GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 132 MATHEMATICAL CONCEPTS FOR THE ELEMENTARY CLASSROOM II – SPRING 2012

Motivation

Quantitative information and reasoning is important for many personal, business, and societal decisions. An advanced understanding of mathematics is needed for some careers (e.g., accountants, doctors, engineers, and scientists). To become quantitatively literate adults and have the opportunity to enter any career, elementary school students need to build a solid foundation in mathematics. This includes an understanding of concepts, competence in the use of procedures, ability to apply mathematics to new problems, and an enthusiasm for learning more mathematics. In order to flexibly guide their students' foundation building, elementary school teachers must have an adult-level understanding of elementary mathematics.

Learning Goals

By the end of the course, students will do the following.

1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
2. Specify location and describe spatial relationships using coordinate geometry and other representational systems.
3. Apply transformations and use symmetry to describe and analyze real-world phenomena.
4. Use visualization, spatial reasoning, and geometric modeling to solve real-world problems.
5. Identify measurable attributes of objects and the units, systems, and processes of measurement.
6. Apply appropriate techniques, tools, and formulas to determine measurements.
7. Exhibit curiosity, playfulness, creativity, confidence, and perseverance towards mathematics.
8. Describe stages of geometric development in relation to the elementary school curriculum.
9. Recognize and reflect upon a variety of pedagogical approaches to mathematics education.

Instructor

David Housman, SC 117, dhousman@goshen.edu, 535-7405 (office), 875-0339 (home)
Office hours posted on office door and at http://people.goshen.edu/~dhousman/Schedule12Spring.htm

Class Time

TR 11:00 a.m. - 12:15 p.m. in SC 107.

Textbooks

Bassarear, Tom. (2012) *Mathematics for Elementary School Teachers*, 5th edition. New York: Houghton Mifflin Company. ISBN-13: 978-0-8400-5463-0. This print version is optional.

Bassarear, Tom. (2012) *Mathematics for Elementary School Teachers: Explorations*, 5th edition. New York: Houghton Mifflin Company, ISBN-13: 978-0-8400-6245-1.

Enhanced WebAssign with eBook LOE Printed Access Card for One-Term Math and Science, ISBN-13: 978-0-538-73810-1. Provides an eBook version of the text but not the explorations manual.

All three of the above were used in Math 131

On-line

https://moodle.goshen.edu for grades and many resources.

https://webassign.net/login.html for homework and electronic text book.
The first time you visit this site, you should

1. Click on the I Have a Class Key link.
2. Enter the Class Key: `goshen 2942 2134`.
3. Follow the directions to either use an existing or create a new WebAssign account.

You can do this before purchasing access to WebAssign; however, eventually you will need to pay on-line or enter a code obtained when purchasing the bundled text. If you purchased access to the Math 131 materials, you should not need to purchase access to Math 132 because the Bassarear text is LOE.

Learning Journal

A three-ring binder with loose-leaf lined and graph paper is recommended so that you can keep a written record of anticipatory reading work, assignment related work, class notes, concept discoveries, process assessments, questions, and answers. The instructor will occasionally browse these as part of your participation grade.

Tools

You should acquire and bring to class a ruler (clear plastic and 12 inches in length is recommended), compass (clear plastic is recommended), compass (an inexpensive "student" model is sufficient) , and a basic calculator (an inexpensive one that uses scientific notation and can work with fractions is recommended).

Manipulative Kit

Manipulatives are often used in elementary classrooms and will be used sometimes in Math 131 and Math 132. To purchase a kit, go to http://www.etacuisenaire.com and enter 978-0-7406-8393-0 in the "search" field. This is an optional purchase.

Activities and Grading

The study of mathematics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, and receiving feedback are essential to learning mathematics. Course grades will be based on performance in the activities in the table. If helpful, the Final Exam grade will replace one mid-term exam score.

Activity	Weight
Participation	10%
Assignments	20%
Projects	20%
Three mid-term exams	30%
Final Exam	20%

Participation

Attend class and contribute useful questions, answers, explanations, ideas, assessments, and comments. Maintain a learning journal. Summarize class activities, task answers, content discoveries, process reflections, and remaining questions. Complete four surveys. See Moodle for details.

Assignments

Construct and exhibit understanding by completing exercises. Answer each question in your learning journal first. Include a description of your thinking process, explanations, questions, and/or reflections. After you have obtained your answer on paper, input your answer into WebAssign. It can be beneficial to collaborate but make sure you could solve similar problems on your own.

Projects

Opportunities to delve into several geometry concepts in more depth and to relate elementary school curriculum standards with stages of concept development.

