Geometry Foundations

An Overview

Welcome

The Math Team from Talent Development High Schools (TDHS) would like to be the first to congratulate you on becoming a TDHS mathematics teacher. We are excited that you and your students are embarking on the *Geometry Foundations* (GF) adventure.

You have a wide variety of support resources available from your Teacher Manuals to your local math coach and visiting math facilitator from Johns Hopkins University. As you read the following pages you will get a clear idea of what GF is all about. As the year progresses, you may want to refer back to this overview to refresh your plans and goals for successfully implementing *Geometry Foundations*.

The Research

Learning mathematics is the product of at least three factors.

Knowledge and Experience — Over 30 years of cognitive research has reaffirmed what should be, but is often not obvious: ***effective strategies are based on a solid foundation of knowledge***. Expert knowledge, in turn, comes from experience, structured learning opportunities, and reflective thought. The same research has also shown that people do not simply learn what they are told. Every new piece of information is interpreted through the lens of our prior knowledge both correct and incorrect.

Strategic and Active Thought — Real and lasting learning is the product of active and purposeful thought. New information needs to be integrated and connected to our existing knowledge.

Desire and Belief — If we believe something is unimportant, we will not learn it. We may attend to it for a short duration if we are made to, but we will not learn it. In general, the usefulness and power of mathematics is not made apparent to students. Also, if we do not believe we have a chance for success, we are unlikely to put forth our best effort for risk of public failure. Students, like most people, are often taught to believe that a talent for mathematics is a gift, which you either have or do not have. They also believe, like most people, that mathematics is a sequential subject. In school this usually boils down to the belief that you must master advanced arithmetic before you can learn other mathematical topics. Neither of these commonly held beliefs is true, yet they often prevent students from risking effort and becoming engaged with mathematics.

…Create an Environment that Encourages and Supports a Variety of Learning/Thinking Styles.

Most mathematical problems and procedures can be solved and employed visually, verbally, and symbolically with concrete models. Often students who struggle with symbolic approaches are very often effective visual, concrete, or verbal problem solvers. Traditionally, however, school mathematics has been designed to only recognize and promote strategies based on symbolic manipulation.

…Create an Environment that Makes Effective Use of Peer Assisted Learning

Research shows that there are effective and ineffective forms of cooperative learning. Unstructured group work often brings few benefits. There is, however, compelling evidence that peer assisted learning leads to higher classroom achievement when students work together on a structured task, that provokes thought, requires everyone to participate, and provides multiple opportunities for students to share their thinking process.

…Create an Environment that Builds on the Mathematical Knowledge and Insights Students Have Acquired In and Out of School and Demonstrates the Relevance of Mathematics to Their Current and Future Lives.

Students who have weak formal arithmetic skills can possess strong mathematical insights. A classroom full of students with weak formal arithmetic skills can still provide the necessary prior knowledge and insights which will enable the class to explore interesting and challenging mathematical topics. These topics should be chosen to demonstrate and highlight the power and significance of mathematics to students' current and future lives.

GF Class Components

Geometry Foundations contains many components to keep students engaged with a variety of tasks in various modes. While this is exciting for students and helps them stay focused on shorter activities, it is also ideal for block-scheduled classes. It will take extra effort from the teacher to keep organized and ensure the transitions flow quickly and efficiently. The benefits of engaging the students in these meaningful activities, however, are well worth the additional time and energy. Many of these components can be used and transferred to the second semester when students are engaged in the Geometry or integrated math texts. It is essential that students be engaged from start to finish.

Component I: Peer Assisted Starter Activities (Problem of the Day)

TDHS suggests that every class period begin with a "Problem of the Day" (POD). These activities are designed to spark students' problem solving abilities, develop their number

sense, and increase their mathematical communication skills. These problems are also designed to demonstrate that students possess a greater range of mathematical knowledge and insight than they might suspect.

Many teachers allow students to pick up the POD Student Journal as they enter class so they can begin working on them immediately. The average amount of time given to the POD is 10 to 15 minutes. You may find that some days lend themselves to shorter or longer amounts of time. It is best to have students work in pairs. After the pairs have had the appropriate time to work, select partnerships to share their thoughts and solutions orally and/or at the overhead. Ideas for sharing can be found in the "Instructional Strategies Section" of this Overview. Make sure that in any given week, most students have a chance to share either orally or at the overhead. Remember these activities are not where students master a skill. Rather, it is an opportunity for them to communicate and review various topics, common mistakes, standardized test questions, etc.

