SPAGHETTI MEASURE

Performance Standard (6C/7A/7B/7C).I

Use circles and diameters of given dimensions to determine a new circle with an area that is the sum of two other areas:

- *Mathematical knowledge*: know the relationships of radii, diameters, and area; know how to calculate the area of common circles or combinations of circles,
- *Strategic knowledge*: use appropriate measurement strategies for problem situations, and
- *Explanation*: explain completely and clearly what was done and why it was done.

Procedures

1. Provide students with sufficient learning opportunities to develop the following skills in order to (6C) compute and estimate using mental mathematics, paper-and-pencil methods, calculators and computers, (7A) measure and compare quantities using appropriate units, instruments and methods, (7B) estimate measurements and determine acceptable levels of accuracy, and (7C) select and use appropriate technology, instruments and formulas to solve problems, interpret results and communicate findings:
   - Determine an appropriate number of digits to represent an outcome,
   - Develop fluency in operations with real numbers and matrices using mental computation or paper-and-pencil calculations for simple cases and technology for more-complicated cases,
   - Calculate by an appropriate method the length, width, height, perimeter, area, volume, surface area, angle measures or sums of angle measures of common geometric figures, or combinations of geometric figures,
   - Choose units and scales that are appropriate for problem situations involving measurement,
   - Determine answers to an appropriate degree of accuracy using significant digits,
   - Solve problems involving scale drawings, models, maps or blueprints, and
   - Explain the meaning of a measurement answer in context.
   - Note: students must know the relationships of radii, diameters, and area and how to apply them.
2. Provide each student a copy of the "Spaghetti Measure" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it. The task should be completed in a classroom setting.
3. Have student complete the following problem:

   The Spaghetti Measure allows you to measure the amount of spaghetti needed for the desired number of people by filling the hole with uncooked spaghetti, then removing the dry pasta and placing it in the pot to cook. Chelsea wants to make her own spaghetti measure for 5 portions. What diameter should that hole measure? Write in words what you did and why you did each step to answer the question.

4. Evaluate each student's work using all three dimensions of the rubric and its guide to determine the performance level. A score of 4 in mathematical knowledge would require an answer for a diameter of 4.9 cm. There are a variety of appropriate strategies that could lead to a correct answer: Adding the areas of the circles for 1 and 4 portions, then calculating an appropriate radius for that area, adding the areas of circles for 2 and 3 portions and then calculating an appropriate radius for that area, or adding two the areas of the circles for 2 portions to the area of the circle for 1 portion and then calculating the appropriate radius for that area should give a diameter of 4.9 cm. Any strategy that would lead to a correct answer is an appropriate strategy. A complete explanation would require a detailed description of the step taken and the reason for each step. A 2 should be given for strategy if the student uses patterns instead of area.

Examples of Student Work follow

Resources

- Copies of the "Spaghetti Measure" task sheet
- Calculator
- Mathematics Rubric

Time Requirements

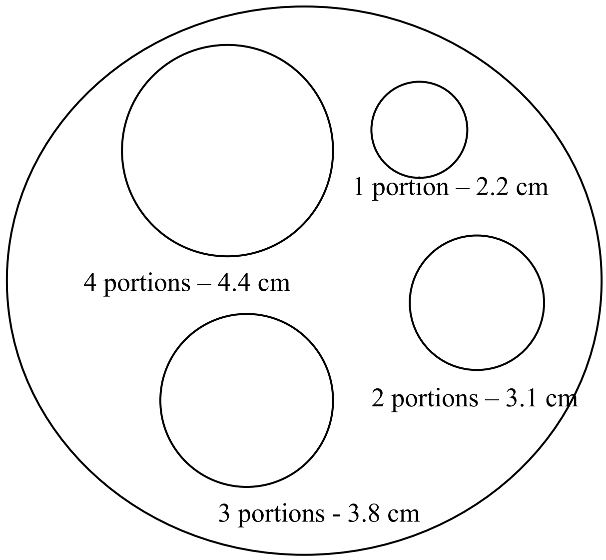
- 30 minutes

NAME ______________________________________ DATE _________________________

SPAGHETTI MEASURE

Student Task Sheet

The Spaghetti Measure allows you to measure the amount of spaghetti needed for the desired number of people by filling the hole with uncooked spaghetti, then removing the dry pasta and placing it in the pot to cook. One is shown below with portion sizes and diameter.



Chelsea wants to make her own spaghetti measure for 5 portions. Use mathematics to find what diameter the hole should measure. Write in words what you did and why you did each step to answer the question.

