Mathematics 131 (section 01)
Geometric Reasoning: Geometry as Earth Measures
Spring Semester, 2016

Course Description:

This course has a multi-dimensional focus on geometric reasoning, addressing geometry through: visualization, drawing and constructing figures; correspondence to structures in the real, physical world; by reference to abstract mathematical concepts; and by argumentation and discussion within a logical-mathematical system. This course satisfies the middle-core quantitative reasoning requirements for general education at Illinois State University.

Meeting Place and Time:
Stevenson Hall, Room 347 B
9:35 until 10:50 on Tuesdays & Thursdays

Instructor and Office Hours:

Dr. Jeffrey Barrett STV 329 D
Office phone: (309) 438-7849
jbarrett@ilstu.edu

Office hours: Wednesdays @ 3 until 4:30 PM; or by appointment.
The office hours are meant to help answer your questions about class work, or about topics in the course. Please email at jbarrett@ilstu.edu or speak with me after class to set an appointment.

Also, the ReggieNet site will contain course documents and notes that may be helpful records of lessons and class meetings.

Required Textbooks and class materials:

(1) **Geometry Connections: Mathematics for Middle School Teachers** 1st Edition
by John K. Beem (Author), University of Missouri

(2) A website hosted by Clark University professor, D. Joyce; copyright 1996, 1997, 1998. This **website provides a virtual version of Euclid's Elements** of Geometry. (free, via the internet):
http://aleph0.clarku.edu/~djoyce/java/elements/elements.html

Required Tools and Supplies:

(1) **Geometer's Sketchpad (version 5.0) computer software** (student version may be purchased for your own computer, www.keypress.com, at approximately $25, or $10 for a single semester);
(2) **Ruler and compass** and protractor;
(3) Calculator;
(4) A loose leaf notebook/binder and at least one other bound notebook
(5) Graph paper, multi-color pens or pencils

Course Objectives:

This course is designed to develop students' understanding of mathematical concepts by providing opportunities to investigate and reason about geometric ideas and principles in a variety of contexts. Too often students' previous experiences with geometry have caused them to believe geometry is only a rather meaningless process of proving ideas that seem to be readily apparent, or memorizing terminology and formulas. Consequently our understanding of what geometry is and how geometry can be used in daily life is rather limited and narrow. And yet geometric reasoning consists of much more. The multi-dimensional focus of this course allows students to explore geometry & measurement from several viewpoints, but especially as an axiomatic system.

The course will utilize a problem-solving instructional methodology. Here content is explored in context of various problem situations through visual, quantitative, graphic, historical, scientific, and abstract approaches. From these problems we will focus on the various dimensions of geometric reasoning: investigating and exploring shapes, measures, and relationships; describing, analyzing, and applying; reasoning and conjecturing; justifying and verifying; connecting ideas within mathematics and across other disciplines; and communicating our understanding and findings.

Students will make drawings with hand tools and computer tools to explore geometric principles and properties; dynamic “sketchpad” software will be used as one method of exploration and investigation and it will be connected to compass and straightedge constructions. Geometric ideas such as similarity and proportion, symmetry, and transformations will be explored. These ideas can be historically linked to art, architecture, and culture, and lead into the study of another perspective on geometry. In contrast to the use of drawings and objects, we will also examine representations of abstract mathematical ideas and concepts from geometry.

Another dimension students will explore is geometry in relation to the real, physical world. Geometric ideas of repeated patterns, spirals and branching are seen in a variety of natural physical situations. These can be as simple as a honeycomb, or as advanced as the astrophysicist's use of geometric models for the structure of the universe. In addition, through virtually every aspect of life we are

faced with measurement concepts that are closely related to geometric relationships. Thus, measurement and related topics will be explored.