A form has been provided in the Forms Section of this Teacher Manual for recording and assessing student involvement and understanding. Use this form or adapt it to fit your needs. In addition, you may find it valuable to have students remove certain Problems of the Day and place them in their Portfolios. Note: After you have established the procedure for completing the Problems of the Day, you can use the first five minutes of class to address attendance concerns or other house keeping while the students are engaged.

Component II: Whole Class Discovery

Setting the Stage: Each lesson begins with a "Setting the Stage" activity. Setting the Stage is generally presented on the overhead with a provided transparency. Note: All transparencies are located in the Transparency Packet with a master copy in each unit's Teacher Manual.

Please read over the directions and complete each Setting the Stage yourself before implementing the activity. You may need to supply the students with manipulatives and/or implement specific cooperative learning instructional strategies. The goal is to engage students in a short review or introduce new topics to help them transition into the lesson. This is generally a whole class activity. There is one Setting the Stage activity offered for each lesson. When you implement a lesson that may be more than one day in length, you may want to prepare a small Setting the Stage for students to quickly review the previous day's material or to introduce them to the next part of the lesson. A Setting the Stage self-assessment form is provided in the Forms section of this Teacher Manual. Please use this form or adapt it to fit your needs. This form can eventually be stored in the students' portfolios.

Class Discussion: We have included some specific class discussions in the Student Journal to help students focus on a topic and take notes as you introduce or review a topic. We encourage you to have class discussions many times throughout a lesson. Discussions are useful to specifically address the introduction of new material or review what students have just learned. You may want to use various cooperative learning strategies to implement these discussions. Please refer to the "Instructional Strategy Section" of this Overview.

Discovery Activities: These activities are generally the longest part of a lesson and often use manipulatives to engage students in an activity that ties a concept to a skill. There are a variety of instructional strategies and cooperative learning techniques implemented in these activities. You will want to plan for the Discovery Activities by reading the activity, preparing the materials, organizing the room (if necessary), planning the transitions, and reviewing the instructional strategies before the students enter the room. You may want to have students include some of these activities in their portfolios. **Each Discovery Activity is from 30 to 60 minutes**.

Exercises: These problems are generally extensions to the Discovery Activity(ies). They can be completed as homework or classwork. A tool to assess this component has been provided in the Forms section of this Teacher Manual. Use this form or adapt it to fit your needs.

Algebra Connections: These lessons are designed to keep the students familiar with algebraic concepts. A tool to assess this component has been provided in the Forms section of this Teacher Manual. Use this form or adapt it to fit your needs.

Outcome Sentences: These sentences are provided at the end of each lesson to be used as needed. Have students fill out one to three of the sentences in response to a lesson's concept, activity, or skill. Please follow with a short discussion of the students' sentences. You may want the students to include some of their outcome sentences in their portfolios. You may want to make your own Outcome Sentences.

Component III: Differentiated Individual and Small Group Instruction and Activities

Students will enter *Geometry Foundations* with varying levels of prior knowledge. Different students also learn in different ways. Thus, it is necessary to build time into the course weekly for you to provide individualized instruction to small groups of students. One of the advantages of extended periods is that the 80- to 90-minute block enables teachers to provide both significant whole class and small group instruction within a single period. This can only be successful, however, if the remainder of the class is actively engaged in productive learning activities, while you work with an individual student or a small group. Typically, these activities occur two to three times a week and run for 20 to 30 minutes. They include:

Thinking Worksheets: A traditional approach to occupying the class is having students work individually on worksheets or problem sets. The problem with this approach is that most worksheets have students practice a single, narrow skill in a repetitive manner. Practice is essential, but in reality this approach neither engages students nor develops the mathematical approaches they will need to succeed in advanced high school mathematics. Fortunately, we have a resource, included in the Teacher's Resource Kit, that provides a rich stock of worksheets which enable students to practice essential skills in an active and thoughtful manner.

Learning Stations: Learning Stations are a valuable component to the GF classroom. Try to create a new learning station each quarter. By the end of the year you will have four learning stations that you can use the following year and/or share with your colleagues. Eventually, you will have access to various learning stations that address many students' needs.

