DETAILED UNIT LESSON PLAN 2nd DAY

RICTEACHER [redacted] DATE Fall 2008

CLASS/GRADE LEVEL 9th – 10th Grade LESSON TITLE Surface Area: Prisms and Cylinders

RIBTS: 5.5 Use tasks that engage students in exploration, discovery, and hands-on activities

NCTM STANDARD(S): Use geometric ideas to solve problems in, and gain insight into, other disciplines and other areas of interest such as art and architecture.

GLEs/GSEs M(G&M)-10-6 Accurately Solves problems involving perimeter, circumference or area of two-dimensional figures (including composite figures) or surface area or volume of three-dimensional figures (including composite figures) within mathematics or across disciplines or contexts.

OBJECTIVES	• The students will identify and give examples of prisms and cylinders in everyday life • The students will examine the bases and lateral faces of prisms and cylinders • The students will find the surface area of prisms and cylinders.
INSTRUCTIONAL MATERIALS AND RESOURCES	• Manipulatives including (but not limited to) rectangular prism, triangular prism, hexagonal prism, cubic, and cylindrical shaped objects; cm cubes; ink pads; small paint rollers; application worksheets; homework handout • No technological resources will be needed for the lesson.
INSTRUCTIONAL ACTIVITIES AND TASKS KEY Qs: ↓ • What is an essential characteristic of your figure? • Can you describe the most important characteristic which will help place you in a group? • Is there one question which	**A. LAUNCH: (10-15% of lesson)** **Engage students in preliminary thinking related to the lesson.** • As the students enter the class, each student will receive a physical model representing a particular prism or a cylinder. The students will not be told anything about the object, just that they are not to show it to anyone. Students are to keep it hidden from the rest of the class until they receive further directions. • As class starts, each with a manipulative, the class shall receive direction for the launch activity. • Each student, in turn, shall state one characteristic of their space figure (polyhedron). That person will stand in one particular area of the room. • The next person will state one characteristic of their polyhedron. If they think

you could ask another group which will most help you to understand what kind of figures they have?	they have the same object, or something quite similar, they are to stand next to the person, or persons, with similar characteristics for their space figures. If they think their figure is quite unique, they shall start a new group. • After one full round, each of the groups formed will now state 2-3 more characteristics of each of their polyhedrons within their groups. Those who think they have similar polyhedrons shall remain with the group. Those who think they do not shall try to find the group where they belong. Students are to not tell exactly what they have but only describe 1-2 characteristics of their object or ask about 1-2 characteristics of another groups. • Each group will now give 3-4 common characteristics of their space figures and students will be given one last chance to find the appropriate group. • The class will reveal the figures they have and discussion will start. • The students will have a discussion revolving around why they chose the descriptions they did and what each figure has in common. • Ultimately, the students will end up in appropriate groups, each of which is a certain type of prism or cylinder. **B. EXPLORE: (60-70% of lesson)** **Have students explore the problem or activity. Observe, listen closely, & ask questions that promote learning.**
KEY Qs: ↓ • What are the most important characteristics shared among the figures within your common groups? • Can you name a real-world example of the space figure for which you have? • If you were to" unroll" a cylinder, what shape would the lateral area be represented by? • How many different prisms can you make using all 48 cubes? Does the surface area change?	• The class will be led (through discussion) to defining right prisms and right cones by discussing the models they have. Characteristics of each will be identified. The concept of surface area shall be introduced as the amount of area it would take to "wrap" each of the space figures they have in front of them. • The students are to be asked of other examples in the real world which take on the shape of such polyhedrons. • The students will be split into pairs. • One person in the group will be given 48 cm cubes and the other person will receive a small (paint) roller, and an ink pad. • The person with the cubes will be asked to form a rectangular prism using all 48 cm cubes, record a prediction for the surface area of the prism they created, and then find the surface area. The person with the roller will be asked to find a way to estimate the surface area of this cylinder. The students are to do this individually as this activity is in the form of a think-pair-share. • After about five minutes, the students will switch tasks (even if not done yet). • After another five minutes, the students will be allowed to discuss their findings and compare estimates. • If the groups have successfully found ways to properly make estimates, we will begin to discuss as a class; if not, the groups will be led (through the teacher acting as a facilitator of exploration) to consider ways the task can be accomplished. For the prisms, lead students to counting the total of exposed square faces. The cylinder may require much more. Start with how the students may "unroll" the lateral area...perhaps by making use of the ink pad and one rotation of the cylinder. Then, making the relation with the circumference to the width of the rectangle formed by "unrolling". The pairs may then make the connection to cover this rectangle with cm cubes.

