation (also called a nonlinguistic representation) to help students elaborate, justify, or explain their knowledge.

Spaced vs. Massed Practice (*d* = 0.71) - Students are given more time to practice and master new concepts rather than many problems given at once.

Pillar 3: Learning

Learning is a cycle involving a multitude of changing variables and conditions contributed by teachers and students. The key components of Formative Instructional Practices (FIP) are rooted in educational research and outline the cycle for learning (Battelle for Kids, 2011). These components include: clearly defined learning targets, formative assessment, constructive feedback, and student ownership in determining next steps for learning. All of these contributors to student learning then subsequently support students' confidence, which, in turn, leads to an even higher level of motivation, enthusiasm, engagement, and learning success (Sutton & Krueger, 2002). Before learning can begin, effective mathematics educators must have strong mathematics content knowledge (MCK) and strong pedagogical content knowledge (PCK). Furthermore, effective mathematics educators must hold a growth-mindset: the underlying belief that one's skills, intelligence, and talents can be further cultivated, developed, and increased through hard work, dedication, and perseverance (Dweck, 2006). It is this pivotal underlying belief that transforms classrooms into places where all students are honored for where they are in their learning and equally supported in making learning gains accordingly.

A growth-mindset creates a classroom environment that empowers students to openly share, model, and justify their thinking, to take risks, to learn from mistakes, to productively critique their own work and the work of others, to generate a hypothesis and test the validity of that thinking, and to ultimately recognize the value of their mathematical thinking as relevant to our world. A growth-mindset is the pivotal underlying belief that supports the learning process. In addition, educators must ensure equity within mathematics. All students can learn mathematics, deserve to learn mathematics, and must learn mathematics in order to become prepared 21st century citizens.

Once the classroom environment has been established, the four key components of FIP will support the learning cycle. The FIP model drives learning by answering the following questions:

- "Where am I going?"
- "Where am I now?"
- "Am I on the right path?"
- "What do I need to be successful?"

Teachers must use clearly communicated learning targets to define success, to establish evidence for learning, to gauge student learning using evidence of learning, also known as assessment data, and to provide timely, constructive feedback which supports student learning. Teachers must provide timely, constructive feedback that addresses what is correct and elaborates on what next steps need to be taken. In turn, students become empowered to use their own evidence of learning and feedback to plan for the next steps needed to achieve learning success (Dean, Hubbell, Pitler & Stone, 2012).

Clear learning targets must be explicitly communicated to students, written for display, discussed, and referenced as active threads throughout the lesson so students can gauge their learning as related to the learning target, learning evidence, and feedback. These clear learning targets are derived from ONLS for Mathematics, along with the Mathematical Practices, that have been designed to support students to become prepared 21st Century Citizens through college and career readiness. In addition, ONLS for Mathematics and Mathematical Practices integrate conceptual understanding with procedural fluency. Faster does not mean better. Instead, the ultimate goal is for students to flexibly work with numbers, problem-solve using various efficient strategies, and most importantly understand, apply, and synthesize mathematical reasoning and conceptual knowledge so higher level connections are ongoing and deeply-rooted.

Well defined, clearly communicated learning targets serve as the bridge which connects teaching and learning. In *Classroom Assessment for Learning,* Rick Stiggins asserts that "students can hit any target they see that holds still for them" (2011, p. 57). Dean et al. (2012) found that when this best practice is fully implemented, students are able to take ownership of their learning and, as a result, are more intrinsically motivated to learn and to set personal learning objectives. The significance of establishing clearly communicated learning targets has been outlined, tied back to FIP, and supported in research.

Evidence of learning, also known as assessment data, is collected, analyzed, and used to make decisions regarding how to most effectively scaffold student learning and communicate next steps for learning. Formative assessment is key because it enables teachers to be responsive to student learning on the spot, to make instructional adjustments accordingly, and to provide specific, automatic feedback to move student learning forward. When used effectively, assessment informs feedback, instruction, and learning. The importance of providing constructive, timely feedback is critical in these steps and can support metacognitive learning. Hattie (2009) reports constructive, timely feedback is one of the most influential contributors to student achievement with an effect size of 0.72. Timely, constructive feedback become stepping stones which support students in creating pathways to achieve learning success. When students collect and evaluate their own evidence of learning and provide peer feedback, students move into the meta-cognitive realm of learning which is thinking about their thinking. This higher level thinking requires active learning engagement and is proven to be a high yield learning strategy. Hattie (2009) posts the effect size for employing metacognitive strategies as 0.67. Meta-cognitive strategies include, but are not limited to, using graphic organizers to set and monitor goals within specific time frames such as vocabulary inventory tools where students set a goal to learn and apply new content specific vocabulary, and then monitor and judge the effectiveness of their learning gains within or beyond a unit of study.

An overview of literacy strategies and resources that support math vocabulary acquisition and application in math discourse and writing are found as active links within the reading, writing, and vocabulary content of this framework. The district expectation is that math vocabulary will be explicitly taught to support student prior knowledge and experience and concept development and content connections. Math word walls, aligned by the grade level district unit maps, will be posted and taken down by unit so that teachers and students can actively reference and use math vocabulary in math discourse and writing. Key grade level math vocabulary can be posted as distributive review in order to make cross unit connections throughout the year, as well. In addition to vocabulary inventory tools and other such graphic organizers that support reading, writing, and vocabulary, there are other strategies that can also support metacognitive thinking that include connecting prior and future learning, planning, monitoring, and judging learning gains using specific criteria as in a student created or teacher created rubric (Sutton & Krueger, 2002). Including these strategies fosters student ownership of their learning. Hattie (2009) reports that when students self-report grades the student achievement effect size is 1.44. This is the highest student achievement effect size within the student domain of meta-analyses.

All students can learn mathematics, deserve to learn mathematics, and must learn mathematics to become 21st century citizens. In order to support this high level of student learning for all students, effective mathematics teachers must create a supportive classroom environment and include the four key components of the FIP learning cycle.

Pillar 4: Assessment

Assessment is the pathway to gather information about student learning and improve student achievement through informed decisions. Effective assessment can identify the academic needs of individual students that can then inform instructional decisions to maximize learning (Stiggins, Arter, Chappuis, & Chappuis, 2004). To get the most holistic picture of a student's individual strengths and needs, the National Council of Teachers of Mathematics (2000) recommends using a variety of assessments and including real world contexts often. Assessment also serves as a primary means of communication of student progress to teachers and students, as well as to parents, the school district, and the community (Sutton & Krueger, 2002).

Evidence of learning can be shown in many different formats. A teacher's choice in assessments should reflect this variety of options. A balanced classroom will have assessments that match what is being taught so assessment choice begins with the learning targets (Sutton & Krueger, 2002). Assessment choices include, but are not limited to the following:

- Selected-response assessments;
- Constructed-response assessments;
- Performance tasks;
- Observations, checklists, interviews, and portfolios;
- Standardized, norm-referenced tests (Sutton & Krueger, 2002).

A variety of assessment options will ensure the teacher and student can track all progress towards a clearly communicated learning target. It is important to involve students and families in the assessment process. Students need to know what is expected of them and how they can be successful. "Long-term retention and motivation increases when students, track, reflect on, and communicate about their learning (Chappuis, 2009, p. 13)." Hattie (2009) states that when students report their own grades and have an accurate estimate of their own performance there is an overall effect size of 1.28. Involving students and families in assessment gives them an accurate picture of progress towards the goal and makes them active partners in the learning process.

Assessment is the active thread that runs alongside the learning target and drives teaching. "Quality classroom assessment produces *accurate information* that is *used effectively* to increase student learning" (Chappuis, Stiggins, Chappuis, & Arter, 2012, p. 12). When used as part of the FIP cycle of learning, assessment ties the multitude of variables and conditions contributed by teachers and students together. This in turn provides the link to the next level of learning.

Pillar 5: Technology

The ONLS in Mathematics and the Mathematical Practices have been designed to promote fluency and with conceptual understanding. Rote math fact memorization has been de-emphasized, and more flexible and fluid strategies for problem solving have been emphasized (Parker, 2015). As a result of the ONLS in Mathematics and the Mathematical Practices shift, educators must define when to use technology such as calculators, to most effectively and efficiently support teaching and learning. "The mathematics we want students to learn should be the driving force behind the lesson and behind the choice of what tools to use, not the other way around" (Seeley, 2009, p. 105). Educators must identify opportunities to implement technology in ways that enhance and enrich students' mathematical experiences (Seeley, 2009). John Hattie (2009) reports an overall student learning effect size of 0.20 for calculator usage when used for: computation, drill and practice, and checking work, when the students' cognitive "load" is reduced so students can shift their focus to conceptual problem solving, or when calculator usage is related to an instructional purpose related to teaching and learning (p.145). Ellington (2000) concluded that calculator usage had a greater effect size in lower ability

students for an effective size of 0.30. In addition, Smith (1996) reported a positive effect size on math attitude of 0.37 for students using calculators in math. Calculator usage had a negative effect size on student learning of - 0.23 with high ability math students (Hattie, 2009). Accordingly, Ellington (2006) reported an effect size of 0.72 when calculators were involved in the teaching process during problem solving (Hattie, 2009). It is important to note the extensive array of these meta-analyses results and additional related educational research relating to calculator usage and student achievement because this information is directly connected to the educator's responsibility to make informed decisions on when to use technology to most effectively and efficiently enhance and enrich students' mathematical experiences. Educators must ensure the equity of technology resources. Technology implementation is one way to increase overall student engagement and interest in mathematics and should not be used to target certain student groups. Accordingly, educators must be open to devote the time and effort in learning new ways to incorporate technology into mathematics teaching and learning and must stay abreast of the related research so that decisions can be made to best support effective and efficient teaching and learning.

Implementing technology into math instruction should not be an afterthought. When planning, teachers need to think about when and how to use available technology to most effectively facilitate student learning connections. The district has access to various online programs: *Study Island* (3-8), *Math XL* (6-12), *Khan Academy* (1-12), TenMarks (1- Algebra II), *Desmos* (online graphing calculator for applicable higher level mathematics courses), *Xtramath* (1-6), and *MobiMax* (K-8). In addition to these online programs, the district has also purchased several math apps at the primary level such as "Friends of Ten" which can also be used to support student learning. These online learning opportunities should be shared with students and parents and used to support math instruction, ultimately preparing students for college and career readiness.

Mathematics | Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1. **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. **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. **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. **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. **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. **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. **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 x2 + 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. **Look for and express regularity in repeated reasoning.**
   Mathematically proficient students notice if 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)(x2 + x + 1), and (x – 1)(x3 + 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.

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction.

The Standards for Mathematical Content are a balanced combination of procedure and understanding. *Expectations* that begin with the word “understand” are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential “points of intersection” between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

Common Core Standards for Mathematical Practice Look-for Tool

	Mathematics Practices	Student dispositions:	Teacher actions to engage students in Practices:
Overarching habits of mind of a productive math thinker	**1. Make sense of problems and persevere in solving them**	☐ Have an understanding of the situation ☐ Use patience and persistence to solve problem ☐ Be able to use strategies ☐ Use self-evaluation and redirections ☐ Communicate both verbally and written ☐ Be able to deduce what is a reasonable solution Comments:	☐ Provide open-ended and rich problems ☐ Ask probing questions ☐ Model multiple problem-solving strategies through *Think- Aloud* ☐ Promotes and values discourse ☐ Cross-curricular integrations ☐ Promotes collaboration ☐ Probe student responses (correct or incorrect) for understanding and multiple approaches ☐ Provide scaffolding appropriately ☐ Provide a safe environment for learning from mistakes Comments:
	6. Attend to precision	☐ Communicate with precision-orally and written ☐ Use mathematics concepts and vocabulary appropriately ☐ State meaning of symbols and use appropriately ☐ Attend to units/labeling/tools accurately ☐ Carefully formulate explanations and defend answers ☐ Calculate accurately and efficiently ☐ Formulate and make use of definitions with others and their own reasoning ☐ Ensure reasonableness of answers ☐ Perseverance through multiple-step problems Comments:	☐ Encourage students to think aloud/talk aloud ☐ Explicit instruction/teacher model of think aloud/talk aloud ☐ Guided Inquiry including teacher gives problem, students work together to solve problems, and debriefing time for sharing and comparing strategies ☐ Probing questions targeting content of study ☐ Promote mathematical lingo ☐ Give room to discuss why wrong answers are wrong Comments:
Reasoning and Explaining	**2. Reason abstractly and quantitatively**	☐ Create multiple representations ☐ Interpret problems in contexts ☐ Estimate first/answer reasonable ☐ Make connections ☐ Represent symbolically ☐ Visualize problems ☐ Talk about problems, real life situations ☐ Attending to units ☐ Using context to think about a problem Comments:	☐ Develop opportunities for and model problem solving strategies ☐ Give time for processing and discussing ☐ Tie content areas together to help make connections ☐ Give real world situations ☐ Think aloud for student benefit ☐ Value invented strategies and representations ☐ Less emphasis on the answer Comments:
	3. Construct viable arguments and critique the reasoning of others	☐ Ask questions ☐ Use examples and counter examples ☐ Reason inductively and make plausible arguments ☐ Use objects, drawings, diagrams, and actions ☐ Students develop ideas about mathematics and support their reasoning ☐ Analyze others arguments ☐ Encourage the use of mathematics vocabulary Comments:	☐ Create a safe environment for risk-taking and critiquing with respect ☐ Model each key student disposition ☐ Provide complex, rigorous tasks that foster deep thinking ☐ Provide time for student discourse ☐ Plan effective questions and student grouping ☐ Probe students Comments:

Mathematics Practices		Students:	Teacher(s) promote(s) by:
Modeling and Using Tools	**4. Model with mathematics**	☐ Realize they use mathematics (numbers and symbols) to solve/work out real-life situations ☐ Analyze relationships to draw conclusions ☐ Interpret mathematical results in context ☐ Show evidence that they can use their mathematical results to think about a problem and determine if the results are reasonable. If not, go back and look for more information ☐ Make sense of the mathematics Comments:	☐ Allow time for the process to take place (model, make graphs, etc.) ☐ Model desired behaviors (think alouds) and thought processes (questioning, revision, reflection/written) ☐ Make appropriate tools available ☐ Create an emotionally safe environment where risk taking is valued ☐ Provide meaningful, real world, authentic, performance-based tasks (non traditional work problems) ☐ Discourse ☐ Investigations Comments:
	5. Use appropriate tools strategically	☐ Choose the appropriate tool to solve a given problem and deepen their conceptual understanding (paper/pencil, ruler, base 10 blocks, compass, protractor) ☐ Choose the appropriate technological tool to solve a given problem and deepen their conceptual understanding (e.g., spreadsheet, geometry software, calculator, web 2.0 tools) ☐ Compare the efficiency of different tools ☐ Recognize the usefulness and limitations of different tools Comments:	☐ Maintain knowledge of appropriate tools ☐ Effective modeling of the tools available, their benefits and limitations ☐ Model a situation where the decision needs to be made as to which tool should be used ☐ Compare/contrast effectiveness of tools ☐ Make available and encourage use of a variety of tools Comments:
Seeing structure and generalizing	**7. Look for and make use of structure**	☐ Look for, interpret, and identify patterns and structures ☐ Make connections to skills and strategies previously learned to solve new problems/tasks independently and with peers ☐ Reflect and recognize various structures in mathematics ☐ Breakdown complex problems into simpler, more manageable chunks ☐ Be able to "step back" / shift perspective ☐ Value multiple perspectives Comments:	☐ Be quiet and structure opportunities for students to think aloud ☐ Facilitate learning by using open-ended questioning to assist students in exploration ☐ Careful selection of tasks that allow for students to discern structures or patterns to make connections ☐ Allow time for student discussion and processing in place of fixed rules or definitions ☐ Foster persistence/stamina in problem solving ☐ Through practice and modeling time for students Comments:
	8. Look for and express regularity in repeated reasoning	☐ Identify patterns and make generalizations ☐ Continually evaluate reasonableness of intermediate results ☐ Maintain oversight of the process ☐ Search for and identify and use short-cuts Comments:	☐ Provide rich and varied tasks that allow students to generalize relationships and methods, and build on prior mathematical knowledge ☐ Provide adequate time for exploration ☐ Provide time for dialogue and reflection, peer collaboration ☐ Ask deliberate questions that enable students to reflect on their own thinking ☐ Create strategic and intentional check in points during student work time Comments:

- All indicators are not necessary for providing full evidence of practices (s). Each practice may not be evident during every lesson.
- Document originally created by NCSM Summer Leadership Academy then edited by Region 2 Algebra Forum.

Identification for Algebra I

Historically there have been one-two classes of gifted students that enter Algebra I in 7th Grade in the Winton Woods City School District. For the most part, these students are the same students that move through the accelerated math track culminating in AP Calculus in high school. We are shifting from a sift and sieve advanced course track model which identifies and supports a small, select student population to a more encompassing model with multiple safety nets in place to catch and bring more students along the accelerated track as students demonstrate readiness. Strategic, systematic supports will ensure acceleration opportunities for a larger student population in these higher level mathematics courses. The district objectives related to Algebra I placement are as follows:

- To implement strategic, systematic supports so all students can succeed in higher level mathematics.
- To establish a screening system to identify Algebra I ready students that includes student disposition, class performance, prior state test scores, and an algebra specific screening assessment.
- To ensure that all students have multiple opportunities to take higher level mathematics courses.

Algebra I is a gatekeeping course and failure in Algebra I puts students at a significant disadvantage for future success in higher level math courses. In response to this, the district is moving to a proactive approach in terms of strengthening math instruction district-wide. The district math framework has been established to define a common instructional language through the pillars and create a set of explicit expectations around mathematics instruction K-12. An algebra screening form has been established to take teacher feedback as related to class performance and student disposition, state test scores, and a potential Algebra I readiness assessment all into consideration when identifying students for Algebra I placement. Students that demonstrate readiness in 6th and 7th grade will be tested. Accordingly, all 8th graders will be tested. Students who do not demonstrate readiness will be strongly encouraged to attend a summer bridge program to focus on algebraic thinking and reasoning to strengthen their skills prior to taking Algebra I in ninth grade.

Algebra Readiness Screening WWCS Math Grades 6-8

Teachers please use the following criteria to screen your students for Algebra readiness.
Student:_____ Grade:_____ Teacher:_____

A. Student Disposition for Algebra Readiness: (27-36 total rubric points.) Total Score:_____

Attributes (student disposition)	1 Demonstrates little or no proficiency.	2 Demonstrates partial proficiency.	3 Demonstrates proficiency.	4 Demonstrates accomplishment.
Demonstrates higher level thinking skills.	1	2	3	4
Retains and is able to apply concepts.	1	2	3	4
Accepts challenges of accelerated activities.	1	2	3	4
Acquires information quickly.	1	2	3	4
Works well independently, seeks help when needed.	1	2	3	4
Computation skills (Use IAAT score for verification).	1	2	3	4
Can explain/ justify responses.		2	3	4
Can effectively communicate mathematical thinking.	1	2	3	4
Works well in groups.	1	2	3	4

Check which one applies or fill in blank.

B. Homework Completion: _____Consistently completes homework _____Inconsistently completes homework.

C. Spring Math OAA Proficiency Level:

_____Advanced_____Accelerated_____Proficient_____Basic_____Limited

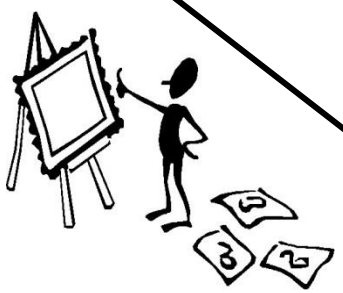
D. Iowa Algebra Aptitude Test (IAAT) Percentile Score:_____

E. Overall Math Common Assessment Performance:

_____Advanced_____Accelerated_____Proficent_____Basic_____Limited_____

What do good problem solvers do?

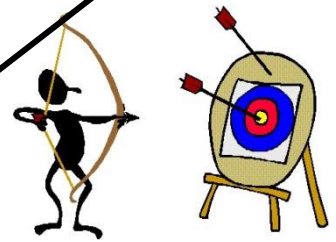
Do what makes sense and be persistent



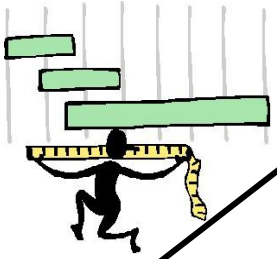
Use number sense when representing a problem

Look for and use patterns and connections

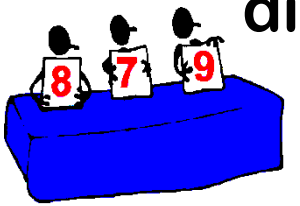
Be precise with words, numbers, and symbols



Use math to describe a real situation or problem

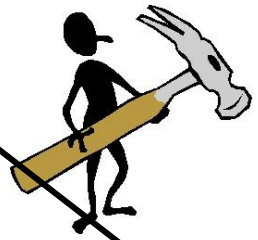


Make conjectures and prove or disprove them



Look for and create efficient strategies

Use tools and technology strategically



Kindergarten Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Foundational Number Sense #1-10	**Identify and Describe Shapes Analyze, Compare, Create, and Compose Shapes**	**Comparisons of Length, Weight, and Numbers to 10**	**Decomposing and Composing (Adding and Subtracting) Numbers to 10**	**Numbers 10-20, Counting to 100 by 1 and 10 (Extending all previous concepts)**
8 weeks & ongoing	**2 weeks**	**9 weeks**	**10 weeks**	**8 weeks**
K.CC.1	K.G.1	K.CC.6	K.OA.1	K.NBT.1
K.CC.2	K.G.2	K.CC.7	K.OA.2	K.CC.1
K.CC.3	K.G.3	K.MD.1	K.OA.3	K.CC.2
K.CC.4	K.G.4	K.MD.2	K.OA.4	K.CC.3
K.CC.5	K.G.5	K.MD.3	K.OA.5	K.CC.4
K.CC.6	K.G.6	MP.3	MP.1	K.CC.5
K.MD.3	MP.3	MP.5	MP.2	K.CC.6
MP.4	MP.6		MP.4	MP.1
MP.6	MP.7		MP.6	MP.2
			MP.8	MP.4
				MP.5
				MP.7

Major Clusters	Supporting Clusters	Additional Clusters	Other
CC—Counting and Cardinality (1, 2, 3, 4, 5, 6, 7) OA—Operations and Algebraic Thinking (1, 2, 3, 4, 5) NBT—Number and Operations in Base Ten (1)	MD—Measurement and Data (3)	MD—Measurement and Data (1, 2) G—Geometry (1, 2, 3, 4, 5, 6)	MP—Standards for Mathematical Practice

Kindergarten Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in Grades K-8 and will extend this approach into the high school mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, *Math Investigations* will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of *Math Investigations* to Common Core are filled uniformly, *Envisions 2.0* will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an Inquiry Based lens. TERC is in the process of completely redesigning a new Common Core aligned version of *Math Investigations*. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Kindergarten Mathematics
As you see in your Year at a Glance the major areas for Kindergarten are related to Counting & Cardinality and Operations and Algebraic Thinking in order to build a strong conceptual understanding of number values and structures, also known as number sense. More learning time should be devoted to number sense than any other topic. The year begins with building a strong foundation of understanding the cardinality of numbers up to 10. The plan intentionally moves to Geometry to give students additional time to internalize key components of the first unit and give teachers time to conduct small groups of intervention and extensions. Next, the year transitions into Comparisons of Length and Weight in order to give more exposure to numbers up to 10 in a different context. In Unit 4, students will have the chance to apply their understanding of cardinality by composing and decomposing numbers to 10. Unit 5 extends all previous concepts up to 100. The year is wrapped up by analyzing, comparing, creating, and composing shapes.
Fluency Requirements * Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
K.OA.5—Fluently add and subtract within 5 1.OA.6—Fluently add and subtract within 10 2.OA.2—Fluently add and subtract within 20
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 1 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Place Value to 99 and Extending the Counting Sequence to 120	**Measuring Length**	**Operations and Algebraic Thinking with Composing and Decomposing Numbers to 20**	**Reason with Shapes and their Attributes**	**Using Place Value to Add and Subtract Number to 100**	**Review of Major Clusters and Preview of 2nd Grade by Generalizing to 1,000**
5 weeks	**4 weeks**	**6 weeks**	**5 weeks**	**6 weeks**	**4 weeks**
1.NBT.1	1.MD.1	1.OA.1	1.G.1	1.NBT.4	1.OA
1.NBT.2	1.MD.2	1.OA.2	1.G.2	1.NBT.5	1.NBT
1.NBT.3	1.MD.4	1.OA.3	1.G.3	1.NBT.6	2.NBT.1 a,b
MP.3	MP.3	1.OA.4	1.MD.3	MP.1 - 8	MP.1 - 8
MP.4	MP.5	1.OA.5	1.MD.4		
MP.5	MP.7	1.OA.6	MP.3		
MP.7		1.OA.7	MP.5		
MP.8		1.OA.8	MP.8		
		MP.1 - 8			

Major Clusters	Supporting Clusters	Additional Clusters	Other
OA—Operations and Algebraic Thinking (1, 2, 3, 4, 5, 6, 7, 8) NBT—Number and Operations in Base Ten (1, 2, 3, 4, 5, 6) MD—Measurement and Data (1, 2)	MD—Measurement and Data (4)	MD—Measurement and Data (3) G—Geometry (1, 2, 3)	MP—Standards for Mathematical Practice

Grade 1 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in Grades K-8 and will extend this approach into the high school mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, *Math Investigations* will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of *Math Investigations* to Common Core are filled uniformly, *Envisions 2.0* will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an Inquiry Based lens. TERC is in the process of completely redesigning a new Common Core aligned version of *Math Investigations*. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Grade 1 Mathematics
There are four key critical areas for Grade 1 Mathematics in the CCMS, also known as Ohio's New Learning Standards in Mathematics. These areas include the following: 1) Students need to understand addition and subtraction and related addition and subtraction strategies within 20. (Students need to understand and explain how to compose and decompose numbers, using multiple strategies and models such as the tens frame and base ten blocks. WWCS Elementary Math Teachers created a list of addition and subtraction strategies to be taught in order to establish more uniform instruction across grade levels and to support teacher and student vertical progressions. Uniformly introducing and referring to the strategies will support students' learning connections from grade level to grade level as teachers are able to access prior knowledge and experience more consistently. Please utilize the WWCS Addition and Subtraction Strategies found within this document's appendices with your students.) 2) Students need to understand place value so they can compose and decompose two digit numbers, add within 100, and subtract within multiples of 10. (Students need to understand, for example, 29 is two groups of ten and nine ones. By building number sense as related to place value and multiples of ten within the 100 Chart, students are able to recognize patterns and make generalizations to support multiple strategies for composing and decomposing numbers.) 3) Students need to understand the basic meaning and processes of measurement. 4) Students need to understand how to compose and decompose plane or solid figures, build whole to part understanding of shapes, make comparisons between plane or solid figures, and build spatial sense by understanding attributes, different perspectives, and orientations of shapes and solid figures which will lead into student basic understanding of geometry properties such as symmetry or congruence and measurement as related to perimeter, area, and volume as students progress in their learning from grade level to grade level. As you will notice, the Grade 1 Year at a Glance was intentionally designed to support the critical areas through the units, providing the necessary developmental experiences and time to support learning connections throughout the year from unit to unit.
Fluency Requirements *Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
1.OA.6—Fluently add and subtract within 10 2.OA.2—Fluently add and subtract within 20 AND 2. NBT.5 Add/Subtract within 100 3.OA.7 Multiply/ Divide within 100 (Know single digit products from memory) AND 3.NBT.2 Add/ Subtract within 1000
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 2 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Place Value and Extending the Counting Sequence to 1,000	**Estimating, Composing, and Decomposing Length**	**Composing and Decomposing Numbers to 100**	**Time and Money**	**Composing and Decomposing Numbers to 1,000**	**Composing and Decomposing 2D Shapes and Cubes**	**Foundations for Multiplication**	**Represent and Interpret Data**
5 weeks	**3 weeks**	**3-4 weeks**	**4 weeks**	**4 weeks**	**2 weeks**	**3 weeks**	**3 weeks**
2.NBT.1	2.MD.1	2.OA.1	2.MD.7	2.NBT.6	2.G.1	2.OA.3	2.MD.9
2.NBT.2	2.MD.2	2.OA.2	2.MD.8	2.NBT.7	2.G.2	2.OA.4	2.MD.10
2.NBT.3	2.MD.3	2.NBT.5	MP.2	2.NBT.8	2.G.3	MP.3	MP.4
2.NBT.4	2.MD.4	2.NBT.9	MP.5	2.NBT.9	MP.2	MP.4	MP.5
MP.3	2.MD.6	2.MD.5	MP.6	2.MD.8	MP.4	MP.7	MP.6
MP.4	2.MD.9	2.MD.6	MP.7	MP.1 - 8	MP.6	MP.8	
MP.5	MP.3	MP.1 - 8			MP.7		
MP.7	MP.5						
MP.8	MP.7						

