

# Let's Investigate!

# Plane Geometry

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A journey into real-world concepts of Plane Geometry



## About the Authors

**Judy Bippert** is a credentialed teacher with a master's degree. She has more than 35 years of experience teaching junior high and college level students, coordinating Gifted Education programs, and supervising student teachers. She is recently retired from being a faculty member at San Diego State University where she taught mathematics methods to pre-service teachers and coordinated Field Experience. She recently made presentations at the National Council of Teachers of Mathematics, the California Mathematics Council, the Greater San Diego Mathematics Council, the Conference for the Advancement of Mathematics Teaching (Texas), and the California Association for the Gifted annual conferences. She has co-authored 11 mathematics simulations with Interact Publications and also contributed to university texts.

**Louise Vandling** is a credentialed teacher and administrator with a master's degree. She has more than 35 years of experience as an elementary teacher, administrator, district math mentor, staff developer and university math instructor. She is retired from the Vista Unified School District where she was the mathematics specialist for grades 2–5 at Casita Center, a math magnet school in the district. She has co-authored eight nationally published math simulations through Interact Publications and has contributed to Mathematics journals. Currently she consults for districts in mathematics and continues to present at the National Council of Teachers of Mathematics, the California Mathematics Council, the Greater San Diego Mathematics Council, Texas and Arizona math teachers Associations, and the California Association for the Gifted and Association of San Diego Educators for the Gifted annual conferences.

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# Welcome to *Let's Investigate!*

One of the most effective learning tools for students is discovering knowledge for themselves. This unit will take you and your students on an adventure investigating plane (two-dimensional) geometric concepts. The unit supports and reinforces classroom instruction or can be used to introduce concepts of geometry before standardized testing. It provides for your students to apply their knowledge and skills to solve real-life situations.

Students will be responsible for their choice of investigations and will sign a contract along with their parent and teacher stating their goal for a grade on the project. Students develop their organizational skills as they plan how they will collect information from their investigations and keep the record of their completed work. They will design a means of sharing their new knowledge with their classmates and the teacher. The difficulty and level of success of the work will determine each student's evaluation (grade/rubric score).

Investigations are based on the hierarchy of levels of Bloom's Taxonomy. They are designed to encourage students to use higher order thinking skills and, in addition, use a variety of learning styles: written, oral, visual and tactile. Each investigation is separate from the others and does not depend on knowledge gained from other investigations in the unit.

Students from grades 3–7 will benefit from this unit. It will provide a variety of experiences with plane (two-dimensional) geometry, reinforce skills and help students needing review.

*The best way to learn anything is to discover it by yourself.*  
—George Polya



#### **Teaching tip**

These investigations are ideal for students in homeschool.

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## Purpose and Overview

### What is *Let's Investigate! Plane Geometry*?

*Let's Investigate! Plane Geometry* is a collection of activities that enhance instruction of mathematics ideas/content. These tasks provide support for:

- ongoing teaching of geometry;
- review of previously taught material;
- chances to investigate ideas of interest;
- opportunities to make real-world connections in mathematics;
- situations where individual students can make their own choices, work with others and have fun with math while communicating their learning in written, oral or visual form.

The selection of investigations will vary according to the needs of each individual student. Each investigation sets up a situation or poses a problem where students will work with one or more mathematical ideas.

### What are Students Learning?

In the current climate toward common core standards, developing an understanding of geometry skills is increasingly important. Specifically, students will be enhancing the following abilities:

#### **Knowledge**

- Developing an understanding of the characteristics of two-dimensional geometric shapes
- Evaluating previous information in making decisions
- Understanding the need to make sense of problems and to persevere in solving them
- Understanding coordinate systems
- Connecting math to real-world applications

#### **Skills**

- Developing geometric thinking and spatial sense
- Learning about how shapes change and do not change (topology)
- Understanding networks
- Using coordinate systems

## Purpose and Overview

*Let's Investigate!*

- Organizing and writing about mathematical information
- Setting goals and making a contract commitment
- Using appropriate tools strategically to gather data
- Working independently or with others toward a goal
- Using higher order thinking skills
- Using technology as a tool for research and to share learning
- Communicating mathematically
- Using geometric tools (ruler, compass)

### **Attitudes**

- Feeling at ease with analyzing shapes and making predictions
- Developing a positive attitude toward mathematics
- Developing confidence in math abilities
- Having a sense of accomplishment when the contract goals are successfully completed

### **How are Students Organized?**

Students should be allowed to choose to work on their own or with a partner or group of three to complete their contract. Students individually or with their partner(s), make their own decisions about what investigations they want to do and thereby the grade they want to achieve.