The goal of learning stations is to offer differentiated instruction and extensions to the lessons. They are to be used by students who have completed the lesson of the day and have extra time at the end of the period. At the learning stations, students will be able to self select activities that apply mathematics in a variety of different manners. For example, one station could contain mathematical games and puzzles. Another station could require students to use their data skills to gain a deeper understanding of current events. A third station could enable students to explore how mathematics is used in a variety of careers, and a fourth station could demonstrate the connection between mathematics and the humanities. Please speak with your local coach or supporting facilitator to help create valuable learning stations for your room.

Study Groups: One of the continuing struggles that teachers face when teaching students with poor prior knowledge and low motivation is finding ways to establish a productive homework routine. Often students fail to complete homework on a regular basis because they either do not understand or are not motivated to complete it. This can then lead to a situation in which the teacher feels it is futile to assign homework. The practice, review, and elaboration provided by homework, however, is essential to student learning. Organized study groups of two to four students are one way to combat this dilemma. Study groups are groups of students who work as a team to both encourage and enable the regular completion of homework.

The key to making study groups work is by creating a format that rewards group effort while still holding each individual accountable. This can be accomplished in a number of ways. On the day homework assignments are due, for instance, they can be routinely, but randomly, given as a pop quiz with scores given to both each individual student and the group. Another strategy is to reward the group for days when every group member turns in a successfully completed assignment and when one random member is able to explain how a given problem is solved.

Another key to successful study groups is to occasionally provide time at the end of class for groups to begin working together on homework. This gives the group some face-to-face time which may be difficult to arrange after school if students do not live near each other or cannot easily meet after school.

Peer Tutoring and Computer Assisted Instruction: Two other options which may not be available in all schools are: a) organized peer tutoring where students from the upper grades tutor small groups of students in this foundation course on a regular basis; and b) computer assisted instruction where students work alone, or with a partner, to work with computer software selected to build skills and understanding.

Additional Components & Suggestions

Quiet Signal: Use an established "quiet signal" to get eyes and ears focused on you for transitions and class discussions. Two common methods are: 1) turn off and on the lights, or 2) hold your hand up until all students are quiet and holding up one of their hands.

Calculators: We highly recommend that students have access to calculators throughout each lesson. The calculator is a valuable tool when used appropriately. There are specific components in lessons that are based on calculator use. Your math coach can help you organize the calculators in your classroom so that you can pass them out and collect them easily with little damage or loss. If your students have access to graphing calculators, we strongly recommend you utilize them throughout GF. This gives students valuable experience with graphing calculators during geometry.

Graphing calculators have advantages even for arithmetic ideas. For example, because there are many lines on a graphing calculator's screen, the expression that was entered remains on the screen after it is simplified to a value. Another advantage is to use the letter feature to explore the concept of evaluating an expression for certain values. Graphing calculators can allow students to explore many examples of a situation that help them determine their own hypothesis to share or test.

Overhead Projector: The TDHS math curriculum and instructional strategies rely on the use of transparencies and overhead projectors. Please inform your coach if you do not have an overhead. Printed transparencies are supplied to use for "Setting the Stage" and when needed for various lessons. The materials kit includes a box of blank transparencies and overhead markers to be used by both the teacher and students when presenting ideas. In a TDHS classroom, it is not uncommon to hand out a blank transparency and overhead marker to student groups, so they can prepare a small presentation of their tasks or solutions. The overhead allows students to come to the front of the class and share their ideas. This reinforces their communication skills and solidifies their knowledge. The chalkboard, while a valuable tool, does not lend itself well to student presentations.

Display Student Work: Many of the activities will generate valuable tables, graphs, or posters that should be displayed in the room for referral or review at later dates. The typical TDHS classroom will have various student created displays on the walls, cabinets, and countertops.

Attendance: TDHS is rich with activities and each student's attendance is paramount. Work with your teacher team members to establish ways of helping the habitual late or absent students make it to class on time. Work with students and within teacher teams to establish ways of dealing with late and absent students. You can have students help each other be accountable by using cooperative groups appropriately. The group member(s) can inform the late or absent student of what they have missed or need to make-up. A check-in log book is another valuable tool that can be used in parent conferences or phone calls. An example is provided in the Forms section of this Teacher Manual. Use this form or adapt it to fit your needs.

