

NHU/NASA Summer Institute

Lesson Plan

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Lesson Plan Title	Calculating the Area of Parts of Satellite Models and of Various Polygonal Shapes
Grade Level	8 - 12
Concept/Topic to Teach	How to Calculate the Areas of Various Shapes
Content Standards	<p>NCTM standards:</p> <p>Geometry Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationship , understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;</p> <p>Measurements Apply appropriate techniques tools, and formulas to determine measurements; select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision;</p> <p>Technological Students perform basic mouse manipulations such as point, click & drag, and use a browser for experimenting with the activities.</p> <p>CA Standards:</p> <p>Geometry Students know how to calculate the perimeter and area of various polygons</p>
General Goals	Given the exposure to satellite information and to the concept of area, students will be able to recreate a paper model of a satellite, be able to calculate the area of some of its parts and extend the concepts to the calculation of area of various random polygonal shapes

Specific Objectives	Upon completion of this unit, students will be familiar with concept of satellites and some of its parts; and able to calculate the area of a random polygonal shapes
Required Materials	<p>If using technology) Video or Website to show a satellite launch and orbit TV& VCR Computers & Access to a browser Access to the Internet to use EXPLORER activities Overhead project, transparencies, markers Pencil and grid paper Satellite paper models (NASA, Lockheed) Copies of supplemental materials for the activities: Worksheet to accompany the Area Lessons NASA Videos & materials related to satellites Materials for students to make own satellites: Thin cardboard tubes, paper roll tubes, etc.; scissors, glue, paper; makers, color pencils Poster board for presentations Grid paper, rulers (in. and cm.) Calculators (teacher's discretion) Resources: NASA videos and materials on satellites The Shodor Education Foundation's Website for worksheets</p>
Anticipatory Set	<p>Key Terms Satellite, bus, area, polygons. geoboards</p> <p>Teacher explains the purpose of the project, possibly saying " For the next several days, we will be studying about area of various shapes. We will begin our assignment by first learning a bit about satellites and their parts, We will watch a video of a satellite being launched into orbit, and discuss what happens. We will then make model satellites in the classroom so you can see the different shapes that make up a satellite. We will then make our own satellites out of materials you bring from home. I will give you a list of things you will need." We will use all of these shapes to learn about and to calculate the Area of each."</p> <p>Teacher lets the students know what they will be doing and learning each day, possibly saying something like this: Today, class, we will be talking more about the area of (polygons). We will learn exactly what this term means, and we will learn how to calculate the area of random shapes on a grid.</p> <p>If using computers, Teacher may say: "We are going to</p>

	<p>use the computers to learn to compute areas. Do not turn your computers on or go to this page until I ask you to. I want to show you about the Area Explorer applet first.</p>
Step-by-Step Procedures	<p>This is a multi-lesson plan. It is meant to be flexible according to the students and teachers' need and the availability of technology and materials.</p> <p>Focus and Review Remind students what has been learned in previous lessons that will be pertinent to this lesson and/or have them begin to think about the words and ideas of this lesson: Teacher may ask students to recall information about polygons. She might ask students to consider how they might find the area of their desk. Teacher may discuss what it might mean to talk about the area of a polygon. Every day, Teacher lets the students know what it is they will be doing and learning that day by first asking about what they learned the day before.</p> <p>Lesson 1. Teacher introduces the Lesson by asking students what they know about satellites tells the students that they will be watching a video about a satellite launch, and how it is placed in orbit. Teacher lets students know that they will be building their own paper model satellite and that they will use the shapes to learn about the concept of area. Students also will have an opportunity during the unit the design and build their own model satellite and make presentations to the class on their findings.</p> <p>After a few minutes of discussion, Teacher plays video of satellite launch. At the end, Teacher as questions like: How do engineers and scientists that design satellites know who much material to use when the satellites are built? After a short discussion, Teacher asks students to form their groups and begins demonstrating the construction of the paper model. Teacher First shows a semi-finished model and a fined model to guide the students. Teacher then shows step by step how to cut and assemble parts together. More</p>

advanced students may follow the written directions that accompany each model. Teacher makes a few measurements of length of sides as she goes along, promoting students to think about the lengths of the sides of their models.

Teacher walks around the room, supervising the work and as students complete their model, Teacher might ask pointing at a side, How long do you think this side is? Students are reminded to store their satellites are they will use them to calculate areas later on.

As an independent activity, Teacher might assign homework where students measure lengths of indicated sides of a non-assembled model. Students write the information on their journal for later use.

Lesson 2 (follows)

Lesson 3

Teacher might have the students design and build their own satellites in class adding a Social Component to this lesson and assessing students on how they work as a group. Students also do a self assessment.

Students may present their findings on poster board as part of the group presentations)

Lesson 2

Teacher may choose to lead the students in a short discussion about how to find the area of irregular figures.

Teacher explains to the students how to do the assignment. Model or demonstrate it for the students, especially if they are not familiar with how to use computer applets.

