

MATH 7413 – Geometry for Inservice Teachers

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Purpose: *PSC Standards – 2 ii, iv, v, vii, viii, 3, 4, 5, 6, 7, 8 v, viii, 9, 10, 11, 12, and 13*

This course focuses on preparing P-5 mathematics specialist candidates to:

- a) Broaden understanding of fundamental concepts of geometry with particular attention given to specific methods and materials of instruction.
- b) Solve measurement and geometry problems using multiple strategies, manipulatives, and technological tools.
- c) Construct and justify arguments as well as interpret solutions; and determine reasonableness of answers and efficiency of methods.
- d) Nurture collaboration, critical thinking, hands-on exploration, manipulative use, problem-based inquiry, technology utilization, and activity implementation addressing various learning styles.
- e) Select and use a variety of formative and summative assessment techniques to monitor student progress, gauge students' mathematical understanding, and interpret school-based progress.

The principle geometry topics to be taught in this course are: introductory geometry, constructions, congruence, and similarity, concepts of measurement, motion geometry, and tessellations.

Learning Outcomes: *PSC Standards – 2 ii, iv, v, vii, viii, x, xi, 5, 7, 8 iv, v, vii, and 14*

All students course will learn to:

- 1) Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- 2) Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
- 3) Apply transformations and use symmetry to analyze mathematical situations.
- 4) Use visualization, spatial reasoning, and geometric modeling to solve problems.
- 5) Understand measurable attributes of objects and the units, systems, and processes of measurement.
- 6) Apply appropriate techniques, tools, and formulas to determine measurements.
- 7) Demonstrate a deep understanding of how P-5 students learn mathematics and of the pedagogical content knowledge appropriate to P-5 mathematics teaching.

Course Objectives: *PSC Standards – 2 ii, iv, v, vii, viii, x, xi, 5, 7, 8 iv, v, vii, and 14*

All students will be able to demonstrate:

- 1) an understanding of standard vocabulary and symbols of elementary mathematics.
- 2) an ability identify, describe, visualize, classify and compare one, two, and three-dimensional shapes.
- 3) a confidence, desire, and ability to use estimation to facilitate solving geometric and measurement problems.
- 4) an ability to use geometry in real-world problem solving.
- 5) a well-developed spatial sense including both two- and three-dimensional figures (tessellations, symmetry, congruence, similarity, polygons and other curves, polyhedra).

- 6) an understanding of geometry and measurement from a historical perspective.
- 7) an ability to apply the process of measurement to one-, two-, and three-dimensional objects using nonstandard and customary geometric units.
- 8) an ability to solve measurement problems involving perimeter, circumference, area, volume, temperature, and mass.
- 9) an understanding of coordinate, and transformational geometry with an emphasis on problem solving.
- 10) an understanding of the uses of a variety of manipulatives, technology, and other materials for the P-5 level.
- 11) an understanding of the vision of mathematics education as put forth in NCTM's Principles and Standards (2000).
- 12) an understanding of the scope and sequence of elementary school mathematics programs.
- 13) a knowledge of current professional literature in the field of mathematics education.

Pedagogy and Professional Development Objectives:

- 1) Select and use appropriate concrete materials and technological tools for learning mathematics.
- 2) Select, use, and determine the suitability of the wide variety of available mathematics curricula and teaching materials.
- 3) Recognize the role of national, state, and local level mathematics standards and legislation in developing local curriculum and planning instruction that addresses the needs of diverse student populations.
- 4) Demonstrate knowledge of different types of mathematical instructional strategies.
- 5) Use multiple strategies to assess students' mathematical knowledge.
- 6) Identify professional mathematics organizations and describe their contributions to the teaching of mathematics and the professional development of teachers.

Technology: *PSC Standard – 5*

The Geometer's Sketchpad; Calculators: TI-73 Explorer, TI-83 Plus SE, Voyage 700

Manipulative Materials: *PSC Standard – 8 iv, v, and vii*

Compasses, pentominoes, geoboards, rulers, protractors, polydrons, patty papers, metric and standard weight systems, polyhedras, miras, thermometers, tangrams, pattern blocks, cubic centimeters and cubic inches, scales.

