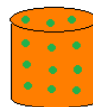
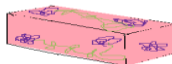


Nets and Surface Area of Solids



A SUIT FOR A SOLID



Overview:

This lesson will focus on constructing a net for the following types of solids (cylinder, prism, and pyramid), and calculating the surface area of those solids using their nets.

Benchmarks:

3-4th Grade

Number, Number Sense and Operations

L. Use a variety of methods and appropriate tools (mental math, paper, pencil, calculators) for computing with whole numbers.

Measurement

A. Select appropriate units for perimeter, area, weight, volume, time, and temperature, using:

* U.S. Customary units; e.g. mile, square inch, cubic inch, second, degree, and other units as appropriate;

* Metric units; e.g. millimeter, kilometer, square centimeter, kilogram, cubic Celsius, and other units as appropriate.

D. Identify appropriate tools and apply counting techniques for measuring side lengths, perimeter and area of squares, rectangles, and simple irregular two-dimensional shapes, volume of rectangular prisms, and time and temperature.

Mathematical Processes

F. Recognize relationships among different topics within mathematics; e.g. the length of an object can be represented by a number.

I. Represent problem situations in a variety of forms (physical model, diagram, in words or symbols), and recognize when some ways of representing a problem may be more helpful than others.

5-7th Grade

Measurement

A. Select appropriate units for measuring angles, circumference, surface area, mass, and volume, using:

* U.S. Customary units; e.g. degrees, square feet, pounds, and other units as appropriate;

* Metric units; e.g. square meters, kilograms, and other units as appropriate.

C. Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area of triangles, quadrilaterals, circles, and composite shapes, and surface area and volume of prisms and cylinders.

8-10th Grade

Measurement

B. Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specific level of precision.

C. Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference, and area of circles, triangles, quadrilaterals, and composite shapes, and to find volume of prisms, cylinders, and pyramids.

E. Estimate and compute various attributes, including length, angle measurement, area, surface area, and volume, to a specific level of precision.

Mathematical Processes

A. Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solutions.

F. Use precise mathematical language and notations to represent problem situations and mathematical ideas.

Time

2 periods (90 minutes)

Materials

- 3-d solids (prisms, pyramids, and cylinders) of various sizes
- White tissue paper or square centimeter paper
- Scissors
- Ruler
- Tape
- White copy paper
- Calculator
- Decorative thick paper, wallpaper samples, or construction paper
- Worksheet A or alternative worksheets-(B1, B2, &B3)

Procedures

1. Each small group (2-3) gets a cylinder, a prism, and a pyramid. Try to give a different size or type (square pyramid, triangular pyramid) to each group.
2. Students make a net by tracing all the surfaces/faces of one the solids onto the tissue paper or square centimeter paper.
*** The easiest way is to place the solid on the tissue paper and trace the base. After that turn the solid onto the next surface, while keeping the shared edges aligned, students trace the second surface. Continuing this method until all the surfaces have been traced to form the net.**
3. When the students cut out the net, they can assemble it to confirm if it covers the surface of the solid. This will become the pattern for the suit of that solid. Mark the base(s) with a “B”.
4. Now, students copy the outline of the pattern (net) onto white copy paper. One person from the group needs to affix this copy of the net on the board under the correct solid name- cylinder, prism, pyramid.
5. Repeat steps 2, 3 and 4 until all three solids are finished for each group.
6. Discuss the similarities of each set of nets on the board. Here are

some sample observations:

cylinder

- * there are 2 different shapes on the net. *the bases are circles*
- *the circles are congruent*The other shape is a rectangle.*
- *the circles are on opposite sides of the rectangle.*

prism

- *There are 2 different shapes on the net. * there are 2 bases.*
- *The bases are congruent. *the sides are rectangles*
- * the bases are on opposite sides. * all shapes are polygons.*
- * the # of rectangular faces (Not including the bases) is equal to the # of sides on the base.*

pyramid

- *There are 2 different shapes on the net. * there is only 1 base.*
- *the sides are triangles *the base is in the center of the net*
- * the # of triangular faces (not including the base) is equal to the # of sides on the base.*
- * all shapes are polygons.*

7. Use the net -made from the tissue paper-as a pattern for the suit. Trace the decorative paper to create a real suit for the solid. Cut out and fold the net when necessary.
8. Tape the suit together so that it is freestanding.
9. Repeat steps 7 and 8 until all the solids have suits.
10. Now, students find the **Total Surface Area** of the 3 solids, and record results on the provided worksheet A or worksheets (B1,2,&3)
 - * Measure and find the area of each shape in the net. Add up all the areas and that is the total surface area for that solid, making sure the units are squared. Repeat for all 3 solids.*