Assessments

A meaningful assessment of mathematics should span a variety of concepts, tasks, and contexts in the classroom. These formative assessments should not only be sources for evaluating student products but should also be sources for providing formative feedback to students.

Geometry Foundations includes examples of practical classroom assessment techniques. The assessment techniques are designed to successfully integrate instruction and

assessment. Additionally, students are given opportunities to self-assess and take ownership of their own mathematical learning. Reflective behaviors such as, self-monitoring and self-evaluation are inherent in these classroom assessment techniques. Students are engaged in activities with teachers and peers that facilitate reflection, justification, elaboration, and revision.

Keep in mind this array of assessment techniques is only one way of depicting the students' growth in mathematics. While all the assessment tools listed have individual merits, no single form of assessment will adequately complete a learner's profile. Consequently, a balance of assessment formats-formative and summative, formal and informal-remains the best way to gauge student performance throughout the semester.

Note: Assessment is continual, regardless of whether you are recording the information or not. You have properly assessed the situation when you decide to continue with an activity past the time you planned or when you enter into an unplanned discussion. In both of these instances, you have assessed the students by some method to determine that they need more time or information. Some assessments are more formal than others. You must decide which types of assessments you will need to record and which types you need to make a mental note. We have included various assessment tools in the forms section of this Teacher Manual to give you an opportunity to record assessment information. The following items describe the assessment items we suggest and when is the most appropriate time to use them:

Normed or Criterion Reference Tests: These assessments should used be at the beginning and end of the year or course. The results can be placed in the student's individual portfolio. We suggest only placing the raw scores in the portfolio not the grade equivalent.

Diagnostic Tests: These tests should be administered early in the first semester or at the end of the previous semester to help you determine where students should be placed. Some Normed or Criterion Reference Tests can also be used for Diagnostic Tests. The results of these tests can also be placed in the portfolio.

Student/Teacher Conference Surveys: We suggest that the teacher, coach, or both conduct conferences with each student at least three times a year. The first conference should be held at the beginning of the first semester, the second at the end of the first semester, and the third at the end of the year. A form has been provided to facilitate this process in Forms section of this Teacher Manual. These conference surveys could be added to the students' portfolios.

Open-Ended Assessment: We suggest that you have the students complete an open-ended assessment before, during, and after each unit. We suggest you use your state's or disctrict's standardized exam scoring rubrics.

Portfolio: TDHS strongly recommends that students keep a math portfolio beginning in the 9th grade and continuing throughout their TDHS high school math experience. We recommend the portfolios be kept in the classroom. We suggest that the following items are kept in the portfolio: Normed or Criterion Referenced Tests, Open-Ended Assessments, one Problem of the Day from each unit, one appropriate activity from each unit, a few outcome sentences from each unit, and an item, or two, of the students' choosing. You can be creative as to what additional items go into the portfolio.

Mathematics Journal: We suggest that students keep a Mathematics Journal. Sentence prompts for the journal can come from the generic Outcome Sentence list supplied in the Student Journals or from lists supplied by the school district or state. The prompts could also be teacher generated.

Unit Assessments: Each unit has an individual and group assessment. The individual assessment demonstrates mastery of certain skills or concepts. The group assessment demonstrates growth in communication skills and cooperative learning.

Component Assessments: We have provided many component assessments in this Teacher Manual: "Problems of the Day," "Setting the Stage," "Exercises," and "Algebra Connections." We suggest that you use these assessments or create your own forms and rubrics to assess the various components of GF.

Grading

Each teacher implementing a TDHS course undoubtedly has a different way of grading. We suggest the following basic guidelines for grading.

- Remember the goal of *Geometry Foundations* is to give students opportunities to increase their conceptual understanding and skills in geometry, not necessarily the mastery of every skill. With this in mind, in addition to successful activity completion, incorporate the students' growth in communication and conceptual understanding when grading. These can be addressed by grading the portfolio.
- We suggest that some portion of a student's grade is based on attendance. Attendance has qualitative as well as quantitative aspects. All teachers at a site should come together to design a shared attendance grade plan.
- Another portion of a student's grade can be attributed to participation in the discussions and cooperative learning.
- A portion of a student's grade can be directly linked to completion of Student Journal pages. Walk around the class once a week and have students show you their Student Journal or look at them during your preparation period once a week to record approximate completions.
- A portion of a student's grade can be attributed to mastery learning of skills and concepts. Teacher-created quizzes and the supplied unit assessments can supply this information.