Instructional Materials: *PSC Standard – 9*

Beckman, S. (2008). *Mathematics for Elementary Teachers, 2nd edition*. Boston: Pearson Addison Wesley.

Instructional Methods: *PSC Standards – 10, 11, 12, and 13*

Teaching methods for this course will include small and large group projects, individual, small group and whole class problem solving, student presentations, teacher led discussion, and some lecture.

Evaluation Methods: *PSC Standards – 2 ix, x, xi, 3, 4, 5, 6 i, ii, iii, 7, 8 iv, v, vii, 9, 10, 11, 12, and 13*

Student performance will be evaluated through the use of projects, in-class presentations, tests, reflective logs, computer work, instructional unit, peer and self-assessment, and content and pedagogical proficiency demonstrations.

Assignments: All assignments are individual assignments and must be in a typed, double-spaced format with Times/Times New Roman font, size 12, and 1-inch margins unless otherwise indicated. **Assignments are due at the BEGINNING OF CLASS on the designated date.** Failure to meet deadlines and/or follow directions will result in a grade reduction of at least 10% per assignment. Technical/computer problems are not an acceptable excuse for a late assignment. Rubrics are provided for each assignment and must be turned in with the corresponding assignment. Assignments submitted without the rubric will counted as late submissions. If you are absent, it is your responsibility to get any missed work and turn in any assignments that are due. **An absence DOES NOT change an assignment's due date.** *Remember: Assignments are not negotiable, however, due dates are.* Contact the instructor to make arrangements if necessary BEFORE the assignment is due.

1. **GPS Geometry/Measurement Analysis** – Analyze the Geometry and Measurement standards for your grade level. Reflect on the concepts and skills in (a) the previous grade level – what foundation are you building on?; (b) your grade level – what are you responsible for teaching?; and (c) the next grade level – how does the next grade extend what you have taught? How can you incorporate the process standards into your teaching of geometry and measurement?
2. **Partner Presentations** – Select one of the class activities for each chapter (4 chapters – 8, 9, 10, and 11) that you and your partner would like to be in charge of leading. During that class, you and your partner will lead the activity for the rest of the class. You may also choose to do the presentations individually.
3. **Field Assignments** – Select an appropriate activity to do with students. Complete the write-up as described the handout distributed during the first night of class.
4. **Integrating Mathematics and Literature** – Find 2 mathematics literature books – one for Geometry, one for Measurement – for grades K-5 (or 6-8). Identify the GPS. Develop an extension activity for the story.
5. **Glossary** – Develop a Geometry and Measurement Glossary. The words are located on pages 7 and 8 of the syllabus. Each word/group should be on a separate page. For each word/group, create a Frayer model or other graphic organizer. (Examples should include picture representations if appropriate. Non-examples should vary.)
6. **Geometry Unit** – Create a geometry and/or measurement unit (5-10 days) that you can use in your classroom. Use the GPS for your grade level. Details are located at the end of the syllabus.
7. **Geometer's Sketchpad Activities** – You will have several activities to complete using Geometer's Sketchpad. When you complete the activity, you will need to print out a copy of it to submit.
8. **Exams** – There will be four exams during the semester based on the materials and information we have worked on in class.

Grading

Assignment	Points Possible	Evaluation Method
GPS – Geometry/Measurement Analysis	50	Rubric
Partner Presentations (4@10 points)	40	Rubric
Field Assignments (2 @25)	50	Rubric
Glossary (4 chapters @ 25 points)	100	Rubric
Geometry Unit	50	Rubric
Geometer’s Sketchpad Activities	30	Rubric
Tests (4@50 points)	200	Exam
Professionalism/Participation	30	
Total Points	550	

Final grades will be distributed according to the following scale:

A	=	$500 \leq x \leq 550$
B	=	$450 \leq x < 500$
C	=	$400 \leq x < 450$
F	=	$x < 400$

The final letter grade of “A” will be reserved for those students who demonstrate excellence in all of their work and contributions to class.