Exams

Exhibit your ability to solve problems, describe methods and concepts, employ reasoning, recognize connections, and use representations found in the elementary school mathematics curriculum. Exams will primarily be in-class but may also have take-home portions. The only excused absence for an exam is for an event that is completely beyond your control and over which you have no choice. You must seek approval for a make-up exam as soon as you become aware of the problem. You are expected to complete exams without assistance from other people.

Tentative Schedule

Activity	Date
Project 1: Standards and Stages of Development	Tue, Jan 24
Exam 1: Basic Concepts, 2-D Figures, Constructions, & Standards	Tue, Feb 7
Project 2: Polyhedra	Tue, Feb 14
Exam 2: 3-D Figures, Congruence, Transformation, Symmetry, & Tessellation	Tue, Mar 13
Project 3: Similarity	Tue, Mar 20
Project 4: Measurement	Thu, Apr 5
Exam 3: Magnification, Similarity, Measurement, Length, Area, & Volume	Tue, Apr 10
Final Exam: Comprehensive	Wed, Apr 18, 1pm

Academic Resource & Writing Center and Disabilities

Goshen College wants to help all students be as academically successful as possible. If you have a disability and require accommodations, please contact Lois Martin, the Director of the Academic Resource & Writing Center early in the semester. In order to receive accommodations, documentation concerning your disability must be on file with the Academic Resource & Writing Center, Good Library 113, x7576, lmartin@goshen.edu . All information will be held in the strictest confidence. The Academic Resource & Writing Center offers tutoring and writing assistance for all students. For further information please see http://www.goshen.edu/studentlife/arwc.

Collaboration and Academic Integrity

You are encouraged to use all available resources in order to learn the concepts and techniques discussed in this course. In particular, conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.

For assignments, give written acknowledgement to people with whom you have had discussions and to any written materials (other than the text) that were helpful.

For exams, you may *not* use any resources unless a specific exception is stated by the instructor.

Failure to observe the above rules will result in a penalty ranging from a zero on the assignment or exam to immediate failure of the course. Any violation of academic integrity will be reported to the Academic Dean.

Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.

Exam 1 Learning Objectives	1. Define, identify and create examples of, and interrelate the following concepts: point, line, line segment, ray, parallel lines, perpendicular lines, concurrent lines, skew lines, plane, parallel planes, acute angle, right angle, obtuse angle, straight angle, reflex angle, complementary angles, supplementary angles, vertical or opposite angles, simple curve, closed curve, simple closed curve, polygon, regular polygon, vertex, side, triangle, acute triangle, right triangle, obtuse triangle, median (and centroid), perpendicular bisector (and circumcenter), angle bisector (and incenter), altitude (and orthocenter), congruent, quadrilateral, trapezoid, parallelogram, kite, rhombus, rectangle, square, pentagon, hexagon, and octagon. 2. Use geoboard and isometric dot papers to illustrate geometric shapes and explain why certain geometric shapes cannot be illustrated with these papers. 3. Use straight-edge, compass, and/or a MIRA to construct geometric objects and explain how the constructions are accomplished and why the constructions work. 4. Specify location and describe spatial relationships using coordinate geometry. 5. Describe stages of geometric development in relation to the elementary school curriculum.
Exam 2 Learning Objectives	1. Define, name examples of, and create examples of the following three-dimensional figures: cylinder, cone, sphere, polyhedron, prism, regular polyhedron, pyramid, cube, tetrahedron, octahedron, icosahedron, and dodecahedron. 2. Count the vertices, edges, and faces of polyhedra, and make use of Euler's relationship among these numbers. 3. Sketch figures made of cubes using isometric dot paper. 4. Sketch the front, right, and top views of figures made of cubes. 5. Construct and identify nets for prisms. 6. Explain why there are only five regular polyhedra. 7. Sketch translations, rotations, reflections, and glide reflections of two-dimensional shapes using physical tools (e.g., rulers, protractors, MIRAs, and tracing paper), Cartesian coordinate system, and Geometer's Sketchpad. 8. Describe transformations consisting of one or more translations, rotations, reflections, and glide reflections that will transform one two-dimensional shape to a congruent two-dimensional shape. 9. Describe translation, rotation, and reflection symmetries in figures. 10. Sketch figures to illustrate different combinations of translation, rotation, and reflection symmetries, and explain when it is impossible for a figure to have a certain combination of translation, rotation, and reflection symmetries. 11. Sketch tessellations given a figure or explain why the figure does not tessellate.
Exam 3 Learning Objectives	1. Determine when polygons are similar, construct a polygon similar to another polygon, and find measurements for similar polygons. 2. Estimate lengths, areas, volumes, masses, and temperatures using metric and U.S. customary units. 3. Directly measure lengths and areas. 4. Know simple length, volume, mass, and temperature conversions between different metric and U.S. customary units. 5. Convert between different units of measurements. 6. Report direct and derived measurements with appropriate units and precision. 7. State, use, and derive formulas for finding perimeters and areas of triangles, rectangles, and circles. 8. State, use, and derive formulas for finding surface areas and volumes of rectangular prisms, right circular cylinders, and spheres.