Major Clusters	Supporting Clusters	Additional Clusters	Other
OA—Operations and Algebraic Thinking (1, 2) NBT—Number and Operations in Base Ten (1, 2, 3, 4, 5, 6, 7, 8, 9) MD—Measurement and Data (1, 2, 3, 4, 5, 6)	OA—Operations and Algebraic Thinking (3, 4) MD—Measurement and Data (7, 8, 9, 10)	G—Geometry (1, 2, 3)	MP—Standards for Mathematical Practice

Grade 2 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its Inquiry Based philosophy for mathematics in grades K-8 and will extend this approach into the High School mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, Math Investigations will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of Math Investigations to Common Core are filled uniformly, Envisions 2.0 will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an Inquiry Based lens. TERC is in the process of completely redesigning a new Common Core aligned version of Math Investigations. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Grade 2 Mathematics
There are four key critical areas for Grade 2Mathematics in the CCMS, also known as Ohio's New Learning Standards in Mathematics. These areas include the following: 1) Students must be able to extend their base-ten system understanding. 2) Students must be able to use their addition understanding to develop addition and subtraction fluency within 100, problem solve within 1000 by applying and extending their understanding of models and specific strategies for addition and subtraction, and demonstrate place value, operations properties, and mental computation understanding of sums and differences. (WWCS Elementary Math Teachers created a list of addition and subtraction strategies to be taught in order to establish more uniform instruction across grade levels. Uniformly introducing specifically named strategies will support students' learning connections from grade level to grade level as teachers are able to access prior knowledge and experience more consistently. See WWCS Addition and Subtraction Strategies in this document's appendices.) 3) Students must extend their basic understanding of measurement to include a solid rationale for the use of standard measurement. Students must also understand that the smaller the measurement units, the more iterations needed to measure a given length. 4) Students must be able to describe and analyze shapes by their sides and angles. Students must be also able to compose and decompose shapes through investigations, and describe, explain, and justify the newly composed or decomposed shape. Students must also build, draw, and analyze two and three dimensional shapes to in order to build the future understanding of perimeter, area, and volume in upper grades. As you will notice, the Grade 2 Year at a Glance was intentionally designed to support the critical areas through the units, providing the necessary developmental experiences and time to support learning connections throughout the year from unit to unit.
Fluency Requirements * Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
2.OA.2—Fluently add and subtract within 20 AND 2.NBT.5 Add/ Subtract within 100 3.OA.2 Multiply/ Divide within 100 (Know single digit products from memory) AND 3.NBT.2 Add/ Subtract within 1000 AND 3.NBT.2 Add/ Subtract within 1000
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 3 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Whole Number Operations	**Multiplying and Dividing with Whole Numbers**	**Area of Rectangles**	**Time**	**Fractions**	**Equivalent Fractions**	**Measurement and Graphing**	**2-Dimensional Figures**
5 weeks	**6 weeks**	**3 weeks**	**3 weeks**	**3 weeks**	**4 weeks**	**4 weeks**	**3 weeks**
3.NBT.1	3.OA.1	3.MD.5	3.MD.1	3.NF.1	3.NF.3 a,b,c	3.NBT.3	3.G.1
3.NBT.2	3.OA.2	3.MD.6	MP.7	3.NF.2	MP 5	3.MD.2	3.G.2
MP.1	3.OA.3	3.MD.7	MP.8	3.NF.3d	MP 7	3.MD.3	ALL
MP.4	3.OA.4	3.MD.8		ALL	MP 2	3.MD.4	
MP.6	3.OA.5	MP.3			MP 4	ALL	
MP.6	3.OA.6	MP.5					
	3.OA.7	MP.7					
	3.OA.8						
	3.OA.9						
	3.NBT.3						
	MP.1						
	MP.4						

Major Clusters	Supporting Clusters	Additional Clusters	Other
OA—Operations and Algebraic Thinking (1, 2, 3, 4, 5, 6, 7, 8, 9) NF—Number and Operations-Fractions (1, 2, 3) MD—Measurement and Data (1, 2, 5, 6, 7)	MD—Measurement and Data (3, 4) G—Geometry (1, 2)	NBT—Number and Operations in Base Ten (1, 2, 3) MD—Measurement and Data (8)	MP—Standards for Mathematical Practice

Grade 3 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in Grades K-8 and will extend this approach into the high school mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, *Math Investigations* will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of *Math Investigations* to Common Core are filled uniformly, *Envisions 2.0* will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an inquiry-based lens. TERC is in the process of completely redesigning a new Common Core aligned version of *Math Investigations*. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Grade 3 Mathematics
There are four key critical areas for Grade 3Mathematics in the CCMS, also known as Ohio's New Learning Standards in Mathematics. These areas include the following: 1) Students must develop an understanding of organized groups of numbers, arrays, and area models that leads into the understanding of multiplication and division and multiplication and division strategies within 100. By comparing strategies and by understanding properties of operations, students further develop their understanding of multiplication and division. 2) Students must develop an understanding that the size of a fraction is related to the size of the whole and total fractional parts. Students need to apply their understanding of fractions to problem solve using models and justification for their thinking. 3) Students must extend their understanding of composing and decomposing shapes to measuring area, understanding that area is the measure of a two-dimensional closed figure or region. 4) Students must be able to compare and classify shapes by their attributes and extend their understanding of fractions to geometry. For example, the area of part of a shape is also a unit fraction of the whole. As you will notice, the Grade 3 Year at a Glance was intentionally designed to support the critical areas through the units, providing the necessary developmental experiences and time to support learning connections throughout the year from unit to unit.
**Fluency Requirements ***Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
2.OA.2—Fluently add and subtract within 20 AND 2.NBT.5 Add/ Subtract within 100 3.OA.2 Multiply/ Divide within 100 (Know single digit products from memory) AND 3.NBT.2 Add/ Subtract within 1000 AND 3.NBT.2 Add/ Subtract within 1000 4. NBT.4 Add/Subtract within 1,000,000
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 4 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Whole Number Operations and Measurement	**Place Value and Patterns**	**Multiplication and Area**	**Division**	**Fractions**	**Applied Fractions**	**Decimals and Fractions**	**Geometry**	**Geometry/ Measurement**	**Essential Concept Review**
2 weeks & Ongoing	**2 weeks**	**4 weeks**	**3 weeks**	**4 weeks**	**6 weeks**	**3 weeks**	**3 weeks**	**3 weeks**	**6 weeks**
4.NBT.4	4.NBT.1	4.MD.3	4.NBT.6	4.NF.1	4.NF.3 d	4.MD.2	4.G.1	4.MD.5	4.NBT.4
4.NBT.5	4.NBT.2	4.OA.1	4.OA.2	4.NF.2	4.NF.4 a,b,c	4.MD.4	4.G.2	4.MD.6	4.NBT.5
4.OA.3	4.NBT.3	4.OA.4	MP.1	4.NF.3 a,b,c	4.NF.5	4.NF.6	4.G.3	4.MD.7	4.NBT.6
4.MD.1	4.OA.5	4.OA.2	MP.3	MP.1	MP.1	4.NF.7	MP.1	MP.1	4.OA.3
MP.1-8	MP.3	MP.1	MP.4	MP.2	MP.3	MP.1	MP.3	MP.2	4.MD.1
	MP.7	MP.4		MP.4	MP.5	MP.2	MP.4	MP.3	4.NF.1
	MP.8	MP.8		MP.6	MP.8	MP.3	MP.5	MP.5	4.NF.2
						MP.4			
						MP.5			
Major Clusters			**Supporting Clusters**			**Additional Clusters**			**Other**
OA—Operations and Algebraic Thinking (1, 2, 3) NBT—Number and Operations in Base Ten (1, 2, 3, 4, 5, 6) NF—Number and Operations-Fractions (1, 2, 3, 4, 5, 6, 7)			OA—Operations and Algebraic Thinking (4) MD—Measurement and Data (1, 2, 3, 4)			OA—Operations and Algebraic Thinking (5) MD—Measurement and Data (5, 6, 7) G—Geometry (1, 2, 3)			MP—Standards for Mathematical Practice

Grade 4 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in Grades K-8 and will extend this approach into the high school mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, *Math Investigations* will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of *Math Investigations* to Common Core are filled uniformly, *Envisions 2.0* will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an inquiry- based lens. TERC is in the process of completely redesigning a new Common Core aligned version of *Math Investigations*. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Grade 4 Mathematics
There are three key critical areas for Grade 4 Mathematics in the CCMS, also known as Ohio's New Learning Standards in Mathematics. These areas include the following: 1) Students understand and make generalizations regarding place value through 1,000,000. This foundational place value understanding extends into multiplying multi-digit numbers as students develop a greater understanding of operations, algorithms, properties, and models which justify their reasoning. 2) Students understand fraction operations, fraction equivalence, and can use models to justify their reasoning and problem solve. Students also demonstrate a conceptual understanding of multiplying fractions through composing and decomposing fractions. 3) Students understand, describe, compare, classify, and analyze two-dimensional shapes. Students use their understanding of two-dimensional shapes to problem solve. This understanding is built on hands-on experiences and investigations where students are able to build, draw, and analyze two=dimensional shapes. You will notice, the Grade 4 Year at a Glance was intentionally designed to support the critical areas through the units, providing the necessary developmental experiences and time to support learning connections throughout the year from unit to unit.
**Fluency Requirements ***Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
3.OA.7 Multiply/Divide within 100 and 3.NBT.2 Add/ Subtract within 1000 4. NBT.4 Add/Subtract within 1,000,000 5.NBT.5 Multi-digit multiplication
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 5 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Powers of 10 & Decimal Place Value	**Multiplying and Dividing Whole Numbers**	**Volume of Rectangular Prisms**	**Multiplying and Dividing Fractions**	**Measurement Conversions**	**Algebraic Expressions**	**2-Dimensional Figures**	**Adding and Subtracting Fractions**	**Multiplication and Division Operations with Decimals**	**Coordinates**
6 weeks	**3 weeks**	**2 weeks**	**4 weeks**	**2.5 weeks**	**2 weeks**	**3 weeks**	**5 weeks**	**2 weeks**	**4 weeks**
5.NBT.1	5.NBT.5	5.MD.3 a,b	5.NF.3	5.MD.1	5.OA.1	5.G.3	5.NF.1	5.NBT.7	5.G.1
5.NBT.2	5.NBT.6	5.MD.4	5.NF.4 a,b	5.MD.2	5.OA.2	5.G.4	5.NF.2	MP.1	5.G.2
5.NBT.3 a,b	MP.4	5.MD.5 a,b,c	5.NF.5 a,b	MP.5	MP.5	MP.3	5.MD.1	MP.6	5.OA.3
5.NBT.4	MP.6	MP.6	5.NF.6	MP.7	MP.8	MP.7	MP.2		MP.3
5.NBT.7		MP.7	5.NF.7 a,b,c				MP.4		MP.7
5.MD.1			MP.2						
MP.6			MP.6						
MP.8									

Major Clusters	**Supporting Clusters**	**Additional Clusters**
NBT—Number and Operations in Base Ten (1, 2, 3, 4, 5, 6, 7) NF—Number and Operations-Fractions (1, 2, 3, 4, 5, 6, 7) MD—Measurement and Data (3, 4, 5)	MD—Measurement and Data (1, 2)	OA—Operations and Algebraic Thinking (1, 2, 3) G—Geometry (1, 2, 3, 4)

Grade 5 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in Grades K-8 and will extend this approach into the high school mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, *Math Investigations* will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of *Math Investigations* to Common Core are filled uniformly, *Envisions 2.0* will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an Inquiry Based lens. TERC is in the process of completely redesigning a new Common Core aligned version of *Math Investigations*. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Grade 5 Mathematics
There are three key critical areas for Grade 4 Mathematics in the CCMS, also known as Ohio's New Learning Standards in Mathematics. These areas include the following: 1) Students develop addition and subtraction fractions fluency, and develop an understanding of multiplication of fractions and division of fractions when the fractional unit is divided by whole numbers and whole numbers divided by a fractional unit. 2) Students extend division to two-digit divisors, making place value connections with decimal place value system, and developing an understanding of decimal operations to the hundredths, and developing whole number and decimal operations fluency. 3) Students will develop an understanding of volume. You will notice, the Grade 5 Year at a Glance was intentionally designed to support the critical areas through the units, providing the necessary developmental experiences and time to support learning connections throughout the year from unit to unit.
Fluency Requirements * Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
4. NBT.4 Add/Subtract within 1,000,000 5.NBT.5 Multi-digit multiplication 6.NS.2 Multi-digit division AND 6.NS.3 Multi-digit decimal operations
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 6 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13
GCF and LCM	Numerical Expression with Whole Number Exponents	Dividing Fractions	Unknown Variables & Distributive Property	Ratios	Expressions Foundation	Expressions Application	Graphing, Rational Numbers, Positives, &	Graphing Expressions Real World Application	Unit Rate & Conversions	Statistics & Probability	Triangle Area	Volume
3 weeks	2 weeks	3 weeks	3 weeks	3 weeks	2 weeks	2 weeks	2 weeks	2 weeks	3 weeks	3 weeks	2 weeks	3 weeks
6.NS.4	6.EE.1	6.NS.1	6.EE.2 a,b,c	6.RP.1	6.EE.5	6.EE.5	6.NS.5	6.EE.9	6.RP.3 b,c,d	6.SP.1	6.G.1	6.G.2
MP.4	MP.7	MP.4	6.EE.3	6.RP.2	6.EE.6	6.EE.6	6.NS.6 a,b,c	MP.2	MP.3	6.SP.2	6.G.3	6.G4
MP.6	MP.8	MP.6	6.EE.4	6.RP.3 a,b,c,d	6.EE.7	6.EE.7	6.NS.7 a,b,c,d	MP.3	MP.5	6.SP.3	MP.6	MP.7
			ALL	MP.7	6.EE.8	6.EE.8	6.NS.8			6.SP.4	MP.8	MP.8
				MP.8	MP.1	MP.1	MP.3			6.SP.5 a,b,c,d		
					MP.2	MP.2	MP.7			MP.3		
										MP.4		