Professionalism/Participation Policy: Students are expected to attend all class and lab sessions and conduct themselves professionally at all times. Professionalism will be graded with the follows:

Points	Tardy/ Leave Early	Absences	Unprofessional Conduct	Late Assignments
30	0	0	0	0
26-29	1	1	1 event	1
21-25	2	2	2 events	2
16-20	3	3	3 events	3
11-15	4	4	4 events	4
6-10	5	5	5 events	5
0 – 5	>5	>5	>5	>5

Class Outline (Tentative) Note: We will work through as many activities as possible each night, possibly beyond those listed.

Date		Topic	Class Activities	Assignments Due
January	10	Syllabus; Chapter 8 – Geometry	8.1 – A, B, C	
	17	Chapter 8	8.2 – G, H, I, J, K, L, M	
	24	Chapter 8	8.3 – S, T, V 8.4 – W, X, Z, AA	Math & Lit – Book 1
	31	Chapter 8	8.5 – DD, EE, 8.6 – FF, GG, HH, JJ	Unit – Part 1
February	7	Geometer’s Sketchpad – Computer Lab	8.4 – Y, BB 8.5 – FF, II, KK	Ed Center – Lab 204
	14	EXAM - Chapter 8 Chapter 9 - Geometry of Motion/Change	9.1 – A, B, F	Glossary – Ch. 8
	21	Chapter 9	9.2 – G, H, M 9.3 – N, O, P, Q	Sketchpad Activities (submit on WebCT)
	28	Chapter 9 Chapter 10 - Measurement	9.4 – R, S, T, U, V, W, X 10.1 – A, B, C	
March	6	EXAM – Chapter 9 Chapter 10	10.2 – D 10.3 – E, F, G, H, I	Unit – Part 2
	13	Chapter 10	10.4 – J 10.5 – K, L, M, N, O, P	Glossary – Ch. 9
	20	Field Assignment - No Class at UWG		GPS Project (Submit on WebCT)
	27	EXAM – Chapter 10		Field Assignment 1 (Submit on WebCT)
April	3	Field Assignment – No Class at UWG		Glossary – Ch. 10
	10	Chapter 11 – More About Area/Volume	11.1 – A, B, C 11.2 – D, E, F 11.3 – G, H, I	Field Assignment 2 (Submit on WebCT)
	17	Chapter 11	11.4 – J, K 11.6 – P, Q, R, S 11.7 – T	Math & Lit – Book 2
	24	Chapter 11	11.8 – U, V 11.9 – W, X, Y	Glossary – Ch. 11
May	1	Chapter 11	11.10 – Z, AA, BB, CC, DD, EE, FF 11.11 – HH, II, JJ	Completed Unit
	8	EXAM – Chapter 11		

Suggested Homework Activities – It is a good idea to work through the practice problems at the end of each section. The answers for these are provided in your textbook.

CHAPTER 8	CHAPTER 10
Section 8.1 – pp. 387-389 (1-3, 7-8)	Section 10.1 – p. 526 – (1-11)
Section 8.2 – pp. 404-407 (1-5, 8-11)	Section 10.2 – p. 532 (1-3)
Section 8.3 – p. 422 (1-5)	Section 10.3 – p. 538 (1)
Section 8.4 – pp. 430-431 (1-10)	Section 10.4 – p. 544 (1-3)
Section 8.5 – p. 441 (1-3)	Section 10.5 – p. 552 (1-8)
Section 8.6 – pp. 449-450 (1-4)	Ch. Summary and Study Items – pp. 557-558
Ch. Summary and Study Items – pp. 455-457	CHAPTER 11
CHAPTER 9	Section 11.1 – pp. 562-564 (1-6)
Section 9.1 – pp. 464-466 (1-4)	Section 11.2 – pp. 579-580 (1-8)
Section 9.2 – pp. 478-480 (1, 5)	Section 11.3 – pp. 588-590 (1-3)
Section 9.3 – p. 490 (1-6)	Section 11.4 – p. 599 (1-4)
Section 9.4 – pp. 503-504 (1-9)	Section 11.6 – pp. 612-613 (1-8)
Ch. Summary and Study Items – pp. 514-516	Section 11.7 – pp. 621-622 (1-2)
	Section 11.8 – p. 626 (1)
	Section 11.9 – p. 630 (1-3)
	Section 11.10 – p. 634 (1-4)
	Section 11.11 – pp. 641-642 (1-5)
	Ch. Summary and Study Items – pp. 644-648