Project 1 Standards

The purpose of this project is to become familiar with the standards for geometry and measurement set both by the National Council for Teachers of Mathematics (NCTM) and by the State of Indiana and to compare these standards to the van Hiele levels for geometric understanding.

Evaluation:

/10 Poster includes all relevant NCTM standards, Indiana standards, and van Hiele levels.

/ 5 Poster makes valid connections among the standards and van Hiele levels.

/ 5 Poster is attractive and organized.

/10 Group paper is readable and well organized

/10 Group paper provides a clear and accurate summary of the relationship between standards and van Hiele levels.

/10 Individual paper accurately summarizes involvement and describes learning obtained.
/50 Total

Project 2 Polyhedra

The purpose of this project is to experience and better understand geometric relationships in 3-dimensional shapes by creating and analyzing several interesting polyhedra.

Evaluation:

/15 All requested polyhedra models were constructed.

/10 The polyhedra models were well constructed (sturdy, exact fit, colorful).

/10 All strategies were explained clearly and results (vertices, edges, faces) are correct.

/5 All relevant standards were identified.

/10 Individual Project Response Form was completed.

/50 Total

Project 3 Similarity

The purpose of this project is to experience some practical applications for the use of scale and similar figures.

Evaluation (choose two of the first three)**:**

/20 The scale drawing was complete and of high quality, and the explanations are correct and clear.

/20 The pantograph was complete and of high quality, and the explanations are correct and clear.

/20 The indirect measurement was complete and of high quality, and the explanations are correct and clear.

/10 Individual Project Response Form was completed.

/50 Total

Project 4 Measurement

The purpose of this project is to create and carry out experimental methods for direct measurement of a non-routine quantity in a manner that is as precise and accurate as possible.

Evaluation:

/8 The attribute to be measured is appropriate and described clearly.

/8 Different methods are clearly described to correctly measure the attribute.

/8 Assumptions made are clearly identified and reasonable.

/8 All measurements are correctly completed.

/8 The written and oral reports are clear and accurate.

/10 Individual Project Response Form was completed.

/50 Total

Participation

Participation is 10% of your course grade and consists of the following components.

Engagement (0-50 points). Full credit if a frequent contributor of useful questions, answers, explanations, ideas, assessments, and/or comments during every class.

The maximum possible score is reduced by 5 points for each missed class. If you have a valid excuse for missing a class (i.e., personal illness, family death, or Goshen College sanctioned activity that takes precedence over a class), please inform the instructor as soon as possible. Of course, for any class you miss, it would be good to find out what happened from the class wiki and/or other students in the class.

The reduction for an excused absence can be eliminated by an extra recorder activity or one of the following outside activities: tutor an elementary school student in mathematics, observe an elementary school classroom when mathematics is explored, document an error in the course resources, participate in a math-related activity, or read a mathematics (not education) journal article. Each activity should be about an hour in duration (e.g., two half-hour tutoring sessions would be acceptable). For each activity, submit a one-page description of the activity (who, what, when, and where) and review of an interesting math-related aspect of the activity (better to focus on one concept deeply rather than enumerate everything). It would be appropriate to include a strength, improvement area, and/or insight about your involvement, the speaker, or the learning environment.

Learning Journal (0-20 points). Maintain a journal containing personal anticipatory reading work, assignment related work, class notes, concept discoveries, process assessments, questions, and answers. Full credit if the journal is organized and complete. Journals will be checked during midterm exams.

Recorder (0-10 points). Post to the appropriate wiki page within 24 hours a summary of class activities, task answers, content discoveries, process reflections, and remaining questions. Expect to devote about an hour to this activity. Assign 5 points for each of two classes.

Introduction (0-5 points). Post an entry to the Introduction forum.

Initial Survey (0-5 points). Complete the Initial Survey.

Final Survey (0-5 points). Complete the Final Survey.

GC Course Evaluation (0-5 points). Complete the GC Course Evaluation.

Total (0-100 points).