Major Clusters	Supporting Clusters	Additional Clusters	Other
RP—Ratios and Proportional Relationships (1, 2, 3) NS—The Number System (1, 5, 6, 7, 8) EE—Expressions and Equations (1, 2, 3, 4, 5, 6, 7, 8, 9)	G—Geometry (1, 2, 3, 4)	NS—The Number System (2, 3, 4) SP—Statistics and Probability (1, 2, 3, 4, 5)	MP—Standards for Mathematical Practice

Grade 6 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in Grades K-8 and will extend this approach into the high school mathematics courses. Please note, the year plan is based on the Common Core Math Standards that you are required and responsible to teach your students. Accordingly, *Math Investigations* will be used as a primary curriculum resource; however, it will not be taught in sequential order as outlined by TERC. In order to ensure that gaps in the alignment of *Math Investigations* to Common Core are filled uniformly, *Envisions 2.0* will be used as a district K-5 mathematics secondary resource. Any tertiary resource must be implemented using an Inquiry Based lens. TERC is in the process of completely redesigning a new Common Core aligned version of *Math Investigations*. The district will be piloting the new version when it becomes available. The target date of release is Fall 2016.

Summary of Year for Grade 6 Mathematics
As you see in your Year at a Glance the major areas for Kindergarten are related to Counting & Cardinality and Operations and Algebraic Thinking in order to build a strong conceptual understanding of number values and structures, also known as number sense. More learning time should be devoted to number sense than any other topic. The year begins with building a strong foundation of understanding the cardinality of numbers up to 10. The plan intentionally moves to Geometry to give students additional time to internalize key components of the first unit and give teachers time to conduct small groups of intervention and extensions. Next, the year transitions into Comparisons of Length and Weight in order to give more exposure to numbers up to 10 in a different context. In Unit 4, students will have the chance to apply their understanding of cardinality by composing and decomposing numbers to 10. Unit 5 extends all previous concepts up to 100. The year is wrapped up by analyzing, comparing, creating, and composing shapes.
Fluency Requirements * Fluency includes working with numbers flexibly and understanding how to compose/decompose numbers, NOT simply rote memorization.
K.OA.5—Fluently add and subtract within 5 1.OA.6—Fluently add and subtract within 10 2.OA.2—Fluently add and subtract within 20
Vocabulary
Math Word Walls will be posted and replaced by unit. Content specific instruction occurs within each unit to support students' understanding and application of key concepts in discussion, writing, and within mathematics. Attending to precision includes correctly using content vocabulary.

Grade 7 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9
2-D Figures	Scale Drawings	Proportional Reasoning	Rational Number Operations	Linear Relationships	Equations & Inequalities	3-D Figures	Probability of Simple Events	Probability of Compound Events	Sampling, Inferences, & Comparisons
21 days	20 days	20 days	21 days	12 days	11 days	23 days	16 days	12 days	19 days
7.RP.A.2	7.RP.A.1	7.RP.A.1	7.NS.A.1	7.EE.B.3	7.EE.A.1	7.RP.A.2	7.RP.A.2	7.RP.A.2	7.RP.A.2
7.EE.A.1	7.RP.A.2	7.RP.A.2a	7.NS.A.2	7.EE.B.4	7.EE.A.2	7.NS.A.3	7.SP.C.5	7.SP.C.5	7.NS.A.1b
7.EE.A.2	7.RP.A.3	7.RP.A.2b	7.NS.A.3	7.EE.B.4a	7.EE.B.3	7.EE.A.1	7.SP.C.6	7.SP.C.6	7.SP.A.1
7.NS.A.3	7.EE.B.3	7.RP.A.2c		7.RP.A.2	7.EE.B.4a	7.EEA.2	7.SP.C.7a	7.SP.C.7a	7.SP.A.2
7.G.A.1	7.EE.B.4a	7.RP.A.2d		7.RP.A.2a	7.EE.B.4b	7.G.A.1	7.SP.C.7b	7.SP.C.7b	7.SP.C.5
7.G.A.2		7.RP.A.3-1		7.RP.A.2b	7.RP.A.2d	7.G.A.3	7.SP.C.8a	7.SP.C.8a	7.SP.C.5
7.G.A.3		7.RP.A.3-2		7.RP.A.2c		7.G.B.4	7.SP.C.8b	7.SP.C.8b	7.SP.C.7A
7.G.B.4		7.G.A.1		7.RP.A.2d		7.G.B.6	7.SP.C.8c	7.SP.C.8c	7.SP.B.3
7.G.B.6		7.G.A.2							7.SP.B.4
		7.G.B.6							

Major Clusters	Supporting Clusters	Additional Clusters
NS -The Number System (1, 2, 3) RP – Ratio and Proportion (1, 2, 3) EE – Expressions & Equations (1, 2, 3, 4)	SP – Statistics – (1, 2, 5, 6, 7, 8)	G – Geometry (1, 2, 3, 4, 6) SP – Statistics (3, 4)

Grade 7 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in grades K-8, and will extend this approach into the High School mathematics courses. Please note, the year plan is based on the Common Core Math Standards, also known as Ohio's New Learning Standards for Mathematics. These are the standards you are required and responsible to teach your students. *Connected Mathematics 3* (CMP3), along with *Math XL*, will be used as the core curriculum resources. It is expected that any additional curriculum resources be used with inquiry-based learning lenses or a problem based learning approach and vetted with the Department of Teaching and Learning prior to implementation.

Summary of Year for Grade 7 Mathematics

In 6th grade, students extend their conceptual understanding of the set of rational numbers to include negative rational numbers. In 7th grade, students will extend their work on operations with rational numbers to include all rational numbers. Students should apply the connections between addition and subtraction as well as the connections between multiplication and division to gain a high level of procedural skill and fluency in performing operations with rational numbers. Students' fluency with rational numbers will be applied in modeling and solving multi-step real-world and mathematical problems; furthermore, their fluency with rational numbers will be applied to their work in solving linear equations and inequalities in one variable. Students will be expected to extend their procedural skill and fluency in solving a single-step equation from 6th grade to solving multi-step equations and inequalities in 7th grade. Then the course will transition to extending students' capacity for rigor with proportional reasoning. First, students will use scale drawing to reengage with proportional reasoning, then apply proportional reasoning to model and solve problems involving percents, and finally extend their work with proportional reasoning to examine relationships between two quantities. After proportional reasoning students will extend their work with univariate statistics from 6th grade to examining and making inferences about populations. Pairing with statistics, students will be introduced to the concept of probability and work problems involving simple and compound probabilities. Both statistics and probability will support student's work with rational numbers and proportional reasoning by allowing students to apply their conceptual understanding and fluency in new and different contexts. The course concludes with a study of geometry including geometric construction, geometric measures of two and three dimensional figures, an introduction to circles, and angle pairs.

Mathematical Practices Recommendations for Grade 7 Mathematics

Mathematical practices should be evident throughout mathematics instruction and connected to all of the content areas addressed at this grade level. Mathematical tasks are an important opportunity to connect content and practices. Some brief examples of how the content of this grade might be connected to the practices follow.

- When students compare arithmetic and algebraic solutions to the same problem (7.EE.4a), they are identifying correspondences between different approaches (MP.1).
- Solving an equation such as $4 = 8(x - ½)$ requires students to see and make use of structure (MP.7), temporarily viewing $x - ½$ as a single entity.
- When students notice when given geometric conditions determine a unique triangle, more than one triangle or no triangle (7.G.2), they have an opportunity to construct viable arguments and critique the reasoning of others (MP.3). Such problems also present opportunities for using appropriate tools strategically (MP.5).
- Proportional relationships present opportunities for modeling (MP.4). For example, the number of people who live in an apartment building might be taken as proportional to the number of stories in the building for modeling purposes.

Fluency Expectations for Grade 7 Mathematics

- 7.EE.B.3: Students solve multistep problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. This work is the culmination of many progressions of learning in arithmetic, problem solving and mathematical practices.
- 7.EE.B.4: In solving word problems leading to one-variable equations of the form $px + q = r$ and $p(x + q) = r$, students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1–3), as well as fluency with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1).
- 7.NS.A.1-2: Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

Grade 8 Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9
Transformation & Congruence	Similarity & Transformation	Discovering Slope-Intercept Form	Linear Functions & Inverse Variation	Exponents & Scientific Notation	Pythagorean Theorem	Rational, Irrational Numbers & Volume	Systems of Equations	Bivariate Statistics: Linear
20 days	12 days	14 days	32 days	15 days	15 days	20 days	24 days	23 days
8.G.A.1	8.G.A.3	8.EE.B.5	8.F.A.1	8.EE.A.1	8.G.B.8	8.EE.A.2	8.EE.C.8	8.SP.A.1
8.G.A.1a	8.G.A.4	8.EE.B.6	8.F.A.2	8.EE.A.2	8.EE.A.2	8.NSA.1	8.EE.C.8a	8.SP.A.2
8.G.A.1b	8.G.A.5		8.F.A.3	8.EE.A.3	8.G.B.6	8.NS.A.2	8.EE.C.8b	8.SP.A.3
8.G.A.1c	7.G.B.5		8.F.B.4	8.EE.A.4	8.G.B.7	8.G.C.9	8.EE.C.8c	8.SP.A.4
7.G.B.5			8.EE.C.7a		8.G.B.8	7.G.B.6	8.F.A.3	
			8.EE.C.7b		8.NS.A.2			
			8.EE.C.8					
			8.EE.C.8a					
			8.EE.C.8c					

Major Clusters	Supporting Clusters	Additional Clusters
EE – Expressions & Equations (1, 2, 3, 4, 5, 6, 7, 8) F – Functions (1, 2, 3, 4, 5) G – Geometry (1, 2, 3, 4, 7, 8, 9)	NS -The Number System (1, 2) SP – Statistics and Probability (1, 2, 3, 4)	G – Geometry (9)

Grade 8 Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. The district will maintain its inquiry-based philosophy for mathematics in grades K-8, and will extend this approach into the High School mathematics courses. Please note, the year plan is based on the Common Core Math Standards, also known as Ohio's New Learning Standards for Mathematics. These are the standards you are required and responsible to teach your students. *Connected Mathematics 3* (CMP3), along with *Math XL*, will be used as the core curriculum resources. It is expected that any additional curriculum resources be used with inquiry-based learning lenses or a problem based learning approach and vetted with the Department of Teaching and Learning prior to implementation.

Summary of Year for Grade 8 Mathematics

Traditionally 8th grade math has served as a culmination of middle school mathematics. Under the Common Core State Standards (CCSS), 8th grade math will serve more as a foundational course for high school mathematics. The topics taught in this course will directly impact students' ability to be successful in Algebra I (which is foundational to Algebra II) as well as in Geometry. Students begin 8th grade math with an introduction to transformations of points, lines, line segments, angles and sets of parallel lines. The work with transformations then extends to transforming figures using coordinates. Students will develop a deep conceptual understanding of the effects of transformations and use their understanding to establish the criteria for figure congruence and figure similarity. After completing their work with transformations, students will then start to extend their understanding of the number system. Students leave the 7th grade having mastered operations with the set of rational numbers. In 8th grade students will learn that numbers that are not rational are called irrational and begin to understand informally that every number has a decimal expansion. Students then extend their work with whole number exponents from 6th grade to working with integer exponents in addition to formalizing the properties of integer exponents. Then students will have an opportunity to apply their understanding of the real number system to working with volume and learning the Pythagorean Theorem. The expectation is that students will be able to explain the proof of the Pythagorean Theorem and be able to apply it to solve geometric and real-world problems. The rest of the course is designed around linear equations and linear functions which will form the basis for the beginning of Algebra I. Here students will discover and master slope-intercept form in a very geometric sense by using their knowledge of proportional relationships and similar triangles on the coordinate plane. The concept of a function will be developed through their work with linear equations in two variables and then applied in a modeling context. Students will also increase their procedural skill and fluency in solving linear equations in one variable which will enable them to solve systems of linear equations in two variables. The course ends with an opportunity for the students to apply their work with linear functions to bivariate statistics.

Mathematical Practices Recommendations for Grade 8 Mathematics

Mathematical practices should be evident throughout mathematics instruction and connected to all of the content areas highlighted above, as well as all other content areas addressed at this grade level. Mathematical tasks are an important opportunity to connect content and practices. Examples include:

- When students convert a fraction such as 17 to a decimal, they might notice that they are repeating the same calculations and conclude that the decimal repeats. Similarly, by repeatedly checking whether points are on a line through (1, 2) with slope 3, students might abstract the equation of the line in the form $(y-2)(x-1)=3$. In both examples, students look for and express regularity in repeated reasoning (MP.8).
- The Pythagorean Theorem can provide opportunities for students to construct viable arguments and critique the reasoning of others (MP.3).
- Solving an equation such as $3x-12=x+2$ requires students to see and make use of structure (MP.7).
- Much of the mathematics in grade 8 lends itself to modeling (MP.4). For example, standard 8.F.4 involves modeling linear relationships with functions.
- Scientific notation (8.EE.4) presents opportunities for strategically using appropriate tools (MP.5). For example, the computation $(1.73\times104)\cdot(1.73\times105)$ can be done quickly with a calculator by squaring 1.73 and then using properties of exponents to determine the exponent of the product by inspection.