1. _____

Name: _____

Block: _____

Type of Solid

Shape of surface Dimensions Area of surface X Number of shape = Total SA of
that shape

| Shape of surface that shape | Dimensions | Area of surface | X Number of shape | = Total SA of |
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| <i>Add up the SA of each row to get The total Surface Area of the solid</i> | |
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2. _____

Type of Solid

Shape of surface Dimensions Area of surface X Number of shapes = Total SA of
that shape

| Shape of surface that shape | Dimensions | Area of surface | X Number of shapes | = Total SA of |
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| <i>Add up the SA of each row to get The total Surface Area of the solid</i> | |
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3. _____
Type of Solid

Shape of surface Dimensions Area of surface x Number of shapes = Total SA of
that shape

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| <i>Add up the SA of each row to get The total Surface Area of the solid</i> | |
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Extinsion#1

The Tent Shop

Time : 1 period (45 minutes)

Materials

- Straws
- Pipe cleaners
- Colored tissue paper
- Construction paper
- Scissors
- Ruler
- Tape
- Glue
- Calculator
- Assignment sheet
- Worksheet “The Tent Shop”

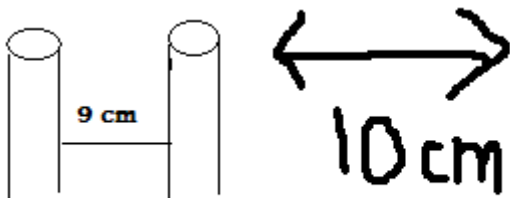
Procedures

Teacher reads the following scenerio to the students:

A company called **The Tent Shop** is expanding. The owner of **The Tent Shop** wants to create unique and artistic tents to sell. She has asked our class to create some models of the tents and to figure out about how much material will be needed to create each tent.

1. Teacher cuts assignment page into individual assignments. Then, hands out the assignment to each group-see attached “assignment” page.
2. One person from each group will get the supplies needed for their group.
3. Each group will assemble their tent.
4. Each student will complete worksheet labeled “The Tent Shop”.
5. *Students may have trouble calculating the surface area of a cylinder. When finding the SA of a cylinder, explain that the length of the rectangle (from the net) is also the circumference of the circular bases. Since that length is not usually given, students need to use the formula $c = \pi * d$ to determine the length of the rectangle.

Teacher’s Notes: The straws that I used were purchased at The Dollar Tree, and are approximately $\frac{1}{2}$ cm in diameter. Before assigning the tents assignment, explain to the students that they must account for that when measuring the tent. See illustration below.



The Tent Shop

Teacher Name: **Cattell**

Student Name _____

| CATEGORY | 4 points | 3 points | 2 points | 1 point |
|---|--|---|--|--|
| Knowledge Gained | All students in group could easily and correctly identify all the nets for cylinders, prisms, and pyramids & correctly explain how to calculate the surface area of any solid without looking at notes/handouts. | All students in the group could easily and correctly identify all the nets for cylinders, prisms, and pyramids & somewhat explain how to calculate the surface area of any solid without looking at notes/handouts. | Most students in the group could easily and correctly identify all the nets for cylinders, prisms, and pyramids & somewhat explain how to calculate the surface area of any solid without looking at notes/handouts. | Several students in the group could NOT easily and correctly identify all the nets for cylinders, prisms, and pyramids & correctly explain how to calculate the surface area of any solid without looking at notes/handouts. |
| Cooperative work | The group worked well together with all members contributing significant amounts of quality work. | The group generally worked well together with all members contributing some quality work. | The group worked fairly well together with all members contributing some work. | The group often did not work well together and the tent did NOT appear to be the work of all members of the group. |
| Attractiveness of tent model | All the bases were blue on the model, and the tent model was both well put together and is appealing to look at. | All the bases were blue on the model, and the tent model was either well put together or was appealing to look at. | No bases were blue on the model, and the tent model was either well put together or was appealing to look at. | No bases were blue on the model, and the tent model was not sturdy or appealing to look at. |
| Measurements of the model tent | All the model's measurements are correct. | All but one of the model's measurements are correct. | Most of the model's measurements are correct. | Several measurements are NOT correct. |
| Accuracy of content on worksheet | All answers on the worksheet entitled "The Tent Shop" are correct. | All but one of the answers on the worksheet entitled "The Tent Shop" are correct. | All but two of the answers on the worksheet entitled "The Tent Shop" are correct. | Several answers on the worksheet entitled "The Tent Shop" are not accurate. |

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<http://rubistar.4teachers.org/index.php?screen=TermsOfUse>