### **How Much Time Do I Require?**

The number of investigations and the duration of the unit will depend on the way you choose to use the unit and the needs of your students. There is a variety of ways to approach these investigations. The contract can take up to three or more weeks to complete depending on the number of investigations you decide will be required and the amount of class time used by students to complete the activities. If you decide to allow more days, it's important to build in time to meet with students weekly to assess progress on completion of the contract.

### **How is Learning Assessed?**

*Let's Investigate! Plane Geometry* contains a rubric for completion of projects assigning the point value for each category of activities based on the level of thinking (difficulty). The Observation Checklist is available to use for recording student performance during their investigations. Students are expected to reflect on their finished work with the teacher or their classmates in written, oral, or some form of visual presentation.

#### **Teaching tip**

The midway evaluation form will help with assessing progress.



### **Why use *Let's Investigate! Plane Geometry*?**

The investigations support the nationally recommended Common Core State Standards for Mathematical Practices. These are:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Using this unit promotes your students' discovery of basic geometry concepts to support their understanding. The unit provides a way to use a wide variety of mathematical skills and apply the mathematics students have already learned. Investigations by their very nature promote higher level thinking skills. As students understand and gather information, then transform it by analyzing, evaluating and applying, they are moving toward the life skills they will use in all future careers and for managing family responsibilities.

### ***Differentiation***

The *Let's Investigate! Contract* offers a student the opportunity to make choices and to work at their own pace individually or in pairs to solve problems. It accommodates multi-ability levels in that you can modify the contract for students who need more time or have mastered what you are currently teaching and need to go farther. You can select specific investigation choices that you think are most appropriate for students.

*Let's Investigate! Plane Geometry* is centered on Bloom's levels of thinking and the scoring (grade) is based on the number and levels and the quality of the final products completed by the student. The unit is also designed to incorporate a variety of learning styles including writing, oral communication, visual and tactile experiences.

Homeschool teachers will appreciate the flexibility and various challenges this unit provides.



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### **Motivation**

When using *Let's Investigate! Plane Geometry*, students are empowered by choosing their activities, making predictions, collecting data and interpreting their results. They are encouraged to experiment with various shapes, use a compass, examine coordinate systems and discover information using technology. When they share the strategies they have developed when completing activities, it clarifies their thinking, increases the chance that that strategy will be used to solve future problems and helps instill confidence in the students, in their ability to be successful mathematicians.

### **Flexibility**

The number of assignments is based on the teacher's judgment and the amount of time allowed. The number of points can be pre-determined by you to make it optimal for the class level. You can modify the investigation selections by using the material on the CD and selecting only the activities under each heading that you feel are appropriate for your entire class or for individual students.

This unit is composed of three increasingly challenging sections based on Bloom's levels of thinking. You may choose to have all students complete their selection(s) in the first section before going on to section two and so forth. You could also set up centers with the investigations you feel are appropriate for your class beginning with those in the first section.

### **Ease of use**

This unit supports classroom management by offering independent work time for individuals to enrich and extend the classroom instruction in mathematics. You can designate time to work on the contracts in class allowing you to work with individuals or with small groups. Or you can assign investigations (or contracts) as long-term projects to allow students to explore a math concept in greater depth. The investigations also give you an opportunity to expose students to the content of a standard that may not be covered in depth prior to standardized testing. Since the contract work can be organized to be ongoing, you can plan for students to work on it should you need to be out of the classroom.

Students are given the list of suggested investigations and they make their own choices. Even when working in pairs or groups of three, they complete their individual contract, and then submit it to you. The time spent on the investigations can be during regular math time, when other work is finished, or done at home. Your role is primarily as a facilitator— allowing students to discover and develop an intuitive sense of geometric concepts as they work through their selected activities.