Fluency Expectations for Grade 8 Mathematics

- 8.EE.7 Students have been working informally with one-variable linear equations since as early as kindergarten. This important line of development culminates in grade 8 with the solution of general one-variable linear equations, including cases with infinitely many solutions or no solutions as well as cases requiring algebraic manipulation using properties of operations. Coefficients and constants in these equations may be any rational numbers.
- 8.G.9 When students learn to solve problems involving volumes of cones, cylinders, and spheres — together with their previous grade 7 work in angle measure, area, surface area and volume (7.G.4–6) — they will have acquired a well-developed set of geometric measurement skills.

Algebra I Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9
Equations and Inequalities	**Linear Equations and Inequalities**	**Systems of Equations and Inequalities**	**Functions**	**Linear Functions**	**Exponents, Square Roots and Polynomials**	**Quadratic Equations**	**Quadratic Functions**	**Exponential Functions**	**Statistics**
20 days	**20 days**	**15 days**	**15 days**	**15 days**	**15 days**	**20 days**	**25 days**	**15 days**	**15 days**
A-CED.A.1	A-REI.D.10	A-CED.A.3	F-IF.A.1	A-SSE.B.3	A-SSE.A.1	A-SSE.A.2	F-IF.B.4	A-SSE.B.3	S-ID.C.7
A.CED. A.4	A-REI.D.12	A-REI.C.5	F-IF.A.2	A-CED.A.1	A-APR.A.1	A.REI.A.1	F-IF. B.5	A-CED.A.1	S-ID.C.8
A-REI.B.3	N-Q.A.1	A-REI.C.6	F-IF.A.3	A-CED.A.2	N-RN.1	A.REI.B.4	F-IF. B.6	A-CED.A.2	S-ID.C.9
N-Q.A.1	F-IF.C.7a	A-REI.D.12	F-IF.B.5	F-LE.A.1	N-RN.2	A-SSE.B.3a	A-APR.B.3	F-LE.A.1	S-ID.B.5
N-RN.B.3	8.EE.B.5	8.EE.C.8	F-IF.C.9	F-LE.A.2	A-APR.A.4	A-SSE.B.3b	F-IF.C.7a	F-LE.A.2	S-ID.B.6
8.NS.A.1			F-BF.B.3	F-LE.A.3	A-APR.A.5	8.EE.A.1	F-IF.C.7b	F-LE.A.3	S-ID.A.1
8.NS.A.2			8.F.A.3	F-LE.B.5		8.EE.A.2	F-IF. C.8a	F-LE.B.5	S-ID.A. 2
				8.EE.A.1		A-CED.A.1	F-IF. C.9		S-ID.A. 3
				8.F.A.3			F-BF.B.3		
				8.F.B.4					
				8.F.B.5					

Major Clusters	Supporting Clusters	Additional Clusters
A-SSE Seeing Structure in Expressions (1, 2) A-APR Arithmetic with Polynomials and Rational Expressions (1) A-CED Reasoning with Equations and Inequalities (1, 2, 3, 4) A-REI Reasoning with Equations and Inequalities (1,3, 4, 5, 6, 10, 11, 12) F-IF Interpreting Functions (1, 2, 3, 4, 5, 6) S-ID Interpreting Categorical and Quantitative Data (7, 8, 9)	N-Q Quantities (1, 2, 3) A-SSE Seeing Structure in Expressions (3) A-APR Arithmetic with Polynomials and Rational Expressions (3) F-IF Interpreting Functions (7, 8, 9) F-BF Building Functions (1) F-LE Linear, Quadratic, and Exponential Models (1, 2, 3 ,5)	N-RN The Real Number System (3) F-BF Building Functions (3) S-ID Interpreting Categorical and Quantitative Data (1, 2, 3) Potential Gaps in Student Pre-requisite Knowledge 8.NS – 1, 2

Algebra I Year-at-a-Glance

This plan is meant to support content teams in creating their own Unit Pacing Guides. Please note, the year plan is based on the Common Core Math Standards, also known as Ohio's New Learning Standards for Mathematics. These are the standards you are required and responsible for teaching your students. *Center for Mathematics Education* (CME) Project, along with *Math XL*, will be used as the core curriculum resources. It is expected that any additional curriculum resources be used with inquiry-based learning lenses or a problem-based learning approach and vetted with the Department of Teaching and Learning prior to implementation.

Summary of Year for Algebra I

Algebra I will begin where 8th grade ended: linear equations in one and two variables and linear functions. In Algebra I students will increase their procedural skill and fluency in solving linear equations and inequalities in one variable. Additionally, students will deepen their understanding of linear equations and inequalities in two variables. Also, the course will emphasize modeling with linear equations and inequalities, culminating with solving systems of both linear equations and inequalities. From there, the course shifts to developing a deeper understanding of functions. Students will focus on linear and exponential functions by exploring situations that could be modeled by either a linear function or an exponential function. Then students will move to studying quadratic equations and functions, including identifying key elements of graphs, transformations with functions, and identifying domain and range. Students will apply these newly developed understandings and skills with functions to simple radical functions and then to piecewise-defined functions. The course concludes with a study of bivariate and univariate statistics to develop necessary understandings and skills the students will need for their study of statistics in Algebra II.

Standards Clarification for Algebra I

• Some standards may be revisited several times during the course; others may be only partially addressed in different units, depending on the focus of the unit. Comments are included throughout the document to clarify and provide additional background for each unit.
• Some standards are addressed in both Algebra I and Algebra II. The relevance to Algebra I is discussed in the Assessment Limits and Clarifications column.

Mathematical Practices Recommendations for Algebra I

Two overarching practices relevant to Algebra I are:
• **Make sense of problems and persevere in solving them** (MP.1).
• **Model with mathematics** (MP.4). Specific modeling standards appear throughout the high school standards indicated by a star (★) symbol.
Indeed, other mathematical practices in Algebra I might be seen as contributing specific elements of these two. The intent of the following set is not to decompose the above mathematical practices into component parts but rather to show how the mathematical practices work together.
• **Reason abstractly and quantitatively** (MP.2). This practice standard refers to one of the hallmarks of algebraic reasoning, the process of decontextualization and contextualization. Much of elementary algebra involves creating abstract algebraic models of problems (A-CED, F-BF) and then transforming the models via algebraic calculations (A-SSE, A-APR, F-IF) to reveal properties of the problems.
• **Use appropriate tools strategically** (MP.5). Spreadsheets, a function modeling language, graphing tools, and many other technologies can be used strategically to gain understanding of the ideas expressed by individual content standards and to model with mathematics.
• **Attend to precision** (MP.6). In algebra, the habit of using precise language is not only a mechanism for effective communication but also a tool for understanding and solving problems. Describing an idea precisely (A-CED, A-REI) helps students understand the idea in new ways.
• **Look for and make use of structure** (MP.7). For example, writing 49x2 + 35x + 6 as (7x)2 + 5(7x) + 6, a practice many teachers refer to as "chunking," highlights the structural similarity between this expression and z2 + 5z + 6, leading to a factorization of the original: ((7x) + 3) ((7x) + 2) (A-SSE, A-APR).
• **Look for and express regularity in repeated reasoning** (MP.8). Creating equations or functions to model situations is harder for many students than working with the resulting expressions. An effective way to help students develop the skill of describing general relationships is to work through several
specific examples and then express what they are doing with algebraic symbolism (A-CED). For example, when comparing two different text messaging plans, many students who can compute the cost for a given number of minutes have a hard time writing general formulas that express the cost of each plan for any number of minutes. Constructing these formulas can be facilitated by methodically calculating the cost for several different input values and then expressing the steps in the calculation, first in words and then in algebraic symbols. Once such expressions are obtained, students can find the break-even point for the two plans, graph the total cost against the number of messages sent, and make a complete analysis of the two plans.

Fluency Recommendations for Algebra I

A/G: Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).
A-APR.1: Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.
A-SSE.1b: Fluency in transforming expressions and chunking (parts of an expression as a single object) is essential in factoring, completing the square, and other algebraic calculations.

Geometry Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Intro to Geometry & Constructions	Transformations	Congruent Triangles	Similarity	Right Triangles and Trigonometry	Polygons, Quadrilaterals & Coordinate Geometry	Circles	Surface Area and Volume	Trigonometry Extensions	Conic Sections
12 days	10 days	17 days	14 days	11 days	15 days	15 days	15 days	19 days	14 days
G-CO.C.9	G-CO.A.2	G-CO.B.6	G-SRT 1	G.CO.C.10	G-CO 10	G-C.A.1	G-MG.A.2	G-SRT 6	G-GPE.A.1
G-CO.A.1	G-CO.A.3	G-CO.B.7	G-SRT 2	G.GPE.B.7	G-CO 11	G-C.A.2	G-GMD.A.1	G-SRT 7	G-GPE.A.2
G-CO.D.12	G-CO.A.4	G-CO.B.8	G-SRT 5	8.G.A.5	G-GPE.B.4	G-C.B.5	G-GMD.A.3	G-SRT 8	
	G-CO.A.5		G-SRT 3	8.G.B.8	G-GPE.B.5	G-CO.D.13	G-GMD.B.4		
	8.G.A.2		G-SRT 4		G-GPE.B.6				
			8.G.A.4		G-GPE.B.7				
					8.G.A.3				

Major Clusters	Supporting Clusters	Additional Clusters	
G. CO Congruence (6, 7, 8, 9, 10, 11) **G. SRT** Similarity, Right Triangles, and Trigonometry (1, 2, 3, 4, 5, 6, 7, 8) **G.GPE** Expressing Geometric Properties with Equations (4, 5, 6, 7) **G.MG** Modeling with Geometry (2)	**G.CO Congruence** (1, 2, 3, 4, 5, 12, 13)	**G.C** Circles (1, 2, 5) **G.GPE** Expressing Geometric Properties with Equations (1, 2) **G.GMD** Geometric Measurement and Dimension (1, 3, 4)	

Geometry Year-at-a-Glance

This plan is meant to support grade level teams in creating their own Unit Pacing Guides. Please note, the year plan is based on the Common Core Math Standards, also known as Ohio's New Learning Standards for Mathematics. These are the standards you are required and responsible for teaching your students. *Center for Mathematics Education* (CME) Project, along with *Math XL*, will be used as the core curriculum resources. It is expected that any additional curriculum resources be used with inquiry-based learning lenses or a problem-based learning approach and vetted with the Department of Teaching and Learning prior to implementation.

Summary of Year for Geometry

Transformations on the coordinate plane are introduced in 8th grade. The basic ideas of congruence and similarity are also established then and are connected to corresponding transformations. In Geometry students will gain a sophisticated understanding of the geometric properties of transformations. They will also connect their understanding of functions to view transformations as a relationship between an input and its corresponding output. Rigid motion will then be used to define congruence. Similarity is defined through similarity transformations. From here, the criteria for triangle congruence and triangle similarity are established. This forms the basis of the proofs students will complete. Students will then use their understanding of similarity and right triangles to develop and establish trigonometric ratios for acute angles. The Pythagorean Theorem along with trigonometric ratios will allow students to solve right triangles that arise in a modeling context. Following a study of three-dimensional figures, the course finishes with an in-depth study of circles and their properties.

Mathematical Practices Recommendations for Geometry

It is important that all Standards for Mathematical Practice are incorporated throughout the year. Below are examples of how they can be connected to this content.

• Reason abstractly and quantitatively (MP.2). Abstraction is used in geometry when, for example, students use a diagram of a specific isosceles triangle as an aid to reason about all isosceles triangles (G-CO.9). Quantitative reasoning in geometry involves the real numbers in an essential way: Irrational numbers show up in work with the Pythagorean Theorem (G-SRT.8), area formulas often depend on passing to the limit and real numbers are an essential part of the definition of dilation (G-SRT.1).

• Construct viable arguments and critique the reasoning of others (MP.3). While all of high school mathematics should help students see the importance of deductive arguments, geometry is an ideal arena for developing the skill of creating and presenting proofs (G-CO.9.10). One reason is that conjectures about geometric phenomena are often about many cases at once. For example, every angle inscribed in a semicircle is a right angle (G-C.2).

• Model with mathematics (MP.4). Students use geometry to solve design problems. Specific modeling standards appear in the high school standards indicated by (★).

• Use appropriate tools strategically (MP.5). Dynamic geometry environments help students look for invariants in a whole class of geometric constructions, and the constructions in such environments sometimes lead to an idea behind a proof of a conjecture.

• Attend to precision (MP.6). Teachers might use the activity of creating definitions as a way to help students see the value of precision. While this is possible in every course, the activity has a particularly visual appeal in geometry. For example, a class can build the definition of quadrilateral by starting with a rough idea ("four sides"), gradually refining the idea so that it rules out figures that do not fit the intuitive idea.

• Look for and make use of structure (MP.7). Seeing structure in geometric configurations can lead to insights and proofs. This often involves the creation of auxiliary lines not originally part of a given figure. Two classic examples are the construction of a line through a vertex of a triangle parallel to the opposite side as a way to see that the angle measures of a triangle add to 180 degrees and the introduction of a symmetry line in an isosceles triangle to see that the base angles are congruent (G-CO.9, 10).

Fluency Recommendations for Geometry

G-SRT.5 Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks.

G-GPE.4, 5, 7 Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

G-CO.12 Fluency with the use of physical and computational construction tools, helps students draft models of geometric phenomenon and can lead to conjectures and proofs.

