### Welcome to Let's Investigate! Solid Geometry

One of the most effective learning tools for students is discovering knowledge for themselves. This project-based unit will take you and your students on an adventure investigating solid (three-dimensional) geometric concepts. It encompasses the eight abilities and skills all students should develop, as stated in the Common Core State Standards. (These can be found under "Why Use *Let's Investigate! Solid Geometry.*") The unit supports and reinforces classroom instruction, or can be used to introduce geometry concepts before standardized testing. It provides an opportunity for your students to use 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 record 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).

*Note:* These investigations are ideal for students in home school.

Investigations are based on the hierarchy of levels of Bloom's Taxonomy. They are designed to encourage students to use higherorder 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 4–8 will benefit from this unit. It will provide a variety of experiences with solid (three-dimensional) geometry, reinforce skills, and help students needing review.

All people ever have is their own understanding; you can tell them all sorts of things, but you can't make them believe it unless they also construct it for themselves —Eleanor Duckworth Harvard



### **Purpose and Overview**

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Name:

## **Investigation Contract**

I understand that I will need to complete	activities by	l will (	complete the
following activities selected from three differen	t categories. My go	al is to get	_total points for
my projects.			

Here is my plan for presenting my findings using written or oral format or using technology.

#### Knowledge and Comprehension (Remembering and Understanding)

Investigation #	<b>Completion Date</b>	Points Possible	Points Earned

#### Analysis and Synthesis (Analyzing and Creating)

Investigation #	<b>Completion Date</b>	Points Possible	Points Earned

#### Application and Evaluation (Applying and Evaluating)

Investigation #	<b>Completion Date</b>	Points Possible	Points Earned

### Total points: \_\_\_\_\_

Student signature \_\_\_\_\_

Parent signature

Teacher signature \_\_\_\_\_

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### **Scoring Rubric for Investigations**

Expectations		Section l Knowledge and Comprehension	Section II Analysis and Synthesis	Section III Application and Evaluation	Goal
Exceeds expectations: Fully accomplishes the purpose of the task; demonstrates clear understanding of the geometric concepts involved in the investigation; recorded work communicates thinking clearly, using some combination of written, symbolic, or visual means.	Complete. Clear and well- communicated	4	8	12	
Meets expectations: Substantially completes the purpose of the task; displays essential grasp of the geometric concepts involved in the investigation; recorded work communicates a large part of the thinking.	Complete	3	6	9	
Approaching expectations: Partially accomplishes the task with limited grasp of the geometric concepts involved in the investigation; recorded work may be incomplete, misdirected, or not clearly presented; strategies may be ineffectual or not appropriate.	Mostly complete with some understanding	2	4	6	
Falls far below expectations: Little or no progress toward accomplishing the task; approach may lead away from task completion; shows little evidence of appropriate reasoning or understanding of the geometric concepts involved in the investigation.	Incomplete with little understanding	1	2	3	

Name:\_\_

Date:

Let's Investigate! Solid Geometry

## Reflection

Three things I learned about Solid Geometry are:

The investigation I liked the most was:

I liked this one because:

Another Solid Geometry topic I might want to explore more if I had more time is:

The hardest part of this assignment was:

The easiest part of this assignment was:

What advice do you have for students doing this assignment next year?

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# Blackline Master 2: Tetrahedron Directions

Materials needed: Compass, ruler, scissors, pencil, construction paper or other stiff paper (4 colors is best)

- 1. Set your compass to 1 ½ inch radius and draw 4 circles.
- For each of the four circles: Keeping the radius of the circle at 1 ½ inches, put the point of the compass anywhere on the circumference. Swing the compass to intersect the circumference and make a tick mark. Then move the compass to the mark you made and do the same thing all around the circle. You should have 6 marks. Number them 1–6. (See Diagram I)
- 3. In each circle, use a ruler to connect even numbered marks to make a triangle in the center. These lines will make an equilateral triangle. (See Diagram II)
- 4. Using the ruler, line up the tick marks on opposite sides of the circles. These will meet in the center of the circles and pass through the midpoint of the sides of the triangles. Put marks at these three midpoints. (See Diagram III)
- 5. Cut out the circles. Then, make three cuts from each of the three vertexes to the midpoint of the triangle side. (See Diagram IV, the dash lines show where to make the cuts.)
- 6. By sliding the cut on one of the circles over the cut side of another circle, you will be able to connect all four circles to form a closed three-dimensional figure. The triangles will form a four-sided figure and the curved portions will be on the outside. The four-sided figure is a tetrahedron.





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Diagram IV

## Blackline Master 3: Pictures of Structures

1.

Surface area (sum of all the faces) = 22 square units Volume (number of cubes used to build the figure) = 6 cubic units



Figure Number	Surface Area (Sum of the area of all the faces	Volume (Cubic Units needed to build the figure)
1	22	6
2		
3		
4		
5		
6		
7		
8		
9		

Name:\_\_\_

Date: \_\_\_\_\_

## **One-Inch Grid Paper**

\_\_\_\_\_

