Group Projects

Overview: Each student is required to participate in a group project. Each group will choose a different project topic from the list below. You can pick your own group members, but there should be 3 groups of 4 members each and 5 groups with 3 members each for a total of 8 groups. Each project will have both a short written paper and an oral presentation. All participants in a group will receive the same grade, so it is important that each person in the group participate fully and equally. You will be graded on correctness, completeness, and creativity. Your project will count 10% of your final grade.

Written Component: Each group will hand in 1 paper. Your paper should be 2 to 5 pages long. Quality is more important than quantity. Have something to say and say it clearly and concisely. If you are presenting the results of your investigation of some journal article or textbook chapter, you should fill in the missing parts of each argument or proof and do any problems left to the reader. It would be better to go into a small part of some topic in depth and detail, rather than try to cover a large area superficially. This is your opportunity to show that you can read some mathematics on your own and then explain it in writing to your reader. *Please do not copy any references - appropriately cite these.*

Oral Presentations: You will have 10 - 15 minutes to enlighten your colleagues about the topic you have researched. Your presentation should be clear and to the point. Choose your examples carefully to illustrate the points you want to make. In a group presentation, all members in the group should have a role and all should be able to answer any questions which arise. You should rehearse your presentation in advance on some fellow students and leave some time for questions and interruptions. Class presentations always take more time than you think they will. Rehearsal will help you to better gauge how much you can accomplish. Attendance is mandatory for everyone for all class presentations. Each absence for these class sessions will reduce your course grade by 1/3 letter.

Important Dates: We will adhere to the following deadlines. There will be no extensions.

- By noon on Monday, October 17 you need to submit the group project survey.
- By noon on Tuesday, October 25 the groups, topics, and presentations schedule will be announced and finalized.
- There will be 4 presentations each class on Tuesday, November 29 and Thursday, December 1.
- The short group paper is due in class on Tuesday, November 29.

Resources: You may want to browse through some of the books on Geometry in the library. The internet has many good sites dealing with geometric topics. Using any of the standard search engines should produce good references. (Be careful about using websites as references - some are more reliable than others! If you want to use a website as one of your references, you should clear it with me first.) I'm happy to help you find some references if you like.

The Topics:

- **Taxi Cab Geometry:** Taxi Cab geometry is a Non-Euclidean Geometry and is based on the idea of city streets being parallel and perpendicular to each other. Introduce this geometry to the class and share some interesting results.
- **Young's Geometry:** Young's Geometry is a finite geometry discussed in Section 1.3 of your textbook. Complete the proofs of Corollary 1.1, Lemma 2, and Young's Theorem 3 and share some interesting aspects of this geometry with the class.
- **Trisecting an Angle:** Discuss the Greek's famous problem of trisecting an angle using only a compass and a straight edge. Discuss the history of the problem and in which specific cases it is possible. Demonstrate a method to trisect angles that uses tools other than a compass and straight edge (e.g., the origami method).
- **The Pythagorean Theorem:** Demonstrate at least two proofs of the Pythagorean Theorem that are different than the proof presented in class.
- **Incidence Geometry:** Incidence Geometry (discussed in Section 1.4 of your textbook) is a geometry that involves four axioms using the undefined terms *point*, *line*, and *on*, yet the axioms do not specify that the number of points or lines is finite. Introduce this geometry to the class and share some interesting results. Be sure to complete some exercises from your textbook in providing examples of an incidence geometry.
- **Fractal Geometry:** In Euclidean Geometry our objects are described in terms of integer dimensions, e.g., a point has dimension 0, a line has dimension 1, a plane has dimension 2, and a sphere has dimension 3. The objects in Fractal Geometry are described via algorithms and have non-integer dimensions. Introduce the fascinating Fractal Geometry to the class. In doing so, be sure to talk about applications of Fractal Geometry to nature.
- **The Euler Line of a Triangle:** The Euler Line of a triangle is a special line which passes through several notable points of a triangle. Introduce the Euler Line and its importance to the class. Construct the Euler Line of a triangle using either a compass and straight edge or a software program.
- **The Miquel Point:** Given a triangle one can define three circles which meet in a single point called the Miquel Point, named after Auguste Miquel. Explain Miquel's Theorem to the class. Can the theorem be reversed? Are there any generalizations to shapes other than triangles?