	Making use of the circumference formula may help with the bases.
	C. SHARE & SUMMARIZE; CLOSURE: (20-25% of lesson) **Have individuals, pairs, small groups or the whole class share their learning. Use lesson objectives to identify key ideas you want highlighted. Based on those, prepare questions to help students develop or consolidate these new ideas.** • The class will then continue discussing their findings, as a class, leading to formulas for lateral area and base area of the prisms and cylinders. Combining these areas shall lead the students to the surface area formulas for prisms and cylinders being the sum of the lateral area and twice the area of a base. • The discussion will also lead the students to making comparisons and noting differences between the two types of polyhedrons (prisms and cylinders). • The class shall record important formulas and characteristics for prisms and cylinders in their notes. • The class will be able to name and label drawings of such polyhedrons, sketch representative nets, determine whether certain nets can be folded to form certain polyhedrons, express surface area formulas, and solve problems
KEY Qs: ↓ • In general, how might we find the total area on the surface of this figure? • Are there any characteristics you notice which might help us to more systematically find this surface area? • We learned that the lateral area of a prism is the product of the perimeter of the base and the height. How can we use this information to compare it to finding the lateral area of a cylinder? How do they compare and contrast?	

APPLICATION OR EXTENSION	• The students will now be grouped homogeneously. • The students will be given worksheets as an application exercise to the day's lesson. There are three types of worksheets. Each is differentiated for different ability levels within the groups. The worksheets are also designed to give students, within each ability level, strengths from which to contribute to the overlying group project for the unit. • Upon completion, the students shall discuss the results via a jigsaw method within each group so that students can see different approaches to solving surface area problems.
ASSESSMENT ACTIVITIES	**How will you determine what the students know and are able to do during and/or at the end of the lesson (in addition to embedded assessment)?** • The students will be informally assessed as they work in groups. • Class work shall be collected for formal assessment. • Homework will be assigned. The homework assignment is to consider the exercise with the 48 square cubes. The students will be asked to consider rectangular prisms of numerous sizes using all 48 cm cubes. They will conjecture which size prism has the greatest surface area and which has the smallest surface area.
ADAPTATIONS	• The worksheets are differentiated to meet essential, extension, and extra objectives. • Manipulatives are used to help students go from the concrete to the abstract.

Essential Practice Worksheet

Name _____ Date _____

1.   

_____ _____ _____

Use the following word bank to identify the space figures above:

RIGHT RECTANGULAR PRISM	*RIGHT TRIANGULAR PRISM*	*RIGHT CYLINDER*

2. You have been given a small paint roller and an ink pad. Express the lateral area this cylinder in the space below.

What shape expresses the lateral area of the cylinder?

3. a) Unfold the cereal box you have been given to reveal its representative net. You will notice that each of the faces has been colored in red or blue. Identify which color corresponds to the bases and which color corresponds to the lateral faces.

   Blue _____ Red_____

b) You have been given red and blue square tiles. Cover the corresponding colored sides with the matching tiles. Enter your results into the following formula to find the surface area of the cereal box:

SURFACE AREA = BLUE SQUARE TILES + RED SQUARE TILES

SURFACE AREA = ____ SQUARE TILES + ____SQUARE TILES

SURFACE AREA = _____SQUARE TILES

Extension Practice Worksheet

Name_____ Date_____

1.   

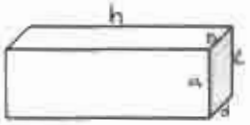
_____ _____ _____

Use the following word bank to identify the space figures above:

RIGHT RECTANGULAR PRISM	*CUBE*	*CONE*	*RIGHT TRIANGULAR PRISM*	*RIGHT CYLINDER*

2. Consider the following cylinder: the base of the cylinder has a circumference of 2 feet and its height is 5 feet. Draw a picture to describe the lateral area of this cylinder and find its area.