Instructional Strategies

Use the following strategies to engage the students in conceptual attainment and communication.

Discussion: Discussions are valuable when briefly covering topics that are not easy for students to discover, may be confusing to students, or may not lend themselves to conceptual activities. Keep the discussion short and transition to another instructional strategy to keep students attentive.

Lecture: Keep lectures short so that students remain attentive. End lectures before the students' attention begins to drift. Use different modes to present your lecture

such as, transparencies and questions. You may want to point out important topics in your lecture that students should make note of or remember.

Positive/Negative Attributes: List positive and negative attributes of a math concept. Students will then use inductive reasoning to determine the concept or definition. For example, write five equations on the board or overhead that include, either numbers and/or letters and list these as positive attributes of equations. Then, write five expressions on the board or overhead that are not equations and list these as negative attributes of equations. Have the students determine what characteristics make an equation.

Counting Off: First, choose the number of people you want in a group. Second, divide that number into the total number of students in class; the result will be the maximum number you want the students to count to before beginning the cycle again.

Four Corners: A strategy that places students in four large groups to work cooperatively at each corner of the classroom. For example, at each corner you could place a problem to solve on a piece of poster paper. Each group could solve their problem and present their solution or the groups could rotate and visit each problem.

Investigation: A general classroom organization plan where students work in small groups utilizing cooperative inquiry, group discussion, and cooperative planning and projects. Students form their own two- to six-member groups. Generally, the teacher assigns a broad topic, which students break down into subtopics based on their backgrounds, interests, and exchange of ideas. Students search for information from sources inside and outside the classroom. The entire group then exchanges, discusses, clarifies, and synthesizes individually gathered information to produce the final group product.

Guided Note Taking: Prepare a handout, leaving portions of it blank, that prompts students to take notes while you lecture. Handouts are used to summarize the major points of a lecture-based lesson.

Guided Practice: The teacher facilitates and guides students through example problems by first modeling a problem, then the teacher completes another example problem as students give input. Finally, the students practice one or two problems as the teacher walks around the classroom helping students as needed.

Predict: The teacher poses a problem or concept and solicits predictions from the students before the students engage in the problem or concept.

Motivating Question: A question that generates students' interest in a lesson and promotes thinking.

Outcome Sentences: After each lesson, students are given the opportunity to reflect on the lesson by composing outcome sentences.

Practicing the Scientific Method: Using the methods of science, students first encounter a problem. They then hypothesize answers to the problem. As the process unfolds they see hypotheses are accepted or rejected based on data and not on the basis of authority. They learn to make conclusions and decisions based on evidence.

Project: A multi-step assignment that students complete over time, both inside and outside of class. A project allows students to investigate mathematical ideas in a new context and often involves a series of related investigations, problem solving, library/internet research, demonstrations, and presentations.

Question, Write, Respond: Students write an answer to a posed question before the teacher picks certain students to respond.

Student Groupwork: When studying a concept, students can work in pairs or small groups. Allowing students to work together increases student involvement, which can have a positive impact on motivation.

Thinking Aloud: The teacher shares thoughts aloud while completing a problem.

Three in a Row: Students are offered a choice of activities, independent work activities or enrichment activities. To create a three-in-a-row menu, follow the four steps below.

1. Create a menu of possible activities.
2. Leave some blank spaces for students to insert their own ideas.
3. Approve and record alternative activities when appropriate.
4. Students choose any three in a row activities.

"What" Questions : Ask good "what" questions and/or questions that allow students to give reasons or explanations for their answers. For example, "Can you think of reason why you need to find a common denominator before adding fractions?" or "What might explain that when you divide a whole number by three the answer always ends in a repeating decimal of 3, a repeating decimal of 6, or ends as a whole number?"

Pass it Along: Give a student a turn to respond to a question, or if a student prefers not to respond he/she can say, "I pass" . You can clarify the number of times that a student can pass. For example, you may want a student to pass no more than three times with the fourth person having to respond. You can have the passing follow the pattern of seating arrangements or you may want the student to determine whom he/she passes to.

