MATH 217. GEOMETRY AND MEASUREMENT FOR PK-8 TEACHERS. (3 hours)

Math 217 by Pat Jones ISBN-10: 1-935435-07-8

Course Description:

This course features applications of measurement and geometry with a focus on understanding and explaining mathematical concepts. Systems of measurement, plane figures, properties of polygons, three dimensional figures, area and perimeter, volume and surface area, geometric patterns, estimation, problem solving, and number concepts are integrated and presented within real world situations.

This content in this course aligns with that of K-8 schools, giving prospective teachers the knowledge of mathematics that they will need to effectively teach the CCSS content. Also, an emphasis is placed on the Standards for Mathematical Practice as described in the CCSS, allowing prospective teachers to experience what their future K-8 students will experience. Prospective teachers enrolled in this course are expected to:

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriately tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

Entrance Requirements:

Completion of MATH 117 with a grade of C or better. Restriction: Education majors only.

Course Outcomes:

Students will learn

- how important concepts can be developed in a smooth progression, giving special attention to significant mathematics and cognitive transitions;
- how the Big Ideas are rooted and interconnected in real-world contexts, and how they can be modeled using familiar objects and situations;
- how number sense, spatial sense, intuition, and problem-solving permeate everything;
- that reasoning and ordinary language are essential components of concept development.

Instructional Methods:

Visual aids such as charts and drawings are presented to help the students grasp the mathematical concepts. A wide variety of techniques, approaches, and appropriate tools will be used as students are encouraged to solve problems in different ways. Emphasis is placed on the students' ability to express

"in writing" how they solve various types of problems and how they know that the answer is correct. Manipulatives will be used to model mathematical topics and create geometric figures.

<u>Calculator</u>: Students are allowed to use calculators when it is appropriate. Students are also expected to use the methods developed in Math 117 to do some calculations mentally and well as incorporating these methods in pencil and paper work.

Evaluation: The grading scale is the normal ten point grading scale. Grades will be calculated by (number of points earned)/ (total possible points).

90%- 100% A 80% - 89% B 70% - 79% C 60% - 69% D Below F

3 one hour exams (100 points each). Homework, pop-quizzes, and projects (maximum of 100 points) Comprehensive final exam (200 points)

Lesson	Topics	Assignments, Activities, Problems
1	What is measurement? Length: inches, half-inches, quarter-inches	Page 3: Activity 1 Homework Set 1: # 4,6,7,10
2	Weight: pounds, ounces Liquid Capacity: cup, pint, quart, gallon	Page 3: Activity 2 Page 4: Activity 3 Homework Set 1: #1-3, 5, 8,9-11
3	Familiar Units: yards, degrees Fahrenheit, feet, tablespoons, liters, etc Perimeter	Page 8: Activity 4 Page 9: Activity 5 Homework Set 2: #13,14,17, 20
4	Familiar Units continued	Page 9: Activity 6 Page 10: Activity 7 Homework Set 2: #15, 16, 18,19
5	Familiar Units continued	Page 11: Activity 8 Page 12: Activity 9 Homework Set 2: # 21,22,23
6	Familiar Units continued	Page 13: In-Class Problems 1-5

7	More Units: Mile, fluid ounce	Page 17: Activity 10 Page 18: Activity 11 Homework Set 3: #24-26
8	Metric Units: centimeter, meter	Page 18: Activity 12 Page 19: Activity 13 Homework Set 3: # 27-32
9	Metric Units: millimeter, kilometer	Page 20: Activity 14 Page 20: Activity 15 Homework Set 3: #32-37
10	More Metric Units: gram and kilogram	Page 26: Activity 16 Page 26: Activity 17 Homework Set 4: #38-42
11	More Metric Units: milliliters, milligrams	Page 27: Activity 18 Homework Set 4: #43-49
12	More Metric Units: Celsius	Homework Set 4: # 50-52
13	Unit 1 Test	
14	Segments, lines, rays	Page 37: Activity 19 Homework Set 5: #53,54,58, 59
15	Circles	Page 38: Activity 20 Page 39: Activity 21 In-Class Problems #1-3 Homework Set 5: #55,56,57,60-65
16	Angles	Page 47: Activity 22 Page 50: Activity 23 Page 51: Activity 24 Homework Set 6: #66-72
17	Shortest Distance from a Point to a Line Parallels	Page 54: Activity 25 Page 56: Activity 26 Page 57: Activity 27 Homework Set 6: #72-77
18	Polygons	Page 63: Activity 28 Homework Set 7: #78-81
20	Area	Page 67: Activity 34 Page 67: In-Class Problem Page 68: Activity 35 Homework Set 7: #80-82