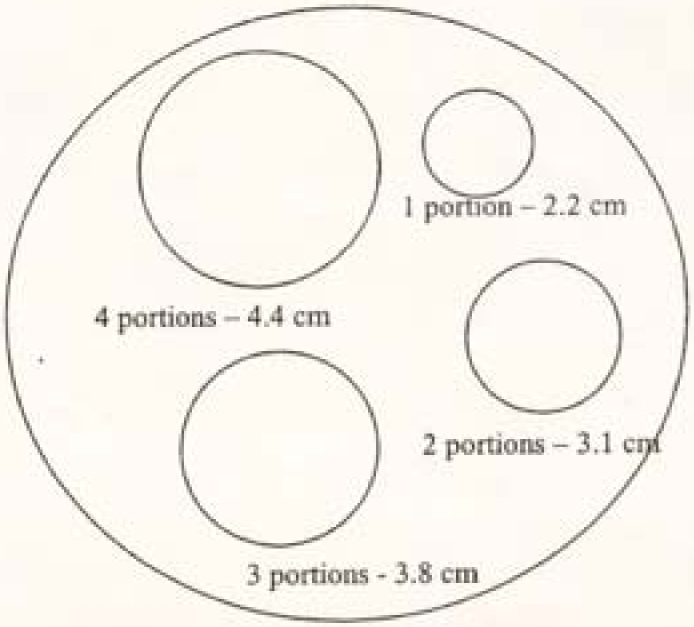
Adapted from the New Standards Released items, “Spaghetti Measure”, March 25, 1997.

"Meets"

SPAGHETTI MEASURE

Student Task Sheet

The Spaghetti Measure allows you to measure the amount of spaghetti needed for the desired number of people by filling the hole with uncooked spaghetti, then removing the dry pasta and placing it in the pot to cook. One is shown below with portion sizes and diameter.



Chelsea wants to make her own spaghetti measure for 5 portions. Use mathematics to find what diameter the hole should measure. Write in words what you did and why you did each step to answer the question.

First I found the area of each proportion.

1portion - $\pi\left(\frac{2.2}{2}\right)^2 = 3.80cm^2/1 = 3.8cm^2$ I then divided the multiple portions a cording to their servings.

2 portions - $\pi\left(\frac{3.1}{2}\right)^2 = 7.55cm^2/2 = 3.8cm^2$

3 portions - $\pi\left(\frac{3.8}{2}\right)^2 = 11.34\ cm^2/3 = 3.8cm^2$

4 portions - $\pi\left(\frac{4.4}{2}\right)^2 = 15.21\ cm^2/4 = 3.8cm^2$

I found that the average serving for 1 is $3.8cm^2$. I multiplied it by 5, and worked backwards to find its diameter.

$3.8 \times 5 = \frac{19cm^2}{\pi} = \sqrt{6.05} = 2.46cm$ = radius

Diameter for 5 portions = 4.92cm

Adapted from the New Standards Released items, "Spaghetti Measure", March 25, 1997.

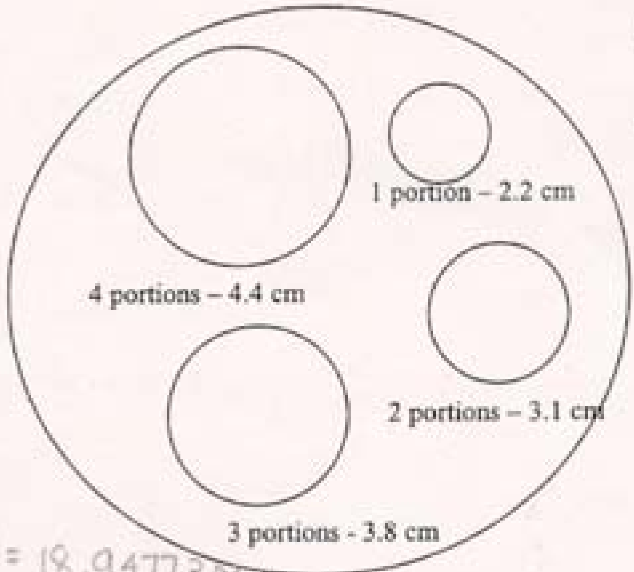
"Exceeds"

SPAGHETTI MEASURE

Student Task Sheet

The Spaghetti Measure allows you to measure the amount of spaghetti needed for the desired number of people by filling the hole with uncooked spaghetti, then removing the dry pasta and placing it in the pot to cook. One is shown below with portion sizes and diameter.

4 portions
$(2.2)^2(\pi) = 15.20530844$
3 portions
$(1.9)^2(\pi) = 11.34114948$
2 portions
$(1.55)^2(\pi) = 7.54767635$
1 portion
$(1.1)^2(\pi) = 3.801327111$
$15.20530844 + 3.801327111 =$
19.00663555
$11.34114948 + 7.54767635 =$
18.88882583
$\frac{19.00663555 + 18.88882583}{2} = 18.94773069$



$\frac{18.94773069}{\pi}$
$\sqrt{6.031249999}$
2.455860338×2
4.911720676

Chelsea wants to make her own spaghetti measure for 5 portions. Use mathematics to find what diameter the hole should measure. Write in words what you did and why you did each step to answer the question.

I found the area of each portion by dividing the diameter by 2, squaring the result, and multiplying by π or 3.14159264... I took the area of the 4 portion meal and added the area of the 1portion meal. Then I took the area of the 3 portion meal and added it to the area of the 2 portion meal. I averaged the 1st 5 portion meal area with the 2nd 5 portion meal. The area of the 5 portion meal should be 18.94773069. To find the diameter, I took the area of the 5 portion meal and divided it by π. Then I took the square root of the answer to find the radius. By multiplying the answer by 2, you can figure out the diameter of the 5 portion meal. The diameter is 4.911720676

4.9

Adapted from the New Standards Released items, "Spaghetti Measure", March 25, 1997.