Fundamentally, the idea of geometry as a logical axiomatic system will be explored through the development of logical arguments and justifications. While many students have experienced this in a high school level geometry course, the proofs they attempted were often proofs of relationships that seemed obvious or of limited usefulness. We will look at proof as a vehicle for explaining and understanding ideas. This is different than making an argument for the validity of a theorem, relying instead on our effort to defend the theorem to help us understand and connect that theorem to relevant geometry. To clarify the importance of the axiomatic structure, and its usefulness in investigating real-world phenomena some basic explorations into non-Euclidean geometries, such as spherical or finite geometry will be used.

In summary, this course will provide you with the opportunity to:

- Experience what it means to understand geometry in a variety of contexts and applications;
- Learn mathematics by investigating, conjecturing, and justifying;
- Engage in investigations and problem solving while working with others;
- Gain insight into how geometry has been used to describe the world around us and appreciate its interdisciplinary role;
- Use technology to solve and generate problems; and
- Learn to communicate mathematics through written and oral presentations.

Policy Regarding Academic Integrity:
Academic Integrity is expected in all classroom endeavors.

Academic Integrity is an important part of this University and this course. Academic Integrity is required of you the student and myself as the instructor. Students are expected to be honest in all academic work. A student□s placement of his or her name on any academic exercise shall be regarded as assurance that the work is the result of the student□s own thought, effort, and study. Students who have questions regarding issues of academic dishonesty should refer to the Code of Student Conduct, B1 (Academic Integrity), which outlines unacceptable behaviors in academic matters. In certain circumstances (such as cheating or plagiarism) I may be required to refer a student(s) to Community Rights & Responsibilities for a violation of Illinois State University's Code of Student Conduct. If you are uncertain about whether or not something is dishonest, please contact me. Academic penalties regarding academic dishonesty may range from a failing grade for a particular assignment (F) to a failing grade for the entire course (F) based on the seriousness of the infraction.

Classroom Behavior should conform to standards of the professional workplace. Students are expected to behave in a manner consistent with being in a professional environment. Open discussion and disagreement are encouraged in a respectful manner.

Open hostility, rudeness, and incivility are discouraged and will result in appropriate action. Mechanical disruptions (cell phones, pagers, electronic toys, music players, etc.) are also strongly discouraged. Students acting in a disruptive or uncivil manner may be dismissed from the class for the remainder of the class period. If necessary, referrals may also be made to Community Rights & Responsibilities for violations of the Code of Student Conduct.

Tentative Course Requirements and Standards for Evaluations:

Quizzes (3-4 quizzes will be graded)	10%
Participation in the course: Includes: class discussion contributions, presentations, and two notebooks, that you are expected to keep current each week: (1) A journal notebook (looseleaf) from Euclid's Book I, including proofs and hand-drawn constructions along with GSP constructions, and (2) A second journal and assignment notebook including your written responses and notes from our textbook (see Beem Text above). This should be a comprehensive record of assigned work from the text.	10%
Exams (approximately three exams will be given)	55%
Final Exam	25%

Participation will be based on these notebooks and your entries to them, in addition to attendance and presentations you will make during the semester for your classmates:

(1) A journal notebook (looseleaf) from Euclid's Book I, including proofs and hand-drawn constructions along with GSP constructions, and (2) A notebook with your solutions to problems and notes from the Beem text and other assignments.

Attendance and participation: It is important in any mathematics course that you be present; however, it is even more important when the text does not tell you step by step procedures for all tasks, but instead asks questions we are to explore and discuss. As a result, absences make it difficult to understand the course content, and generally have a negative impact on quiz and project grades.

Quizzes and Tests:

There will be quizzes in alternation with exams. Quizzes will be given during a shorter period of time, usually from 20-25 minutes in duration. Quizzes will not be made up for any reason.

There will be three or more exams during the semester. Each will be 60-75 minutes in length.

If you are absent the day of an exam, a make-up will be given ONLY if you have notified me in advance of your absence. This means that if you are not going to be in class the day of an exam, I need a phone call, voice mail message or e-mail dated and timed prior to the start of class that day. If you do not notify me of your absence in advance the exam, a make-up will not be given, and your grade will be recorded as a zero for that exam.