If using technology, Teacher opens the browser to Area Explorer in order to demonstrate this activity to the students.

"Area is the amount of space inside the figure. So imagine the grid lines mark off floor tiles like the ones we have here at school. Now floor tiles are one-foot squares. So to find the amount of space in the object we just need to count the floor tiles".

"Once we have calculated the area we will put our

answer in the text field and click the check answer button."

If using technology, Teacher may pass out the Worksheet to Accompany the [Area Explorer](#) Applet

Teacher may print and use these exercises when technology is not available

When using computers, the monitor screen will read:

Directions: Read each question below. Click once in an ANSWER BOX and type in your answer; then click ENTER. After you click ENTER, a message will appear in the RESULTS BOX to indicate whether your answer is correct or incorrect. To start over, click CLEAR.

1. Find the area of a square the sides of which are 6 in long.

ANSWER BOX: _____ in²

RESULTS (show all your work):

2. A rectangular yard has a length of 12 m and a width of 4 m. Find its area.

ANSWER _____: m²

RESULTS (show all your work):

3. The area of a square is 25 square centimeters. How long is one side?

ANSWER: _____ cm

RESULTS (show all your work)

4. A rectangular rug has an area of 28 square feet and a length of 7 ft. What is its width?

ANSWER: _____ ft

RESULTS (show all your work):

	<p>5. A piece of paper has an area of 45 square inches and a width of 5 in. What is its length?</p> <p>ANSWER _____: in</p> <p>RESULTS (show all your work)</p>
<p>Plan for Guided Practice</p>	<p>Non Technology: Teacher may print and use these exercises when technology is not available Teacher will try another example, letting the students direct the steps. or asking, "Can anyone describe the steps you will take for this assignment?"</p> <p>If using computers, the monitor screen will read: Directions: Read each question below. Click once in an ANSWER BOX and type in your answer; then click ENTER. After you click ENTER, a message will appear in the RESULTS BOX to indicate whether your answer is correct or incorrect. To start over, click CLEAR.</p> <p>1. Find the area of a square the sides of which are 8 in long.</p> <p>ANSWER BOX: _____ in²</p> <p>RESULTS (show all your work):</p> <p>2. A rectangular yard has a length of 10 m and a width of 6 m. Find its area.</p> <p>ANSWER _____: m²</p> <p>RESULTS (show all your work):</p> <p>3. The area of a square is 36 square centimeters. How long is one side?</p> <p>ANSWER: _____ cm</p>

	<p>RESULTS (show all your work)</p> <p>4. A rectangular rug has an area of 56 square feet and a length of 8 ft. What is its width?</p> <p>ANSWER: _____ft</p> <p>RESULTS (show all your work):</p> <p>5. A piece of paper has an area of 72 square inches and a width of 9 in. What is its length?</p> <p>ANSWER _____: in</p> <p>RESULTS (show all your work)</p>
<p>Plan for Independent Practice</p>	<p>Allow the students to work on their own and to complete the worksheets or computer assignments. Teacher monitors the room for questions and to be sure that the students are on the correct web site.</p> <p>Another option for independent practice is to have the students work in pairs (carefully chosen so that both students are of the same ability group). Have them race to find the correct area using the Area Explorer applet. Who ever wins gets a point. At the end of the allotted time for the game give the winning member of each pair a reward of some type.</p>
<p>Assessment (based on objectives)</p>	<p>For Lessons 1 & 3 Students can present their finding as groups, using posters</p> <p>For lesson 2. Students are assessed showing their work in calculations, including working though word problems; Word pairings; and multiple choice questions.</p>

	Class observations, computer exercises, and homework may also be used as assessment
Adaptations (ELL students or special populations)	The students work in pairs (carefully chosen so that ELL students are working with EF or advanced ELL students. Teacher monitors their progress and assists as needed, giving one-on-one instruction when needed
Extensions (for gifted students)	<p>Teacher may have students work with with Geoboards. Students may be asked to: Imagine that the grid is a Geoboard (each intersection of the grid lines is a peg on the board). Record the area. The area can be thought of as how many blocks of space are contained in the shape. Can you see a pattern? What is that pattern? Can you create a formula or rule for the area using the data you collected? What is the formula?</p> <p>Try finding the area by imagining the shape enclosed in box and subtracting the area in the box that is not used from the area of the box. Do you get the same answer? Why? Is this method always easier? If not, explain when it is easier to use this method and when it is not.</p> <p>Alternate Outlines These lessons can be rearranged in several ways if there is only one available computer:</p> <p>Have all students pull out a sheet of paper. Have the computer generate a set number of shapes and have them record on their paper the area (Teacher records it as well). When done, papers are collected and checked. The person with the most correct answers gets a reward of some type and the rest of the class gets a participation grade. Everyone is involved and tries.</p> <p>Closure After each lesson, Teacher may wish to bring the class back together for a discussion of the findings. Once the students have been allowed to share what they found, summarize the results of the lesson.</p>