Algebra II Year-at-a-Glance

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13
Properties of Functions through Quadratics	**Complex Number System**	**Polynomial Expressions and Equations**	**Rational Expressions and Equations**	**Radical Expressions and Equations**	**Polynomial Functions**	**Systems of Equations**	**Rational Exponents**	**Geometric Series/Sequence to Functions**	**Exponential and Logarithmic Equations and Functions**	**Trigonometric Functions**	**Univariate Statistics**	**Probability**
14 days	**9 days**	**11 days**	**9 days**	**13 days**	**14 days**	**11 days**	**11 days**	**12 days**	**19 days**	**19 days**	**11 days**	**14 days**
F-IF.B.6	A-REI.B.4B	A-SSE.A.2	A-REI.A.1	A-REI.A.1	A-APR.B.2	A-REI.D.11	N-RN.A.1	A-SSE.B.4	N-Q.A.2	F-IF.B.4	S-IC.B.3	S-CP.A.1
F-BF.B.3	N-CN.A.1	A-APR.C.4	A-REI.A.2	A-REI.A.2	A-APR.B.3	A-REI.C.6	N-RN.A.2	F.BF.A.1a	F-IF.C.7e	F-IF.C.7e	S-IC.B.4	S-CP.A.2
F-BF.B.4A	N-CN.A.2	A-SSE.A.2*	A-APR.D.6	A-REI.A.1	F-IF.B.4	A-REI.C.7	A-SSE.B.3C	F.BF.A.2	F-IF.C.8b	F-TF.A.1	S-IC.B.5	S-CP.A.3
G-GPE.A.2	N-CN.C.7	A.APR.A.1	A-CED.A.1		F-IF.C.7c	A-REI.C.5		F.IF.A.3	F-LE.A.4	F-TF.A.2	S-IC.B.6	S-CP.A.4
F-BF.B.3	A-REI.B.3		A-REI.A.1*		F-IF.C.9	A-REI.D.10		F.LE.A.2	S-ID.B.6a	F-TF.B.5	S-IC.A.1	S-CP.A.5
F-IF.C.8A			A-CED.A.1*		A-APR.B.3	A-REI.D.11*		F.BF.A.1a	F-LE.B.5	F-TF.C.8	S-IC. A.2	S-CP.B.6
					F-IF.B.4	A-CED.A.2		F-LE.A.1	F-IF.C.7a-b	F-IF.C.7a-b	S-IC. A.4	S-CP.B.7
					F-IF.7A-B	A-CED.A.3		F-LE.A.2*	F-LE.A.3			S-CP.B.5
									F-LE.B.5*			

Major Clusters	Supporting Clusters	Additional Clusters	Potential Gaps in Pre-Requisite Knowledge
N-RN The Real Number System (1, 2) **A-SSE** Seeing Structure in Expressions (2, 3, 4) **A-APR** Arithmetic with Polynomials and Rational Expressions (2, 3) **A-REI** Reasoning with Equations and Inequalities (1, 2, 11) **F-IF** Interpreting Functions (4, 6) **F-BF** Building Functions (1, 2) **S-IC** Making Inferences and Justifying Conclusions (3, 4, 5, 6)	**N-Q** Quantities (2) **A-APR** Arithmetic with Polynomials and Rational Expressions (6) **A-CED** Creating Equations (1) **A-REI** Reasoning with Equations and Inequalities (4) **F-IF** Interpreting Functions (3, 7, 8, 9) **F-LE** Linear, Quadratic, and Exponential Models (2, 4) **S-ID** Interpreting Categorical and Quantitative Data (6) **S-IC** Making Inferences and Justifying Conclusions (1, 2)	**N-CN** The Complex Number System ((1, 2, 7) **A-APR** Arithmetic with Polynomials and Rational Expressions (4) **A-REI** Reasoning with Equations and Inequalities (6, 7) **F-BF** Building Functions (3, 4a) **F-LE** Linear, Quadratic, and Exponential Models (5) **F-TF** Trigonometric Functions (1, 2, 5, 8) **G-GPE** Expressing Geometric Properties with Equations (2) **S-ID** Interpreting Categorical & Quantitative Data (4) **S-CP** Conditional Probability and the Rules of Probability (1, 2, 3, 4, 5, 6, 7)	A – SSE-2* A –SSE-3c* CED-1*, 2, 3 REI-1*, 3, 4a, 4b, 5, 10, 11 F – IF-4, 7a-7b, 8a, 8F-1a*, 3* LE – 1, 2*, 3, 5* S – ID – 5 ***CCSS is shared with Algebra I and has different requirements which may present gaps in content for Algebra II students**

Algebra II Year-at-a-Glance

This plan is meant to support content teams in creating their own Unit Pacing Guides. Please note, the year plan is based on the Common Core Math Standards, also known as Ohio's New Learning Standards for Mathematics. These are the standards you are required and responsible for teaching your students. *Center for Mathematics Education* (CME) Project, along with *Math XL*, will be used as the core curriculum resources. It is expected that any additional curriculum resources be used with inquiry-based learning lenses or a problem-based learning approach and vetted with the Department of Teaching and Learning prior to implementation.

Summary of Year for Algebra II

This course is designed to extend and apply students' understanding of functions and the connection between algebraic skills and functions. Students come into this course with a solid foundation of linear and quadratic functions and having been exposed to exponential, absolute value, piecewise, and simple radical functions. This course emphasizes polynomial, exponential, logarithmic, and trigonometric functions. Students will also have the opportunity to master more sophisticated algebraic skills and apply many of them to their work with functions. In addition to the algebraic skills the students will apply to functions, the students will work with rational and radical expressions and equations. Furthermore, students will reengage with univariate statistics and apply their work of inferences, conclusions, and possible solutions to real-world problems. Bivariate statistics will provide students a meaningful context in which to apply their understanding of functions to real-world problems and data sets and use those functions to interpolate and extrapolate data points. Finally, students will extend their understanding of probability from the 7th grade to work with conditional probabilities and probability rules.

Standards Clarification for Algebra II

Some standards may be revisited several times during the course; others may by only partially addressed in different units, depending on the focus of the unit. Comments are included throughout the document in the Standards Clarification column to clarify and provide additional background for each unit.

Mathematical Practices Recommendations for Algebra II

o While all of the mathematical practice standards are important in all three high school courses, the four below are especially important in Algebra II:

- MP.3: Construct viable arguments and critique the reasoning of others.
- MP.6: Attend to precision.
- MP.7: Look for and make use of structure
- MP.8: Look for and express regularity in repeated reasoning.

Fluency Requirements for Algebra II

- o HSA-APR.D.6 This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational expression $\frac{x+4}{x+3}$ as $\frac{x+4}{x+3} = \frac{(x+3)+1}{x+3} = 1 + \frac{1}{x+3}$.
- o HSA-SSE.A.2 The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function.
- o HSF-IF.A.3 Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

The 5 E's Instructional Model

The 5 E's is an instructional model based on a constructivist approach. The 5 E's represent the phases of learning. Below is a brief explanation of each phase.

Engage *(Learning Target/Focus)*

- Piques student's curiosity and generates interest
- Focuses students on key skills
- Determines students' current understanding (prior knowledge) of a concept or idea
- Defines a problem
- Invites students to express what they think
- Invites students to raise their own questions and make predictions
- Objectives clearly stated written and orally
- Connects a literature experience
- Makes prior vocabulary connections

Explore *(Teaching & Learning)*

- Connects activity to the Learning Target
- Encourages student-to-student interaction
- Observes and listens to students as they interact
- Asks probing questions to help students make sense of their experiences
- Provides time for productive struggle and guiding feedback
- Involves the use of manipulatives, math models, and technology to aid conceptual development

Evaluate *(Collecting and Documenting Evidence/Assess)*

- Observes and records as students demonstrate their understanding of the concepts and performance of skills
- Provides time for students to compare their ideas with those of others and perhaps revise their thinking
- Interviews students as a means of assessing their developing understanding
- Encourages students to assess their own progress
- Involves students in math discussion

Explain *(Effective Feedback/Teaching & Learning)*

- Encourages students to use their common experiences and data to develop explanations
- Asks questions that help students express understanding and explanations
- Requests justification (evidence) for students' explanations
- Provides time for students to compare their ideas with those of others and perhaps revise their thinking
- Introduces terminology and alternative explanations after students express their ideas
- Clarifies misconceptions

Elaborate *(Practice/Application)*

- Brings all learning full circle to the Learning Target
- Focuses students' attention on conceptual connections between new and former experiences
- Encourages students to use what they have learned to explain new events or ideas
- Reinforces students' use of scientific terms and descriptions previously introduced
- Asks questions that help students draw reasonable conclusions from evidence and data
- Provides experiences for students to use new skills and concepts in a meaningful way

60 Minute Model	5 E's Grades K-2 Lesson Planning Tool	Questions for Planning	Examples - Not an exhaustive list of all high yield strategies.
I Can Statement/ Learning Target	**Preliminary Planning** -How do you plan activities to support learning target? -How do you anticipate and monitor learning within the lesson using student evidence of learning? -How do you facilitate students in connecting the learning target with prior and future learning? -How do you support students in bringing the "Big Ideas" together to summarize learning connections and make generalizations?	-What are the "big ideas" or driving question? -What are the CCSS that this lesson applies to? -What confusions and misconceptions related to concepts, problem solving, reasoning, strategies and skills do you anticipate students may have? -What do you plan to do to address these?	
5 minutes	**Engagement (Learning Target /Focus)** -Objectives clearly stated written and orally -Piques student's curiosity and generates interest -Focuses students on key skills -Determines students' current understanding (prior knowledge) of a concept or idea -Defines a problem -Invites students to express what they think -Invites students to raise their own questions and make predictions -Connects a literature experience -Makes prior vocabulary connections	-What is your opening question? (What question will generate thinking around the ideas named above?) -What should students know and do as a result of the lesson? -What previous lessons/ideas does this lesson build on? -Which concepts are new and which are concepts that are being deepen or extended?	Students work independently or cooperatively. Work should be ready as students transition so no time is wasted. -Problem of the Day -Journaling -Fluency Practice -Problem of the Day (POD) -Review of homework
25-30 minutes	**Exploration/Activity (Teaching & Learning)** -Connects activity to the Learning Target -Encourages student-to-student interaction -Observes and listens to students as they interact -Asks probing questions to help students make sense of their experiences -Provides time for productive struggle and guiding feedback -Involves the use of manipulatives, math models, and technology to aid conceptual development	-How does your activity support your learning target? -What will students do together (whole group and/ or small group) to use the new concepts? -What questions might you ask students while they are working and/or when they have completed the task that are designed to cultivate learning? -What strategies/interventions will you have in place to encourage problem solving, persistence, reflections, communication and effort? What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	Teacher sets the objective and expectations for the day's work. -Review the Ohio New Learning Standards for Mathematics for the lesson in student friendly language. -Review homework item and/ or formative assessment item from previous lesson. -Review prerequisite skills necessary for mastery of the day's objective and explicitly connect the day's objective to the work that has been taught in previous lessons or grade levels. *Whole Group Teaching* -Teacher poses high-quality questions and problems that prompt students to share their developing thinking about the content of the lesson. -Teacher uses variation in students' solution methods to strengthen other students' understanding of the content. -Teacher uses explanation, modeling, representations, and/or examples to make the mathematics of the lesson explicit. -Teacher provides students time to work with and practice grade-level problems and exercises. -Teacher checks for understanding throughout the lesson using informal, but deliberate, methods.

			Small Group Teaching/Cooperative Grouping -Teacher uses formative observation/ assessment data to differentiate learning experiences for small groups of students while still working towards the same learning target -Teacher provides high quality questions and problems that allow student groups time to work and practice concepts and skills at their level.
5-10 minutes	**Evaluation(Collecting & Documenting Evidence/Assess)** -Observes and records as students demonstrate their understanding of the concepts and performance of skills -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Interviews students as a means of assessing their developing understanding -Encourages students to assess their own progress -Involves students in math discussion	-What evidence of learning will you be looking for from your students? -What will the student do, say or produce that will publicly demonstrate their learning? -How will you assist students in reflecting upon what they learned today? -How will you ensure that all students have mastered the identified learning indicators? -How will you assess their learning? -What homework will be assigned to help students practice, prepare, or elaborate on a concept or skill taught?	Each student demonstrates mastery of the learning target through: -Exit ticket -Response to a journal question -Student centered evaluation -Math discussion -Journal -Cooperative/ independent problem solving with opportunities to revise thinking. -Learning progression monitoring tools -Student generalization of learning opportunities
10-15 minutes	**Explanation(Effective Feedback/Teaching & Learning)** -Encourages students to use their common experiences and data to develop explanations -Asks questions that help students express understanding and explanations -Requests justification (evidence) for students' explanations -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Introduces terminology and alternative explanations after students express their ideas -Clarifies misconceptions	-How will you aid students in constructing meaning of new concepts? -How will you introduce new skills or procedures? -What vocabulary is important for understanding the concepts? -What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	-Graphic Organizers -Knowledge Inventory Tools -Vocabulary development and review -Guided Practice -Independent Practice -Math discussion: Math Talk Moves -Short answer and extended response items that require students to compare, model, and justify reasoning.
Throughout the day	**Elaboration (Practice/Apply)** -Brings all learning full circle to the Learning Target -Focuses students' attention on conceptual connections between new and former experiences -Encourages students to use what they have learned to explain new events or ideas -Reinforces students' use of scientific terms and descriptions previously introduced -Asks questions that help students draw reasonable conclusions from evidence and data -Provides experiences for students to use new skills and concepts in a meaningful way	-What opportunities will students have to use the new skills and concepts in a meaningful way? -How will students expand and solidify their understanding of the concept and apply it to a real-world situation? -How will students demonstrate their mastery of the essential learning outcomes? -What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	-Discussion: Math Talk Moves -Reflective questioning -Reflective response in journal -Flexible grouping -Independent activities (e.g. math menu) -Centers -Word problems -Problem of the Week (POW) -Games

5 E's Grades K-2 Lesson Planning Tool

Unit:	Lesson Title:	Date:
60 Minute Model 5 E's	Planning/ Observation/ Notes	Reflection
I Can Statement/Learning Target		
Engagement (Learning Target /Focus) -Objectives clearly stated written and orally -Piques student's curiosity and generates interest -Focuses students on key skills -Determines students' current understanding (prior knowledge) of a concept or idea -Defines a problem -Invites students to express what they think -Invites students to raise their own questions and make predictions -Connects a literature experience -Makes prior vocabulary connections 5 minutes		
Exploration/Activity (Teaching & Learning) -Connects activity to the Learning Target -Encourages student-to-student interaction -Observes and listens to students as they interact -Asks probing questions to help students make sense of their experiences -Provides time for productive struggle and guiding feedback -Involves the use of manipulatives, math models, and technology to aid conceptual development 25-30 minutes		
Evaluation (Collecting and Documenting Evidence/Assess) -Observes and records as students demonstrate their understanding of the concepts and performance of skills -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Interviews students as a means of assessing their developing understanding -Encourages students to assess their own progress -Involves students in math discussion -5-10 minutes		