Geometry Foundations

Unit Outlines & Objectives

Unit 1: Introduction to Geometry

Lesson 1: Chromatic Number

- Students will construct the concept of chromatic numbers.
- Students will determine the chromatic number of various color patterns.

Lesson 2: Lines of Symmetry

- Students will locate and draw a line of symmetry with a transparent mirror.
- Students will locate and draw a line of symmetry by paper folding.
- Students determine the line of symmetry equation for designs on a coordinate plane.

Lesson 3: Rotational Symmetry

- Students will construct rotational symmetries.
- Students evaluate equations given values.

Lesson 4: Cutting the Pattern

- Students determine the degree measure of rhombi that form a star.
- Students will analyze an equation with tables and graphs.
- Students determine which objects can fill a space.

Lesson 5: Similarity

- Students solve for the unknown in a proportion.
- Students discover the properties of similar objects.
- Students apply proportions of similar objects.

Lesson 6: The n^{th} Term

- Students will determine a sequential geometric pattern and model it with algebra.
- Students will develop the concept of scale factor.
- Students will use the sequential pattern to analyze problems.

Unit 2: Measurement

Lesson 1: Metric Identification Card

- Students measure lengths in centimeters.
- Students collect and record data.
- Students will graph a scatter plot of the data.
- Students will make predictions from a scatter plot.

Lesson 2: Counting Squares

- Using a transparent square grid, students determine the area of rectangles, triangles, other shapes by counting squares.
- Students will determine the area of rectangles and triangles with area formulas.

Lesson 3: Approximating by Counting Squares

- Students determine the approximate area of circles and irregular shapes by counting squares.
- Students determine the area of circles with area formulas.

Lesson 4: Distance Proportions

- Students determine average stride lengths.
- Students will estimate distance by walking.
- Students will use stride length formulas to determine estimated distance.
- Students will use unit cancellation to solve problems.

Lesson 5: Distance Proportions
- Students estimate the height of an object using shadows.
- Students estimate the distance between people using a range finder.
- Students use proportions to estimate distances.

Lesson 6: Area and Perimeter
- Students will determine the area of a rectangle.
- Students complete a scatter plot of data.
- Students will model the relationship between area and perimeter with equations, tables, and graphs.
- Students determine the maximum of a graph and the corresponding x - value.

Lesson 7: Cube Nets
- Students create a cube with a net.
- Students create a net for a cube
- Students will come to know the parts of a cube.

Lesson 8: Big Base
- Students will estimate the volume of prisms and cylinders.
- Students determine the volume of prisms and cylinders.
- Students compare the volume of two cylinders created with the same lateral surface area.

Unit 3: Properties of Objects

Lesson 1: Circles
- Students will construct a circle with a compass.
- Students determine the equation of a circle.
- Students develop the concept of equidistance.

Lesson 2: Basic Triangles
- Students will determine the type of segments that can create triangles.
- Students will determine the sum of the angles of a triangle's interior angles.
- Students will determine the values of a triangle's unknown angles.

Lesson 3: Special Triangles
- Students will come to know and understand the definition of scalene, isosceles, equilateral, acute, obtuse, and right triangles.
- Students will construct scalene, isosceles, equilateral, acute, obtuse, and right triangles.

Lesson 4: Quadrilaterals
- Students will know and understand the definition of a quadrilateral.
- Students will solve for the unknown angle of a quadrilateral.

Lesson 5: Parallelograms
- Students will come to know and understand the definition and properties of a parallelogram.
- Students will understand the concept and definition of supplementary angles.
- Students will construct a parallelogram.

Lesson 6: Special Quadrilaterals
- Students will come to know and understand the definition and properties of a rectangle, trapezoid, rhombus, square, and kite.
- Students will construct a rectangle, trapezoid, rhombus, square, and kite.

Lesson 7: Pythagorean Theorem
- Students determine if a set of numbers is a Pythagorean Triple.
- Students determine the length of a side of a right triangle.
- Students analyze applications based on the Pythagorean Theorem.

Lesson 8: Center of Mass
- Students will locate the center of mass.
- Students will locate the midpoint of a line segment.
- Students draw the median of a line segment.