The Tent Shop **“Assignment Pages”**

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|---|---|
| <p>Create a model of a rectangular prism tent from the following measurements: length=8cm,width=6cm, height=7cm .</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a rectangular prism tent from the following measurements: length=10cm, width=14cm,height=6cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |
| <p>Create a model of a rectangular prism tent from the following sketch. length=8cm, width=12cm,height=7cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a rectangular prism tent from the following sketch. length=10cm, width=7cm,height=6cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |
| <p>Create a model of a rectangular prism tent from the following sketch. length=6cm, width=3cm,height=6cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a rectangular prism tent from the following sketch. length=6cm, width=6cm,height=6cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |

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| <p>Create a model of a cylinder shaped tent from the following measurements: Circumference=$d \times \pi$ diameter=12cm, height=10 cm Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 2 pipe cleaners to form the circular bases, a sheet of construction paper, tape, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a cylinder shaped tent from the following measurements: Circumference=$d \times \pi$ diameter=14cm, height=8 cm Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 2 pipe cleaners to form the circular bases, a sheet of construction paper, tape, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |
| <p>Create a model of a cylinder shaped tent from the following measurements: Circumference=$d \times \pi$ diameter=6cm, height= 10cm Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 2 pipe cleaners to form the circular bases, a sheet of construction paper, tape, ruler, scissors, and glue. Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a cylinder shaped tent from the following measurements: Circumference=$d \times \pi$, diameter=7cm, height=8 cm Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 2 pipe cleaners to form the circular bases, a sheet of construction paper, tape, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |
| <p>Create a model of a cylinder shaped tent from the following measurements: Circumference=$d \times \pi$ diameter=8cm, height=7 cm Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 2 pipe cleaners to form the circular bases, a sheet of construction paper, tape, ruler, scissors, and glue. Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a cylinder shaped tent from the following measurements: Circumference=$d \times \pi$ diameter=16cm, height=7 cm Refer to the Rubric.</p> <p>Materials that you will need: 2 small pcs. of blue tissue paper for the 2 bases, 2 pipe cleaners to form the circular bases, a sheet of construction paper, tape, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |

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| <p>Create a model of a square pyramid tent from the following measurements: Area of the square is 100 cm^2, height of the triangle = 12 cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 1 small pc. of blue tissue paper for the base, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a square pyramid tent from the following measurements: Area of the square is 144 cm^2, height of the triangle = 14 cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 1 small pc. of blue tissue paper for the base, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |
| <p>Create a model of a square pyramid tent from the following measurements: Area of the square is 121 cm^2, height of the triangle = 9 cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 1 small pc. of blue tissue paper for the base, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a square pyramid tent from the following measurements: Area of the square is 81 cm^2, height of the triangle = 10 cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 1 small pc. of blue tissue paper for the base, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |
| <p>Create a model of a square pyramid tent from the following measurements: Area of the square is 100 cm^2, height of the triangle = 6 cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 1 small pc. of blue tissue paper for the base, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> | <p>Create a model of a square pyramid tent from the following measurements: Area of the square is 144 cm^2, height of the triangle = 7 cm</p> <p>Refer to the Rubric.</p> <p>Materials that you will need: 1 small pc. of blue tissue paper for the base, 12 straws, tape, a sheet of tissue paper, ruler, scissors, and glue.</p> <p>Once your group finishes the model, complete the worksheet “The Tent Shop”. Staple this paper to that worksheet and turn it in.</p> |

Name: _____

Block: _____

Type of Solid: _____

Draw the net of your solid (include all measurements) in the space below.

The owner of The Tent Shop needs to know how much material is required to make the tent. In order to determine the amount of material needed, you must calculate the surface area of your tent in the space below.

1. Rectangular Prism

Name: _____ Block: _____

Type of Solid

| Shape of surface | Dimensions | Area of surface |
|------------------|------------|-----------------|
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| <i>Add up the area of all the surfaces to get The total Surface Area of the solid</i> | |
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Writing in Math

Explain in complete sentences how to find the surface area of a rectangular prism. _____

2. Square Pyramid

Name: _____ Block: _____

Type of Solid

| Shape of surface | Dimensions | Area of surface |
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| <i>Add up the area of all the surfaces to get The total Surface Area of the solid</i> | |
|--|--|

Writing in Math

Explain in complete sentences how to find the surface area of a rectangular prism. _____

3. Cylinder
Type of Solid

| Shape of surface | Dimensions | Area of surface |
|------------------|------------|-----------------|
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| <i>Add up the SA of each row to get The total Surface Area of the solid</i> | |
|---|--|

Writing in Math

Explain in complete sentences how to find the surface area of a rectangular prism. _____