Explanation (Effective Feedback/Teaching & Learning) -Encourages students to use their common experiences and data to develop explanations -Asks questions that help students express understanding and explanations -Requests justification (evidence) for students' explanations -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Introduces terminology and alternative explanations after students express their ideas -Clarifies misconceptions 10-15 minutes		
Elaboration (Practice/Apply) -Brings all learning full circle to the Learning Target -Focuses students' attention on conceptual connections between new and former experiences -Encourages students to use what they have learned to explain new events or ideas -Reinforces students' use of scientific terms and descriptions previously introduced -Asks questions that help students draw reasonable conclusions from evidence and data -Provides experiences for students to use new skills and concepts in a meaningful way Throughout the day		

90 Minute Model	5 E's Grades 3-6 Lesson Planning Tool	Questions for Planning	Examples - Not an exhaustive list of all high yield strategies.
I Can Statement/Learning Target	**Preliminary Planning** -How do you plan activities to support learning target? -How do you anticipate and monitor learning within the lesson using student evidence of learning? -How do you facilitate students in connecting the learning target with prior and future learning? -How do you support students in bringing the "Big Ideas" together to summarize learning connections and make generalizations?	-What are the "big ideas" or driving question? -What are the CCSS that this lesson applies to? -What confusions and misconceptions related to concepts, problem solving, reasoning, strategies and skills do you anticipate students may have? -What do you plan to do to address these?	
10 minutes	**Engagement (Learning Target /Focus)** -Objectives clearly stated written and orally -Piques student's curiosity and generates interest -Focuses students on key skills -Determines students' current understanding (prior knowledge) of a concept or idea -Defines a problem -Invites students to express what they think -Invites students to raise their own questions and make predictions -Connects a literature experience -Makes prior vocabulary connections	-What is your opening question? (What question will generate thinking around the ideas named above?) -What should students know and do as a result of the lesson? -What previous lessons/ideas does this lesson build on? -Which concepts are new and which are concepts that are being deepen or extended?	Students work independently or cooperatively. Work should be ready as students transition so no time is wasted. -Problem of the Day -Journaling -Fluency Practice -Problem of the Day (POD) -Review of homework
20 minutes	**Exploration/Activity (Teaching & Learning)** -How does your activity support your learning target? -Whole class learning target -Cooperative grouping -Review homework -Use of manipulatives -Use of technology (calculators, software, internet, etc. -Demonstration/ modeling of concepts -Questioning strategies	What will students do together (whole group and/ or small group) to use the new concepts? What questions might you ask students while they are working and/or when they have completed the task that are designed to cultivate learning? What strategies/interventions will you have in place to encourage problem solving, persistence, reflections, communication and effort? What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	Teacher sets the objective and expectations for the day's work. -Review the CCMS for the lesson in student friendly language. -Introduce or math vocabulary. -Review homework item and/ or formative assessment item from previous lesson. -Review prerequisite skills or concepts necessary for mastery of the day's objective. -Explicitly connect the day's objective to the work that has been taught in previous lessons or grade levels. *Whole Group Teaching* -Teacher poses high-quality questions and problems that prompt students to share their developing thinking about the content of the lesson. -Teacher uses variation in students' solution methods to strengthen other students' understanding of the content. -Teacher uses explanation, modeling, representations, and/or examples to make the mathematics of the lesson explicit. -Teacher provides students time to work with and practice grade-level problems and exercises. -Teacher checks for understanding throughout the lesson using

			informal, but deliberate, methods. *Small Group Teaching- Elaborate and Explore* -Teacher uses formative observation/ assessment data to differentiate learning experiences for small groups of students. -Teacher provides high quality questions and problems that allow student groups time to work and practice concepts and skills at their level. -Stations may be utilized to allow for differentiation.
5 minutes	**Evaluation (Collecting and Documenting Evidence/Assess)** -Observes and records as students demonstrate their understanding of the concepts and performance of skills -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Interviews students as a means of assessing their developing understanding -Encourages students to assess their own progress -Involves students in math discussion	-What evidence of learning will you be looking for from your students? -What will the student do, say or produce that will publicly demonstrate their learning? -How will you assist students in reflecting upon what they learned today? -How will you ensure that all students have mastered the identified learning indicators? -How will you assess their learning? -What homework will be assigned to help students practice, prepare, or elaborate on a concept or skill taught?	Each student demonstrates mastery of the learning target through: -Exit ticket -Response to a journal question -Student centered evaluation -Math discussion -Journal -Cooperative/ independent problem solving with opportunities to revise thinking. -Learning progression monitoring tools -Student generalization of learning opportunities
25 minutes	**Explanation (Effective Feedback/Teaching & Learning)** -Encourages students to use their common experiences and data to develop explanations -Asks questions that help students express understanding and explanations -Requests justification (evidence) for students' explanations -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Introduces terminology and alternative explanations after students express their ideas -Clarifies misconceptions	-How will you aid students in constructing meaning of new concepts? -How will you introduce new skills or procedures? -What vocabulary is important for understanding the concepts? -What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	-Graphic Organizers -Knowledge Inventory Tools -Vocabulary development and review -Guided Practice -Independent Practice -Math discussion: Math Talk Moves -Short answer and extended response items that require students to compare, model, and justify reasoning.
30 minutes	**Elaboration (Practice/Apply)** -Brings all learning full circle to the Learning Target -Focuses students' attention on conceptual connections between new and former experiences -Encourages students to use what they have learned to explain new events or ideas -Reinforces students' use of scientific terms and descriptions previously introduced -Asks questions that help students draw reasonable conclusions from evidence and data -Provides experiences for students to use new skills and concepts in a meaningful way	-What opportunities will students have to use the new skills and concepts in a meaningful way? -How will students expand and solidify their understanding of the concept and apply it to a real-world situation? -How will students demonstrate their mastery of the essential learning outcomes? -What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	-Discussion: Math Talk Moves -Reflective questioning -Reflective response in journal -Flexible grouping -Independent activities (e.g. math menu) -Centers -Word problems -Problem of the Week (POW) -Games

5 E's Grades 3-6 Lesson Planning Tool

Unit:	Lesson Title:	Date:
50 Minute Model 5 E's	Planning/ Observation/ Notes	Reflection
I Can Statement/Learning Target		
Engagement (Learning Target /Focus) -Objectives clearly stated written and orally -Piques student's curiosity and generates interest -Focuses students on key skills -Determines students' current understanding (prior knowledge) of a concept or idea -Defines a problem -Invites students to express what they think -Invites students to raise their own questions and make predictions -Connects a literature experience -Makes prior vocabulary connections 10 minutes		
Exploration/Activity (Teaching & Learning) -Connects activity to the Learning Target -Encourages student-to-student interaction -Observes and listens to students as they interact -Asks probing questions to help students make sense of their experiences -Provides time for productive struggle and guiding feedback -Involves the use of manipulatives, math models, and technology to aid conceptual development 20 minutes		
Evaluation (Collecting and Documenting Evidence/Assess) -Observes and records as students demonstrate their understanding of the concepts and performance of skills -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Interviews students as a means of assessing their developing understanding -Encourages students to assess their own progress -Involves students in math discussion 5 minutes		

Explanation (Effective Feedback/Teaching & Learning) -Encourages students to use their common experiences and data to develop explanations -Asks questions that help students express understanding and explanations -Requests justification (evidence) for students' explanations -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Introduces terminology and alternative explanations after students express their ideas -Clarifies misconceptions 25 minutes		
Elaboration (Practice/Apply) -Brings all learning full circle to the Learning Target -Focuses students' attention on conceptual connections between new and former experiences -Encourages students to use what they have learned to explain new events or ideas -Reinforces students' use of scientific terms and descriptions previously introduced -Asks questions that help students draw reasonable conclusions from evidence and data -Provides experiences for students to use new skills and concepts in a meaningful way 30 minutes		

50 Minute Model	5 E's Grades 7-12 Lesson Planning Tool	Questions for Planning	Examples - Not an exhaustive list of all high yield strategies.
I Can Statement/Learning Target	**Preliminary Planning** -How do you plan activities to support learning target? -How do you anticipate and monitor learning within the lesson using student evidence of learning? -How do you facilitate students in connecting the learning target with prior and future learning? -How do you support students in bringing the "Big Ideas" together to summarize learning connections and make generalizations?	-What are the "big ideas" or driving question? -What are the CCSS that this lesson applies to? -What confusions and misconceptions related to concepts, problem solving, reasoning, strategies and skills do you anticipate students may have? -What do you plan to do to address these?	
5 minutes	**Engagement (Learning Target /Focus)** -Objectives clearly stated written and orally -Piques student's curiosity and generates interest -Focuses students on key skills -Determines students' current understanding (prior knowledge) of a concept or idea -Defines a problem -Invites students to express what they think -Invites students to raise their own questions and make predictions -Connects a literature experience -Makes prior vocabulary connections	-What is your opening question? (What question will generate thinking around the ideas named above?) -What should students know and do as a result of the lesson? -What previous lessons/ideas does this lesson build on? -Which concepts are new and which are concepts that are being deepen or extended?	Students work independently or cooperatively. Work should be ready as students transition so no time is wasted. -Problem of the Day -Journaling -Fluency Practice -Problem of the Day (POD) -Review of homework
10 minutes	**Exploration/Activity (Teaching & Learning)** -How does your activity support your learning target? -Whole class learning target -Cooperative grouping -Review homework -Use of manipulatives -Use of technology (calculators, software, internet, etc. -Demonstration/ modeling of concepts -Questioning strategies	What will students do together (whole group and/ or small group) to use the new concepts? What questions might you ask students while they are working and/or when they have completed the task that are designed to cultivate learning? What strategies/interventions will you have in place to encourage problem solving, persistence, reflections, communication and effort? What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	Teacher sets the objective and expectations for the day's work. -Review the CCMS for the lesson in student friendly language. -Introduce or math vocabulary. -Review homework item and/ or formative assessment item from previous lesson. -Review prerequisite skills or concepts necessary for mastery of the day's objective. -Explicitly connect the day's objective to the work that has been taught in previous lessons or grade levels. *Whole Group Teaching* -Teacher poses high-quality questions and problems that prompt students to share their developing thinking about the content of the lesson. -Teacher uses variation in students' solution methods to strengthen other students' understanding of the content. -Teacher uses explanation, modeling, representations, and/or examples to make the mathematics of the lesson explicit. -Teacher provides students time to work with and practice grade-level problems and exercises. -Teacher checks for understanding throughout the lesson using

			informal, but deliberate, methods. *Small Group Teaching- Elaborate and Explore* -Teacher uses formative observation/ assessment data to differentiate learning experiences for small groups of students. -Teacher provides high quality questions and problems that allow student groups time to work and practice concepts and skills at their level. -Stations may be utilized to allow for differentiation.
10 minutes	**Evaluation (Collecting and Documenting Evidence/Assess)** -Observes and records as students demonstrate their understanding of the concepts and performance of skills -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Interviews students as a means of assessing their developing understanding -Encourages students to assess their own progress -Involves students in math discussion	-What evidence of learning will you be looking for from your students? -What will the student do, say or produce that will publicly demonstrate their learning? -How will you assist students in reflecting upon what they learned today? -How will you ensure that all students have mastered the identified learning indicators? -How will you assess their learning? -What homework will be assigned to help students practice, prepare, or elaborate on a concept or skill taught?	Each student demonstrates mastery of the learning target through: -Exit ticket -Response to a journal question -Student centered evaluation -Math discussion -Journal -Cooperative/ independent problem solving with opportunities to revise thinking. -Learning progression monitoring tools -Student generalization of learning opportunities
15 minutes	**Explanation (Effective Feedback/Teaching & Learning)** -Encourages students to use their common experiences and data to develop explanations -Asks questions that help students express understanding and explanations -Requests justification (evidence) for students' explanations -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Introduces terminology and alternative explanations after students express their ideas -Clarifies misconceptions	-How will you aid students in constructing meaning of new concepts? -How will you introduce new skills or procedures? -What vocabulary is important for understanding the concepts? -What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	-Graphic Organizers -Knowledge Inventory Tools -Vocabulary development and review -Guided Practice -Independent Practice -Math discussion: Math Talk Moves -Short answer and extended response items that require students to compare, model, and justify reasoning.
10 minutes	**Elaboration (Practice/Apply)** -Brings all learning full circle to the Learning Target -Focuses students' attention on conceptual connections between new and former experiences -Encourages students to use what they have learned to explain new events or ideas -Reinforces students' use of scientific terms and descriptions previously introduced -Asks questions that help students draw reasonable conclusions from evidence and data -Provides experiences for students to use new skills and concepts in a meaningful way	-What opportunities will students have to use the new skills and concepts in a meaningful way? -How will students expand and solidify their understanding of the concept and apply it to a real-world situation? -How will students demonstrate their mastery of the essential learning outcomes? -What mathematical models, visuals, manipulatives might enhance the lesson or provide access to students who struggle or speak a different language?	-Discussion: Math Talk Moves -Reflective questioning -Reflective response in journal -Flexible grouping -Independent activities (e.g. math menu) -Centers -Word problems -Problem of the Week (POW) -Games

5 E's Grades 7-12 Lesson Planning Tool

Unit:	Lesson Title:	Date:
50 Minute Model 5 E's	Planning/ Observation/ Notes	Reflection
I Can Statement/Learning Target		
Engagement (Learning Target /Focus) -Objectives clearly stated written and orally -Piques student's curiosity and generates interest -Focuses students on key skills -Determines students' current understanding (prior knowledge) of a concept or idea -Defines a problem -Invites students to express what they think -Invites students to raise their own questions and make predictions -Connects a literature experience -Makes prior vocabulary connections 5 minutes		
Exploration/Activity (Teaching & Learning) -Connects activity to the Learning Target -Encourages student-to-student interaction -Observes and listens to students as they interact -Asks probing questions to help students make sense of their experiences -Provides time for productive struggle and guiding feedback -Involves the use of manipulatives, math models, and technology to aid conceptual development 10 minutes		
Evaluation (Collecting and Documenting Evidence/Assess) -Observes and records as students demonstrate their understanding of the concepts and performance of skills -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Interviews students as a means of assessing their developing understanding -Encourages students to assess their own progress -Involves students in math discussion 10 minutes		