Chapter 8

triangle –

by angles

right triangle

acute triangle

obtuse triangle

by sides

scalene triangle

equilateral triangle

isosceles triangle

quadrilateral –

square

rectangle

rhombus

parallelogram

trapezoid

polygon –

pentagon

hexagon

octagon

decagon

regular polygon

closed

circle –

radius

diameter

sphere –

radius

diameter

prism –

rectangular prism

triangular prism

right prism

oblique prism

pyramid –

square-based pyramid

triangle-based pyramid

right pyramid

oblique pyramid

cylinder –

right cylinder

oblique cylinder

cone –

right cone

oblique cone

point

line

plane

line segment

endpoints

ray

angle –

right angle

acute angle

obtuse angle

straight angle

congruent

degree

protractor

perpendicular

parallel

normal line

compass

hypotenuse

theorem

closed

diagonals

Venn diagram

set

straightedge

midpoint

bisect (line segment)

bisect (angle)

polyhedron (polyhedra)

faces

edge

vertex (vertices)

bases

convex

Platonic Solids –

tetrahedron

cube

octahedron

dodecahedron

icosahedron

Chapter 9

reflection –

line of reflection

glide-reflection

translation

rotation

symmetry –

reflection (mirror) symmetry

translation symmetry

rotation symmetry

n-fold rotation symmetry

glide-reflection symmetry

congruent

SSS congruence

ASA congruence

similar

scale factor

scale factor method

relative sizes method

proportion method

triangle similarity criterion

Chapter 10

unit

measure

cc (cubic centimeter)

metric ton

significant digits

length

one-dimensional

perimeter

area

surface area

two-dimensional

volume

three-dimensional

dimensional analysis

Chapter 11

Pythagorean Theorem

formulas –

area of triangle

area of parallelogram

area of circle

circumference

perimeter

volume of prism

volume of cylinder

volume of pyramid

volume of cone

CULMINATING ACTIVITY: Developing an Instructional Unit

During this course, you will develop a 5-10 day unit of instruction for the Geometry and/or Measurement strands to teach at your grade levels. The teaching unit is to serve as the culminating assessment and to address best practices for mathematics at the elementary level and PSC Standards 2 xi, 4, 5, 6, 9, 10, 11, and 12 for the Early Childhood mathematics endorsement. The unit offers an opportunity for the teacher to connect with other instructional areas both across mathematics strands and with other disciplines.

The teaching unit must include the following:

- Strategies addressing diversity (gender, ethnicity, learning styles, etc.) to support full participation by all students;
- Appropriate use of technology, print and electronic resources, and manipulative and visual materials;
- Interdisciplinary activities and problem solving;
- Effective uses of student groupings such as peer teaching and collaborative grouping;
- Varied instructional strategies based on current research and local, state, and national standards; and
- Formative and summative assessments to determine student achievement.

First half of the course (Part One):

- 1) Choose topic, Identify NCTM standards and GPS standards – what are the key GPS? Supporting GPS?
- 2) Develop essential question for the unit
- 3) Develop concept map for the unit – this will be a DRAFT. You will revise and finalize it as you write your unit.
- 4) Develop essential questions for each of the lessons
- 5) Design culminating activity – this is the unit's summative assessment
- 6) Design rubric for the culminating activity

DUE DATE for Part One: January 31, 2008

Revise Part One.

- 7) Develop the launch activity (capture attention and engage learners)
- 8) Develop the acquisition lessons (lessons for students to acquire knowledge), at least one lesson for each essential question
- 9) Develop the extending/refining lessons (lessons that extend the content)
- 10) Formative assessments

DUE DATE for Part Two: March 6, 2008

At the end of the term (entire unit): May 1, 2008

Revise Part Two.

- 11) List resources and materials – Have you included a variety of resources – technology, manipulatives, visuals, etc?
- 12) Develop timeline, pacing guide (day by day plan)
- 13) Specify differentiation methods – How are you meeting the needs of all students? What strategies – instructional and grouping – are you using in your unit?
- 14) Specify interdisciplinary activities and problem solving – How are these incorporated in your unit?