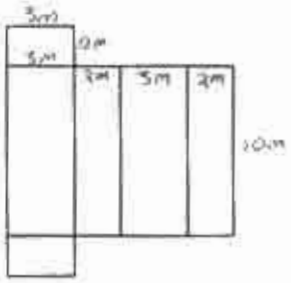
3. Given the following right rectangular prism and right cone:
find the lateral areas, base areas, surface areas.



perimeter = $a + b + c + d$

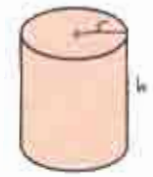
$LA = p \cdot h$ *base area* = $l \cdot w$

LA = **base area** =



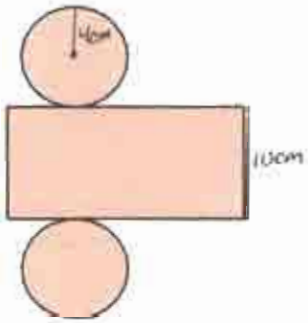
$SA = LA + 2B$

SA =



$LA = 2\pi \cdot r \cdot h$ *base area* = $\pi \cdot r^2$

LA = **base area** =

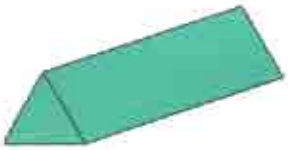


$SA = LA + 2B$

SA =

Extra Practice Worksheet

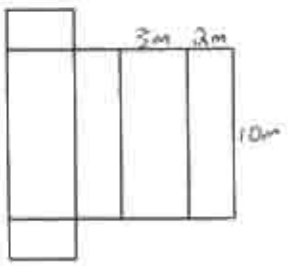
Name_____ Date_____

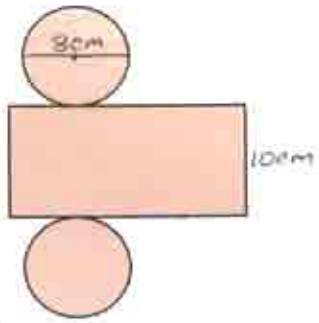
1.   

_____ _____ _____

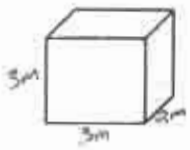
Identify the space figures above.

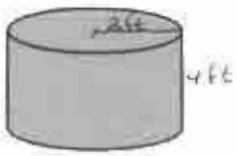
2. Find the lateral area and the base area of the following net representations:





3. For the given space figures below: a)sketch and label the representative net of each figure and b) find the surface area of each.





HOMEWORK

During class, you were working in pairs to construct rectangular shaped prisms using all 48 cm cubes. Try to consider how many different ways which you could do this. Organize your findings in the space provided below.

How might you maximize or minimize the surface area of a prism using all 48 cm cubes?

DETAILED UNIT LESSON PLAN 3rd DAY

RICTEACHER [redacted] DATE Fall 2008

CLASS/GRADE LEVEL 9th – 10th Grade LESSON TITLE Surface Area: Pyramids and Cones

RIBTS: 5.5 Use tasks that engage students in exploration, discovery, and hands-on activities

NCTM STANDARD(S): Use geometric ideas to solve problems in, and gain insight into, other disciplines and other areas of interest such as art and architecture.

GLEs/GSEs M(G&M)-10-6 Accurately Solves problems involving perimeter, circumference or area of two-dimensional figures (including composite figures) or surface area or volume of three-dimensional figures (including composite figures) within mathematics or across disciplines or contexts.

OBJECTIVES	• The students will identify and give examples of pyramids and cones in their daily lives • The students will examine the bases, lateral faces and other essential properties of pyramids and cones • The students will find the surface area of pyramids and cones.
INSTRUCTIONAL MATERIALS AND RESOURCES	• 48 cm cubes for each pair of students, uncooked spaghetti, play-dough, different colored tin foils, cellophane, in-class handouts, homework (performance piece) handout • No technological resources will be needed for the lesson.
INSTRUCTIONAL ACTIVITIES AND TASKS KEY Qs: ↓ • What strategies might you use to ensure that you can account for all rectangular prisms using all 48 cm cubes? • What aspects of the prisms change and what aspects	**A. LAUNCH: (10-15% of lesson)** **Engage students in preliminary thinking related to the lesson.** • The students received a homework assignment the previous night. They were to consider rectangular prisms which could be made from 48 cm cubes. The students were to make conjectures as to the dimensions of such prisms which would produce a maximum and minimum surface area. • As the class begins, the students are to be split into pairs. Each pair will receive a set of the 48 cm cubes. The students are to be directed to constructing as many rectangular prisms as they can; they must use all 48 cm cubes. After each is constructed, each pair is responsible for recording the surface areas of each. • Each pair will record the dimensions of the prism with the greatest and the least