Explanation (Effective Feedback/Teaching & Learning) -Encourages students to use their common experiences and data to develop explanations -Asks questions that help students express understanding and explanations -Requests justification (evidence) for students' explanations -Provides time for students to compare their ideas with those of others and perhaps revise their thinking -Introduces terminology and alternative explanations after students express their ideas -Clarifies misconceptions 15 minutes		
Elaboration (Practice/Apply) -Brings all learning full circle to the Learning Target -Focuses students' attention on conceptual connections between new and former experiences -Encourages students to use what they have learned to explain new events or ideas -Reinforces students' use of scientific terms and descriptions previously introduced -Asks questions that help students draw reasonable conclusions from evidence and data -Provides experiences for students to use new skills and concepts in a meaningful way 10 minutes		

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

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

Depth of Knowledge (DOK) Question Stems

DOK 1	DOK 2
□ Can you recall_____? □ When did ____ happen? □ Who was ____? □ How can you recognize____? □ What is____? □ How can you find the meaning of____? □ Can you recall____? □ Can you select____? □ How would you write___? □ What might you include on a list about___? □ Who discovered___? □ What is the formula for___? □ Can you identify___? □ How would you describe___?	□ Can you explain how ____ affected ____? □ How would you apply what you learned to develop ____? □ How would you compare ____? Contrast_____? □ How would you classify____? □ How are____alike? Different? □ How would you classify the type of____? □ What can you say about____? □ How would you summarize____? □ How would you summarize___? □ What steps are needed to edit___? □ When would you use an outline to ___? □ How would you estimate___? □ How could you organize___? □ What would you use to classify___? □ What do you notice about___?
DOK 3	**DOK 4**
□ How is ____ related to ____? □ What conclusions can you draw _____? □ How would you adapt____to create a different____? □ How would you test____? □ Can you predict the outcome if____? □ What is the best answer? Why? □ What conclusion can be drawn from these three texts? □ What is your interpretation of this text? Support your rationale. □ How would you describe the sequence of____? □ What facts would you select to support____? □ Can you elaborate on the reason____? □ What would happen if___? □ Can you formulate a theory for___? □ How would you test___? □ Can you elaborate on the reason___?	□ Write a thesis, drawing conclusions from multiple sources. □ Design and conduct an experiment. Gather information to develop alternative explanations for the results of an experiment. □ Write a research paper on a topic. □ Apply information from one text to another text to develop a persuasive argument. □ What information can you gather to support your idea about___? □ DOK 4 would most likely be the writing of a research paper or applying information from one text to another text to develop a persuasive argument. □ DOK 4 requires time for extended thinking.

From Depth of Knowledge – Descriptors, Examples and Question Stems for Increasing Depth of Knowledge in the Classroom Developed by Dr. Norman Webb and Flip Chart developed by Myra Collins

Literacy Strategy Overview Guide

This chart helps you choose from a list of suitable instructional strategies for teaching vocabulary and/or writing in the content area. Think of ways to use these strategies as formative assessments, as well.

Instructional Strategy	Goal – use when you want to…	Comments
CODE ***Connect experiences, prior knowledge with vocabulary. Organize new words into related categories that make sense and develop connections. Deep-processing- focusing on the key terms and concepts as the foundation for all other connections. Prioritize key vocabulary within each lesson and unit. Intentionally build on those key concepts with every opportunity. Exercising the brain through meaningful practice, review, and cognitive monitoring of vocabulary acquisition and application.***	This approach is used to support students as they learn new vocabulary so the new information can be connected to prior knowledge, experience, and related terms. When vocabulary instruction is intentional and explicit, students have the opportunity to make deeper, longer lasting connections. Think of ways to support these meaningful connections as you organize your Unit Word Walls so that related connections can be visually reinforced and intentionally built upon. One way to organize vocabulary and support student connections is to make a "Fist List" where a key word such as polygon is shared, then students come up with five supporting words to define and/ or connect with the term. Using a web graphic organizer is yet another strategy to support vocabulary connections.	Give students opportunities to make, revise, and reflect on concept maps that are ongoing throughout units, over the course of the year so that students can make meaningful, intentional vocabulary connections. Attending to precision, Mathematical Practice 6, also includes using applying correct mathematical vocabulary in math writing, problem solving, and discourse, and is essential in developing deeper conceptual understanding and connections.
Power Decoding	Empower students with tools to build meaning: prefix, suffix, root word, context clues, and substitution strategies.	Model using these strategies when appropriate through "think alouds." For example, "I know deca means 10, and I know a decade is 10 years long. So, a decagon must be a polygon with 10 sides and 10 angles." Give students opportunities to also model and share "think alouds" regarding their decoding strategies.
Word Banks and Sentence Starters	Generate with your students a word bank and/ or sentence starters that would include key	Encourage students to make connections in writing by empowering them with a student

	concepts or ideas to be used in writing extensions.	generated word bank and sentence starters that have been supported with authentic math discussion. Often times, the most difficult part of writing is getting started, word banks and sentence starters helps students get started and make connections.
Vocabulary Card Sorts	Give students the opportunity to sort their vocabulary cards, and then explain in writing or through peer discourse why they categorized their vocabulary terms in that way.	This activity lends itself to various extensions and questioning. For example, a student could be asked to reassess their sort, choose a category, then create a sub sort within the original sort, and explain their thinking or choose one word that no longer applied and why.
Portable Student Word Walls	Give students the opportunity to create their own portable word walls using pictures or webs that build connections and understanding.	When students have the opportunity to make decisions regarding vocabulary meaning and connections, deeper understanding is established.
K-W-L	Teach new meanings for known words, but the concepts are not central to the topic	Encourages further student research
Frayer Model	Teach new words for new concepts, and the concepts are central to the topic.	The most complete way of teaching a new word.
Venn Diagram	Used to compare two or more concepts. Should be used, revisited, and revised over time as conceptual understanding develops.	This is identified as one of the essential strategies for Common Core.
Mental Models	A two-dimensional visual representation that supports students' conceptual understanding.	Give students the opportunity to sketch what they know about a key concept, this will give teacher and student insight regarding understanding.
Four Column Notes Form	Give students the opportunity to illustrate key concepts and make generalizations regarding vocabulary concepts and applications.	Maximizes learning time because students learn to understand and apply vocabulary best when given opportunities to connect, not just copy.
Semantic Feature Analysis	Help students decide what features discriminate one word from another	Most useful when doing extended work on a topic or theme,
Knowledge Rating Chart or Tool	Encourage students to examine what they know about words they will encounter.	Best used when the whole class is reading the same text.

Anticipation Guide	Students read statement to see what they know, and then read the text to see what if the text agrees with them.	Time consuming to prepare. Good for discussion. Can be used as "agree v. disagree" instead of "me v. text".
Concept Maps (Graphic Organizers)	Show the relationships between words.	Good way of beginning and ending vocabulary instruction in a unit.
Reading math symbols/Math poetry	Create a witty short story or poem to reinforce student recognition of the symbols/characteristics.	Fun…These can be presented by students as a "coffeehouse" performance.
Muddiest Point	Assess student comprehension of the content addressed in a classroom discussion or lesson.	Allows you to…authentically assess student comprehension, address common problems/misconception and adapt the next lesson accordingly.
One-Minute Summary	A brief writing assignment in which the student free-writes on a particular topic and self-assess their comprehension and write without worrying about grammar, spelling, or a grade	Can be assigned at the beginning, middle, or end of a class in which the student can demonstrate comprehension to a teacher.

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Assessment Strategy Overview Guide

These charts help you choose from a list of assessment activities. It is not an all-inclusive list. Think about how you can incorporate them into your everyday classroom activities. Also think about what you are already doing that can be used as assessment.

Formative Assessment Assessment *for* learning Taken at various intervals to drive instructional decisions Ongoing feedback generated by teachers and students		
Instructional Strategy	**Goal – use when you want to…**	**Comments**
Peer Feedback - Four Corners - Think-Pair-Share - Individual White Boards - Rubrics - Appointment Clocks - Kinesthetic Assessments	Deepen student understanding of quality by constructing descriptive feedback for their peers. This approach can help: - students become more relaxed and receptive to feedback since it comes from a peer - students come up with strategies for tackling problems their peers are struggling with - students view their own work through another's eyes which can trigger thoughts into what to edit.	Before engaging in peer feedback there are many things to think about: - All participants must understand that it is performance that is being rated, not people. (what you actually do, not what you are capable of doing) - Students must be given the means to understand how to do well in their performances, otherwise ratings may be damaging. - Consider practicing giving feedback in a controlled setting or simulation. - Consider having clear guidelines and procedures. - Be selective about when peer feedback is used.
Self-assessment Examples: - Move markers to track learning - Student graphs - Student journals - KWL Chart - Student chart of learning progressions - Knowledge Inventory Tool - Analyzing and Revising My Thinking Tool - Rubrics - Self-check - Laundry Day -Constructive Quizzes	Inspire their sense of ownership of the responsibility to learn. These practices increase engagement, achievement and motivation. When students self-assess and set goals they develop an internal sense of control over the conditions of their success and greater ownership of the responsibility for improving.	If you have made the intended learning clear to students and have had them practice self-assessment as you give descriptive feedback, the transition to accurately evaluating the strengths and weaknesses of their own work won't be as difficult. Consists of 3 parts. Not all parts have to be used at one time. 1. Self-assessment – students make judgments about what they know, have learned, or have mastered. 2. Justification – students show evidence in their work as rationale for their judgments. 3. Goal setting – students make a plan for continued learning.
Teacher Observations Examples:	Observe and document student behaviors, responses, and	It is important to keep in mind the learning target and progressions in

- Teacher anecdotal notes of student learning progressions - Rubrics - Math Talk Moves - Exit Slips -Appointment Clocks -Vocabulary Sorts	reactions to lessons. Observations can also be learned to gain a deeper awareness of how children learn and where they are in their learning.	order to scaffold appropriately for each child. There are many different ways to record your observations of students. Pick what works best for you.
Questioning/Discussion Examples: - Math Talk Moves - Bloom's Question Stems	- provide students an opportunity for deeper thinking and opportunity for rich discussion that expands student learning. - provide teachers with a method to scaffold student learning and gain greater insight into the degree and depth of student understanding.	Be sure to provide appropriate think time which when skillfully used is uninterrupted silence. It should be a minimum of 5 seconds. Questions should go beyond the typical factual or yes/no questions. Refer to Hess' Cognitive Rigor Matrix.
Graphic Organizers Examples: - Venn Diagram - KWL Chart - Brainstorming Web - Frayer Model - Knowledge Rating Scale - Alpha Boxes - Make a Math Connection Table -Visual Representations	Assist students in organizing and clearly communicating information using a visual model. Students can use graphic organizers to structure their thinking and writing, brainstorm ideas, make comparisons, help with problem solving, and define concepts.	Graphic organizers are most effective when used as an interactive learning tool throughout the unit so students have the opportunity to reflect, analyze, revise, and extend learning.

Summative Assessments		
Instructional Strategy	**Goal – use when you want to…**	**Comments**
Presentations/Projects	Gauge the level of understanding of critical concepts and adjust instruction to address any misconceptions. Presentations and Projects give students the opportunity to present learning in multiple formats to address the various learning modalities.	Practice Presentations can be used as formative assessments to provide feedback and opportunities to review, analyze, revise, and extend learning. Presentations and Projects provide opportunities for peer- and self-assessment.
Test/Quiz	Measure student growth after instruction by comparing it against some benchmark or standard.	Be sure that the test/quiz is reflective of the learning goals it is assessing within the clearly defined learning timeframe.

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Instructional Coaching Roles and Responsibilities

Thematic Goal:

Align teachers' instructional practices to district initiatives, including Formative Instructional Practices, research-based instructional strategies, and Ohio's New Learning Standards. Instructional coaches provide teachers with job-embedded professional development.

Roles and Responsibilities:

1. Provide technical assistance with the implementation of Standards Based Instruction which should include mentoring, coaching, modeling, providing demonstrations, co-teaching, and planning to ensure Standards Based Instruction is occurring in every classroom.
    - Specifically, build relationships through work with teachers and teacher teams during team meetings and one-on-one in the development and implementation of rigorous lessons based on Ohio's New Learning Standards.

2. Educate and assist schools, including teachers and principals, in the understanding and interpretation of the Ohio New Learning Standards.
    - Specifically, plan, provide and support professional development based on district initiatives.

3. Maintain open and transparent communication with Teaching & Learning, Principals, Team Leaders/ Facilitators, and teacher teams.
    - Specifically, provide ongoing *non-evaluative* feedback to school personnel on progress and areas needing improvement based on data and instructional practices.

4. Other- including, but not limited to:
    - Create and maintain resources, data, and records of teaching, learning, and coaching;
    - Create, locate, and/or refine instructional and curricular resources for teachers and students;
    - Analyze assessment data for instructional planning;
    - Maintain records of coaching work;
    - Provide support for classroom management, routines, and procedures.

5. Other duties as assigned by district leadership.

Collaborative Coaching Plan

Teacher Name	
Grade Level/ Building	
Date	

Coaching Goals	Time Frame/ Planning Session/ Observation Session	Measureable Outcome
1.		
2.		

Immediate Action Steps to Support Goals	Long Term Action Steps to Support Goals	Additional Action Steps Responsive to Preconference, Coaching Session, Observation, Post Conference
1.		
2.		

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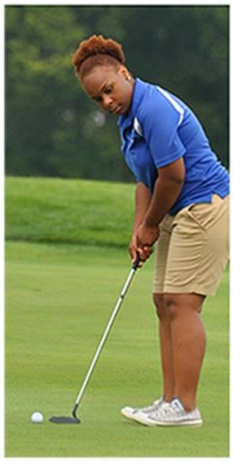

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