21	Area continued	Page 71: Activity 36 Page 72: Activity 37
		Page 74: Activity 38
		Homework Set 7: 83-85
		Page 75: Activity 39
22	Area continued	Page 76: Activity 40
		Homework Set 7: #86-92
		Page 86: Activity 41
23	Regular polygons	Page 87: Activity 42,43
		Page 88: Activity 44
		Homework Set 8: #93-95,97,100
24		Page 90: Activity 46
24	Angle Sum Theory	Homework Set 8: #96,98,9,101-
		106
25	Lipit 2 Tost	
25		
26	Area of Circles	Homework Set 9: #107-112,114
		2 22 4 11 12
27	Area of Sectors	Page 98: Activity 47
		Page 98: In-Class Problems 1-3
		Homework Set 9: #113, 115-123
28	Right Triangles, Pythagorean Thm	Page 104: In-Class Problems 1-3
		Page 105: Activity 48
		Homework Set 10:#124-127
29	Cubes	Page 110: Activity 49
		Page 113: Activity 50
		Page 114: Activity 51
		Homework Set 10: #128,141-144
30	Volume of rectangular box	Page 114: Activity 52
		Page 116: In class problem
		Homework Set 10:
		#129,130,132,133,136
31	Similarity	Homework Set 10: #
		131,134,135,137,138,139,140,145
32	Prisms, Pyramids	Page 125: Activity 53
		Homework Set 11: #146, 149, 150
33	Cylinders, Cones	Page 126: Activity 54
		Homework Set 11: # 147,148, 151
34	Prisms, Pyramids, Cylinders, Cones	Homework Set 11: # 152-156

35	More Problems	Homework Set 11: #156-162
36	More Problems	Homework Set 11: #162-166
37	More Problems	Homework Set 11: #166-173
38	Unit 3 Test	

Sample Class Activities

Activity

A. Use the paper provided by your teacher to cut out a strip of paper which is 1 foot long and about 1 inch wide. (Each person in the group should cut out a strip.)

B. Work with other groups to measure the length of the classroom by lining up the strips, end-to-end, from one wall to the opposite wall. Fill in the whole number that best describes the length of the room: ______feet.

C. Estimate how many feet long each of these things is: a baseball bat your math book a bed the width of the classroom (the side you didn't measure in part b.)

D. Work with other groups to measure the width of the classroom by lining up the 1-foot paper strips end-to-end, as in part B.

Activity

Work in pairs for this activity. A. Cut 3 strips of heavy paper that are each 20 centimeters long.

B. Figure out how to cut them in order to get segments that are 4 centimeters, 5 centimeters, 6 centimeters, 7 centimeters, 8 centimeters, 9 centimeters, 10 centimeters, and 11 centimeters long.

C. Once the strips are cut into these segments, select a set of segments (any number of them) and construct a figure by joining the segments as demonstrated.

D. Select 4 segments, and join them as demonstrated earlier. Can the segments be joined in this way no matter which 4 were chosen? Did anyone make a rectangle? Could anyone have made a rectangle?

E. Select a set of 3 segments, and connect them to form a triangle. The figures we have been building are called polygons. These are the important things to remember about polygons:

i. They are made entirely of segments.

ii. They lie on a flat surface.

iii. Every segment is joined to exactly two other segments—one at each of its endpoints.

Sample In-Class Problems

In-Class Problem:

Use a centimeter ruler, as needed, to answer questions about the figure shown below.



- a. What is the length of the hypotenuse of triangle QHC?
- b. What is the area of quadrilateral PCHQ?

c. The perimeter of triangle QHC is what percent of the perimeter of triangle PCQ?

In-Class Problem:

a. Mark a point near the middle of a plain sheet of paper. Name it point C.

b. Construct a circle which has point C as its center, and a radius of 3 centimeters.

c. Now construct another circle, which also has center C, and which has a radius of 4 centimeters.

d. What is the approximate difference between the circumferences of the two circles?

i. 2 centimeters ii. 4 centimeters iii. 6 centimeters iv. 8 centimeters v. 10 centimeters

Sample Homework Problems

Homework Problem

A can of frozen orange juice concentrate contains 12 fluid ounces of concentrate. Directions on the label of the can say to mix the contents of the can with $2\frac{1}{2}$ cups of water to make orange juice.

a. For orange juice made from these directions, what is the ratio (by capacity) of water to concentrate?

b. How many cans of concentrate will be needed to make a quart of orange juice?

c. Mrs. Dartez bought three 6-packs of cans of concentrate to make orange juice for the Parents' Club breakfast.

How much water must she use?

How many gallons of orange juice will she get?



The aquarium holds 20 gallons of water when it's full. b. How many cubic centimeters of gasoline will fill a 5-gallon can?

Homework Problem

A children's carnival ride has 8 little cars connected to a center wheel by steel "arms". As the wheel turns, the cars move around in a circle. The "arms" are 8 feet long. During one ride the cars make 10 laps around the circle. About how far does a car travel during one ride?



a. 80 feet b. 160 feet c. 250 feet d. 500 feet e. 800 feet

Explain how you got your answer.