stay the same? • How might the surface area be minimized or maximized?	surface area. If pairs finish before others, they are to discuss the results they have found and compare each others conjectures assigned from homework. • When the groups have finished, the class will discuss the results. • The class will be led to realizing that the more the prism is flattened, the greater the surface area is. In addition, the surface area is minimized as the it becomes more like a cube. **B. EXPLORE: (60-70% of lesson)** **Have students explore the problem or activity. Observe, listen closely, & ask questions that promote learning.**
KEY Qs: ↓ • What characteristics do pyramids share with prisms? • If we are still finding the surface area by taking the sum of the base area and the lateral area, can we use the same formulas as for prisms and cylinders? • What pieces of information do we still need so that we may find the lateral area?	• .The students will remain in pairs. During the previous lesson, the students were *deconstructing* prisms and cylinders to learn about their properties. During this lesson, the students will be *constructing* pyramids and cones in order to examine their properties. • Each pair will receive a piece of fishing wire, tinfoil (silver and gold), a container of play-dough, and a package of uncooked spaghetti. The students will be reminded of the rules for the class which include respecting themselves, others, and their environment. More specifically, the students are to be given strict instructions on the care of handling pointed objects. • The students will be given verbal instructions, step-by-step through modeling, on how to construct a square pyramid from the materials. The students will begin by constructing a square with the materials by using the spaghetti as the edges and the play-dough as the vertices. Then, by positioning a piece of play-dough, as the vertex, above the center of the square, the students will connect a piece of the spaghetti to each of the four corners of the square. • The students will be informed that they have constructed a regular square pyramid. Using the models which they have constructed, the class will be led in a discussion. The discussion will include, but not be limited to, defining such properties as base, lateral face, lateral edge, base edge, and vertex. • The students will then begin to discuss how this polyhedron compares and contrasts to the prisms and cylinders discussed during the previous lesson. Eventually, the students will discuss, in general terms, how they might find the surface area (the sum of the areas of all of the lateral faces and the base) and how it compares to the surface area of the prisms and cylinders. • At this point, the class should consider what other information they need. The class needs to conclude that they are finding the area of a square base and the area of four congruent triangles. The class will then perform two more tasks. The first of which is to "hang" a piece of play-dough from the vertex to the base. The second of which will be creating a representative net for the regular square pyramid with the materials. Once completed, the students are to discuss (in pairs) what is formed by the "hanging play-dough" and how it can relate to each of the triangles in the nets which they have formed. **C. SHARE & SUMMARIZE; CLOSURE: (20-25% of lesson)** **Have individuals, pairs, small groups or the whole class share their learning. Use lesson objectives to identify key ideas you want highlighted. Based on those, prepare questions to help students develop or consolidate these new**

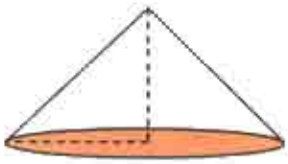
KEY Qs: ↓ •What pieces of information would be helpful for us to be able to find the slant height? •Why would the altitude of a pyramid be helpful? •What type of triangles can be formed to help?	**ideas.** • Through discussion as a class the students will be led to determining that they have created an altitude and a means to find the slant height of the pyramid. The student will then be led to derive the formula for the surface area of a regular pyramid by defining the terms for finding lateral area and the area of the base. The students will use the different color tinfoil to cover the base edges, the lateral edges, the altitude and the slant height. In addition, the students will "wrap" the entire figure with cellophane to represent the surface area. • The students will discuss other types of regular pyramids and how they might generalize the formulas. The results will be that the name of the pyramid is dependent on the shape of the base, the lateral area is one half the product of the perimeter of the base and the slant height, and that the surface area is the sum of the lateral area and the base area. • The students will next consider the same problem but with a circular base. The class shall discuss how this process is similar to a pyramid and how it is different. The discussion will lead to the properties and formulas (base area, lateral area, and surface area) for a right cone. (Lateral area is found by $\pi r\ell$, the base is always the area of the circle, and the surface area is the sum of the lateral area and the base area.
APPLICATION OR EXTENSION	• The class will be given a worksheet to apply the skills acquired. The worksheet is differentiated into essential, extension, and extra objectives. The students will work on these within homogeneous ability groups. • Homework will also be assigned in the form of a performance piece (see assessment activities).
ASSESSMENT ACTIVITIES	**How will you determine what the students know and are able to do during and/or at the end of the lesson (in addition to embedded assessment)?** • The students will be formatively assessed informally through class discussion and their work in pairs. Actively spending small amounts of time with each pair will help with the formative assessment. • The students will also be peer evaluated as they complete the in-class