Final Examination:
The final exam is scheduled according to the university final exam schedule for Final-Exam Week. This schedule allows exactly two hours for the final exam. It will be a cumulative exam, relating to previous material addressed on quizzes and tests and topics specified as critical topics throughout the course in discussions and projects and assignments.

A full distribution of grades from A to F is plausible with A's being reserved for outstanding performance. A grade of C represents the minimal acceptable performance. The following rubric describes the levels of performance typically associated with each grade:

A Outstanding performance. Student demonstrates solid conceptual understanding and insight. The student not only demonstrates mastery of the course content, but also is able to make extensions or apply that knowledge to new situations. Assignments and tests are excellent quality and the student contributes substantially to positive class discussions.
B Good performance. Student demonstrates good understanding and mastery of course content. Assignments and tests are of good quality but not exceptional. The student regularly contributes positively to the class discussion.
C Adequate performance. Student demonstrates adequate understanding and mastery of course content but has difficulty extending or applying the knowledge to new situations. Assignments and tests are adequate. Student may not contribute as regularly to class discussions.
D Inadequate performance. Student demonstrates inadequate understanding of course content. Assignments and/or tests are inadequate, but show effort. Student contributes little to class discussions.
F Unacceptable performance. Student demonstrates little or no understanding of the course content. Assignments are not completed, are late, or of poor quality. The student does not contribute to class discussion. The student's work provides little evidence of effort.

Semester grades are based on the requirements stated above. Exams (and quizzes) will be scored on a rubric that is directly related to these criteria, and you will be able to track your grade by computing a weighted average of the portions of your grade detailed earlier in this document (see above).

Each assignment, quiz, or exam will be graded using a four-point scale, related to the rubric above:

4: A	3: B	2: C	1: D	0: F

At the close of the semester, I will use a weighted average, based on the percentages listed above, to find your semester grade on this same 4 point scale. I will use the following cut-offs to determine letter grades based on your 4 point score:

3.3 or higher	A
2.8 or higher, up to 3.3	B
2.0 or higher, up to 2.7	C
1 to 2.0	D

Available Resources:

The mathematics computer labs (STV 314 or STV 125) are usually open from 9 a.m. to 4 p.m., M-F. Check posted hours.

There are multiple copies of many books, booklets, pamphlets, and journals related to mathematics education, as well as manipulative materials for teaching mathematics in Milner Library, or in the Mathematics Library (STV 334). The Mathematics Library may be available during some daytime hours (you may call the main office in mathematics to check hours. Other Important Information:

All assignments should be submitted <u>during class</u> on or before the date indicated.

Late assignments will not be accepted.

Any major emergencies will be handled on an individual basis.

If at any time you are unsure about what is expected of you, either in class or on assignments, please make an appointment to discuss this with me immediately. Do not wait until an assignment is due to ask questions!

Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TDD).

Important Dates:
IMPORTANT DATES

January 10, 2016	Last day to withdraw from the University with a full adjustment of charges
January 12, 2016	Session 1 for our course
March 5 through March 13 2015	Mid-semester break, no classes
April 12, 2016	project work day (no class meeting scheduled)
April 28, 2016	Last class meeting
May (to be announced)	Final examination

General Education Focus of this course on Quantitative Reasoning:
In Quantitative Reasoning courses, students examine the principles, practices, instruments, and systems of mathematics and logic used to measure, quantify, analyze, and represent social, scientific, technological, and other phenomena as a basis for decision-making. Problems and examples in the course are drawn from a variety of disciplines to represent a rich diversity of applications.

Courses in the Quantitative Reasoning category of General Education address the following program objectives:

I. knowledge of the physical and natural world, allowing students to
  a. use theories and principal concepts, both contemporary and enduring, to understand technologies, and the physical and natural world

II. intellectual and practical skills, allowing students to
  a. make informed judgments
  b. analyze data to examine research questions and test hypotheses

IV. integrative and applied learning, allowing students to
  a. identify and solve problems

b. transfer learning to novel situations
c. work effectively in teams

Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 309-438-5853, www.disabilityconcerns.ilstu.edu.