New York Institute of Technology
The Graduate School of Education and Psychology
EDMA- 625 Mathematics, Science and Technology in Education 1
Daniel Stein, Adjunct Professor - **http://nyitweb.webhop.org**
♦ NYC Dept of Mathematics ♦ Everyday Math ♦ Impact Math ♦ Dept. of Science ♦ Science Standards ♦

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My Mathematics Lesson Plan

Lesson Topic: **Pi and Circle Circumference**

Lesson Overview: This plan is designed for a single period, 6th (5th – 7[th)] grade math class of approximately 45 minutes duration. Students will measure parts of a circle, examine their results and calculate the relationship between the diameter and circumference, discovering that they are the same for every circle. They will learn that this relationship is called Pi and the symbol is Π.

Mathematics Standards:
6.G.6. Shapes: Understand the relationship between the diameter and radius of a circle.
6.G.9. Shapes: Understand the relationship between the circumference and the diameter of a circle.

Mathematics Strand(s): Geometry – Shapes, Geometric Relationships; Number Sense & Operations – Operations; Measurement – Tools and Methods;

Mathematics Process Strand(s): Problem Solving, Representation, Reasoning (and Proof), and Communication and Connections

Aim: Understand how the concept of Pi originated;
Objectives:
- Students will be able to define basic terms: Circle, circumference, diameter, and radius.
- Students will be able to identify and measure the radius, diameter and circumference of a circle.
- Students will be able to discover the approximate value of pi through the relationship between the diameter and circumference.

Materials: Assortment of circular objects labeled A – Z (assorted pot lids, plastic lids, vinyl records, jar tops, wheels, plastic cups, unbreakable dishes, etc.) string and/or drywall tape, rulers, tape measures, calculators, scissors, printed student worksheets, LCD projector connected to computer with Internet access. Digital worksheet to project, or chart paper for duplicating table.

Motivation: United Streaming video (previously downloaded); *Circles Clip 3: Defining Circumference, Radius and Diameter*
http://www.unitedstreaming.com/search/assetDetail.cfm?guidAssetID=9A89F8FB-41F5-4490-A833-4DF6C9DB6595 . The video asks, "What is the relation between circumference and diameter?"

Links with prior knowledge: Area and perimeter of polygons; Similarity principle; Basic knowledge of circle as a geometric shape of 360[o]

Lesson outline:
- Using LCD projector, play Circle video Clip 3 for class to watch. Stop video after scenes showing students measuring circular objects at 1min 58 sec. Direct students to pay attention to any words new to them and to the opening question. (min 0-3)

- Distribute handouts while asking students, "What do you think we're going to do in class today?" Explain the task (measure parts of circle). Elicit definitions of circumference (akin to the perimeter of polygons), diameter and radius. (min 4-6)
- Students work in small groups (4-5 groups of 3-4 students). One student from each group picks up pre-assembled group of materials including 4 circular objects, length of string, measuring sticks/rulers, scissors and calculator. Direct students to copy "Relationship of Circumference to Diameter" into blank table heading.(min 7-10)
- As seen in the video, students complete the task of measuring the items using the tools provided. Each student completes items 1, 2 and 7 of their own worksheet. Students take turns recording and measuring 4 or more different circles. Teacher circulates and assists as needed. (min 11-21)
- Teacher projects worksheet and each group supplies data for one circle. (Either teacher or students can enter the data, and this could be done as the measuring progresses)
- Instruct students to keep working on determining the relationship of the circumference to the diameter. Divide the circumference by the diameter of each circle. Students should be able to calculate that the circumference is at least 3x the diameter. (min 22-32)
- Ask students what they found out and discuss the results, while teacher enters number on projected worksheet. (min 33-38)
- Resume video and play from min 1.58 to min 3.28. (min 39-40) Write Pi and the symbol for Pi on the board
- Review: Ask students to summarize the meaning of Pi and write out that meaning in the vocabulary table of their worksheets. (min 41-43)
- Final summary (time permitting): Play Circle Song video from YouTube, online at http://www.youtube.com/watch?v=eiHWHT_8WrE&NR (min 44-45)
- Collect worksheets as students leave.

Essential Questions:
- How can we use the string (or duct tape) to measure the circumference?
- How is it that the relationship is the same for every circle? Does that happen with other shapes (similarity principle)?
- How accurate are measurements?
- If they were more accurate we do you think that our result (dividing circumference by diameter) would all be the same?

Teacher notes:
Don't use foam or paper for plates and cups. Either string or drywall tape can be used to measure circumferences.

Next day:
- Start with Circle Song
- Students will be able to calculate the circumference of a circle using the correct formula.
- Play balance of video,
- Compare calculations of Pi,
- Discuss properties of the number (irrational);
- Return worksheets and construct formula to complete worksheet items 3 - 6.
- Create and solve several additional questions to reinforce using formula.
- Play video clip 4 if time