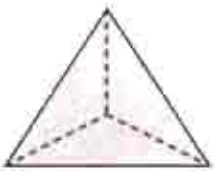
	worksheets. I will be walking around to help and assess, as well. The students' work will not be collected so that they can use it as reference for homework. • The students will be formally assessed through a homework assignment. The assignment will be a performance piece which requires the students to combine their newly acquired knowledge surrounding surface area (of prisms, cylinders, pyramids, and cones) and also using measurement and approximation in order to solve the problems.
ADAPTATIONS	• The students are split into homogeneous ability groupings to work on the in-class application. This is to serve two purposes for differentiating instruction. One, it helps to serve as built-in peer evaluation; students of similar ability are able to help and check the work of peers working at a similar ability level. Two, each worksheet focuses on varying tasks and strategies; the activity is designed to provide skills to be used for the overlying group project for the unit. In this way, each student will be armed with different strategies to contribute to their respective groups, encouraging participation of all students.

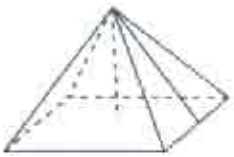
Essential Practice Worksheet

Name_____ Date_____

1. Use the word bank to name the following space figures:







_____ _____ _____

REGULAR SQUARE PYRAMID	RIGHT CONE	REGULAR TRIANGULAR PYRAMID

2. You have been given a square pyramid with red and blue colored faces. Identify which color represents the base and which color represents the lateral faces.

   BLUE _____

   RED _____

3. If the color blue covers 30 square units and the color red covers 14 square units, find the surface area of the regular square pyramid using the formula below:

   SURFACE AREA = LATERAL AREA + BASE AREA

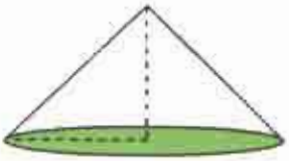
   SURFACE AREA = _____SQUARE UNITS + _____SQUARE UNITS

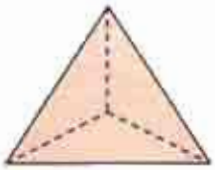
   SURFACE AREA = _____SQUARE UNITS

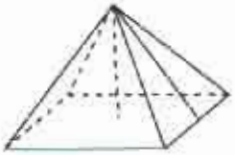
Extension Practice Worksheet

Name_____ Date_____

1. Use the word bank to name the following space figures:



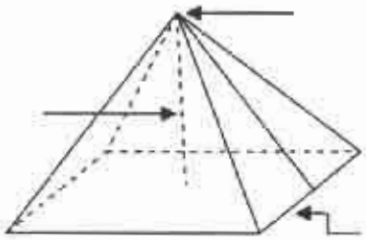


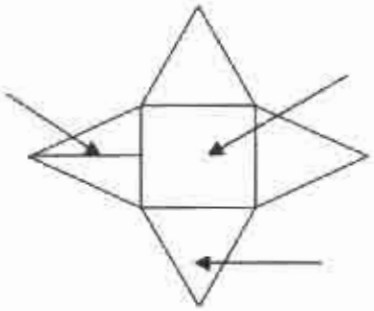


_____ _____ _____

REGULAR SQUARE PYRAMID	RIGHT CONE	TRIANGULAR PRISM
OBLIQUE CYLINDER	REGULAR TRIANGULAR PYRAMID	

2. Use the word bank to label the identified parts of the space figure and net:

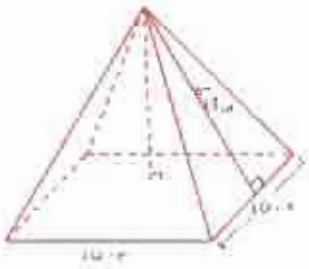




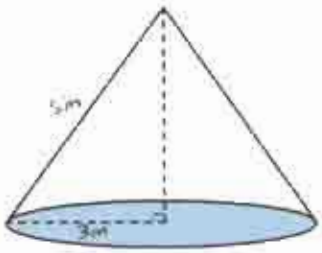
BASE	BASE EDGE	LATERAL FACE	SLANT HEIGHT	ALTITUDE	VERTEX