Lesson 9: Circumscribed Circles

- Students will locate the perpendicular bisector of a segment.
- Students will locate the circumcenter of a triangle.
- Students will draw a circumscribed circle around a triangle.

Lesson 10: Inscribed Circles

- Students will locate an angle bisector.
- Students will locate the incenter of a triangle.
- Students draw an inscribed circle in a triangle.

Unit 4: Coordinate Geometry

Lesson 1: Plotting Points

- Students determine the location of points.
- Students plot points given the ordered pairs.
- Students transition between a table of values and the corresponding plot of those values.
- Students create a connected scatter plot of ordered pairs.

Lesson 2: Calculator Plotting

- Students will plot ordered pairs on a graphing calculator.
- Students will adjust the display on the graphing calculator screen.
- Students create a connected scatter plot of ordered pairs.

Lesson 3: Rise and Run

- The students determine the slope of a roof by determining the rise and run.
- The students discover that a steeper roof corresponds to a larger rise over run ratio.

Lesson 4: Slope

- The students count the rise and run of a segment to determine the slope.
- The students determine the slope of a line using the slope formula.
- The students categorize the four types of slope.

Lesson 5: Perpendicular

- Students discover that the slope of a perpendicular line segment is the opposite reciprocal.

Lesson 6: Parallel

- The students determine which line segments are parallel based upon slope.

Lesson 7: Distant Formula

- Student learn to use the Pythagorean Theorem and the distance formula to determine the distance between the endpoints of a line segment.

Lesson 8: Midpoint

- Students learn to use the midpoint formula to determine the midpoint of line segments.
- Students apply the midpoint formula to various situations.

Lesson 9: Coordinate Proof

- Students will prove that four points create or do not create a square.
- Students will prove that the diagonals of a square are perpendicular and bisect each other.

Unit 5: Language of Geometry

Lesson 1: Get the Point!

- Students will experiment with smaller and smaller dots to conclude that an infinite number of points exist in a contained space.
- Students will locate points on a coordinate plane.

Lesson 2: Line it Up!

- Students develop the concept of a line.
- Students will determine the types of intersections of two lines.
- Students will come to understand the concept of collinear.

Lesson 3: The Plane Truth

- Students will develop the concept of a plane.
- Students review the basic fundamentals of the coordinate plane.

Lesson 4: Space

- Students investigate the relationship of points, lines, and planes in space.
- Students practice drawing 3-D images on 2-D paper.

Lesson 5: Segments and Rays

- Students will learn to use the inductive approach to determine the characteristics of line segments.
- Students learn the symbols for naming segments and for measurements of line segments.

Lesson 6: Angles

- Students will name angles and their parts.
- Students will learn to recognize angle pairs.
- Students will measure angles accurately.

Lesson 7: Congruence

- Students understand the use of congruence and equal symbols and concepts.
- Determine the Side-Side-Side method to show that triangles are congruent.

Lesson 8: Similar

- Students will understand the use of similar symbols and concepts.
- Students will use proportions and angles to determine if polygons are similar.

Lesson 9: 3-D Objects

- The students use nets to create prisms, pyramids, and cylinders.
- Students create a triangular pyramid, truncated triangular pyramid, and an icosahedron (20-sided polyhedron).

Geometry Foundations

Teacher Kit Contents Checklist

- ☐ 30 scissors _____
- ☐ 30 compasses _____
- ☐ 30 transparent mirrors _____
- ☐ 30 rulers _____
- ☐ 30 protractors _____
- ☐ 1 set of 1000 centimeter cubes _____
- ☐ Tracing paper _____
- ☐ String/twine _____
- ☐ 7 sets of colored pencils _____
- ☐ 1 package of overhead transparencies _____
- ☐ 1 package of cardstock paper _____
- ☐ 7 rolls of clear tape _____
- ☐ 5 - 25' retractable tape measures _____
- ☐ 4 sets of overhead markers _____
- ☐ 7 sets of magic markers _____
- ☐ 1 package of poster paper _____
- ☐ 1 classroom timer _____
- ☐ Cooperative Learning book _____
- ☐ *Patty Paper Geometry book* _____
- ☐ *Patty Paper Geometry Student Workbook* _____
- ☐ 1 large storage tub _____

There are specific times that we will refer to items in the kit to be used for certain activities, but they can also be used as needed.

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