3. Find the lateral area and the surface area of the following polyhedrons:

$$LA = \frac{1}{2}p \cdot \ell \;;\; SA = LA + B$$



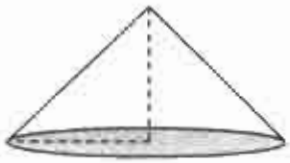
$$LA = \pi \cdot r \cdot \ell \;;\; SA = LA + B$$

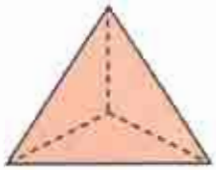


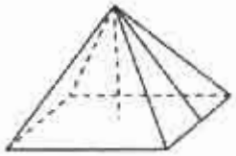
Extra Practice Worksheet

Name_____ Date_____

1. Name the following space figures:

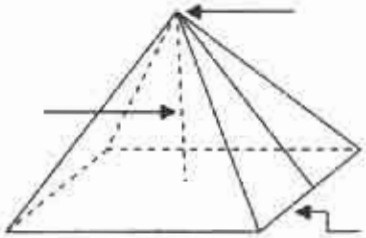


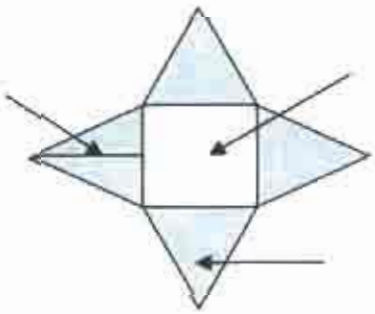




_____ _____ _____

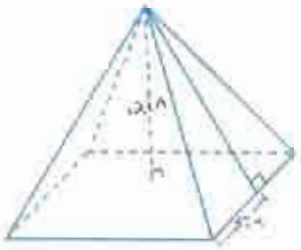
2. Label the identified parts of the space figure and net:



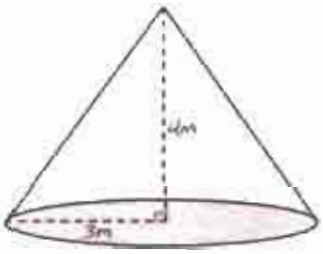


3. Find the *lateral area* and the *surface area* of the following polyhedrons:

$$LA = \frac{1}{2}p \cdot \ell \; ; \; SA = LA + B$$



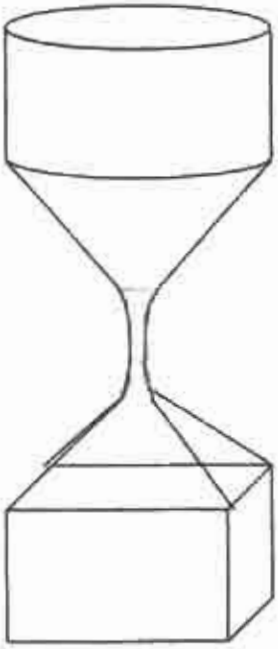
$$LA = \pi \cdot r \cdot \ell \; ; \; SA = LA + B$$



HOURGLASS

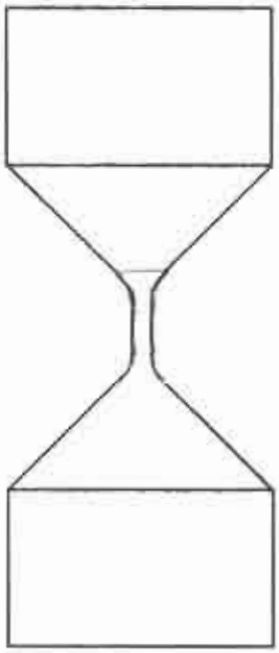
Use the polyhedrons we have been covering in class to model as closely as you can the surface area of the very interestingly shaped hourglass below.

The three pictures at the bottom show side, top, and bottom views of the hourglass. Each picture is accurate and drawn to full scale. The top picture is given so that you may gain a clear picture of the figures comprising the hourglass.

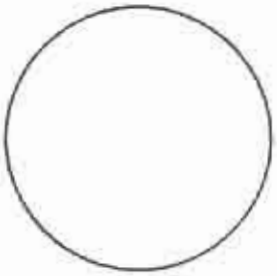


PERSPECTIVE VIEW

SIDE VIEW



TOP VIEW



BOTTOM VIEW