

# MG 5860.02: Visual Group Theory (Summer 2009)

MTWR 9:00AM–12:00PM, Hyde 318

## Instructor Information

**Instructor:** Dr. Dana Ernst

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**Office hours:** MTWR 12:00–2:00PM (or by appointment)

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## Course Information and Policies

**Prerequisites:** Equivalent of MA 3200 (Discrete Mathematics), MA 3110 (Logic, Proof, and Axiomatic Systems), or approval of instructor.

**Text:** *Visual Group Theory*, by Nathan Carter, 1st edition, (Mathematical Association of America).

**Course Description and Purpose:** This course will explore the basics of group theory with an emphasis on gaining intuition into this rich mathematical field through visual representations. This course is a departure from the standard first course in group theory, where the subject is predominately introduced using theorems, proofs, and examples. In this course, we will “see” groups, experiment with them, and understand their significance. Students will be exposed to mathematical proofs and be expected to generate basic proofs on their own. Topics/concepts for the course include, but are not necessarily limited to:

- (1) intuitive and formal definition of a group
- (2) symmetry from the point of view of groups
- (3) Cayley diagrams
- (4) group actions
- (5) group multiplication tables
- (6) cyclic and abelian groups
- (7) subgroups
- (8) cosets
- (9) Lagrange’s Theorem
- (10) direct (and possibly semidirect) products of groups
- (11) normal subgroups
- (12) quotient groups
- (13) normalizers and conjugacy
- (14) embeddings and quotient maps
- (15) the Fundamental Homomorphism Theorem
- (16) modular arithmetic
- (17) the Fundamental Theorem of Abelian Groups
- (18) Cauchy’s Theorem

- (19)  $p$ -groups
- (20) the Sylow theorems

If time permits, we may also introduce Galois theory. Lastly, and perhaps most importantly, the purpose of any mathematics class is to challenge and train the mind. Learning mathematics enhances critical thinking and problem solving skills.

**Software:** We will be using software called *Group Explorer* throughout the course. This software, which compliments our textbook very well, will be installed on the computers in the computer lab on the third floor of Hyde. You can also download and install the software on your own computer for free. You can find the software at

<http://groupeexplorer.sourceforge.net/>.

**Attendance:** Regular attendance is expected and is vital to success in this course.

**Quizzes:** We will be having daily quizzes, which will usually occur at the beginning of each class. The quizzes will test vocabulary and basic concepts. At least one of your lowest quiz scores will be dropped. Your overall quiz score will be worth 20% of your final grade.

**Homework and Group Work:** Homework will be assigned each lecture and will typically be due the following lecture. Each lecture will provide an opportunity for students to ask questions regarding the homework assignment that is due that day. At least one of your homework scores will be dropped. In addition, you will be allowed to turn in up to 3 homework assignments late without penalty. Any other late homework will be accepted for a maximum of half credit. Your homework will always be graded for completion and, in addition, some sample of the problems will be graded for correctness. You are allowed and encouraged to work together on homework. Occasionally, small groups will have the option of turning in a single homework assignment. In addition to homework, there will be group work assigned during class that will often be collected and graded. Your overall homework and group work score will be worth 60% of your final grade.

**Exams:** There will be one exam, which is scheduled for **Thursday, July 30** from 9:00AM–1:30PM. This exam is cumulative and worth 20% of your overall grade.

## Course Evaluation

**Grading:** You will be graded on your written work, which will be judged on the basis of *correctness*, *completeness*, and *legibility*.

**Basis for Evaluation:** Your final grade will be determined by the scores of your homework, group work, and the cumulative exam.

<b>Quizzes:</b>	20%
<b>Homework and Group Work:</b>	60%
<b>Cumulative Exam:</b>	20%

**Grade Determination:** Grades may be “massaged” at the end of the semester, but in general this is what you should expect:

93–100%	A	73–76%	C
90–92%	A-	70–72%	C-
87–89%	B+	67–69%	D+
83–86%	B	63–66%	D
80–82%	B-	60–62%	D-
77–79%	C+	0–59%	F

## Additional Information

**Math Center:** This student-run organization provides peer tutoring services for most 1000 and 2000 level math courses and some 3000 level courses. Tutors are typically math majors interested in teaching math and practicing their instructional skills. The Math Center is located in Hyde Hall room 351. You can drop in anytime during open hours. More information can be found at:

<http://www.plymouth.edu/math/resources/center.html>

**Student Handbook:** The PSU Student Handbook addresses policies pertaining to students with disabilities, religious observation, honor code, general conduct, etc. The Handbook can be found at:

<http://www.plymouth.edu/stulife/handbook/handbook.html>

**ACT for Growth:** All teacher education majors are subject to the Areas of Concern/Targets for Growth policy, which is located at:

<http://www.plymouth.edu/education/act.html>

## Closing Remarks

When does the learning happen? It might happen in class, but most likely it happens when you sit down to do your homework. Most of you can follow what I do on the board, but the question is, can you do it on your own? To learn best, you must struggle with mathematics on your own. It is supposed to be difficult. However, if you are struggling too much, then there are resources available for you. I am always happy to help you. If my office hours don't work for you, then we can probably find another time to meet. You can also get help from each other. Get a study buddy! Help each other learn. Go to the Math Center (see above). It is your responsibility to be aware of how well you understand the material. Don't wait until it is too late if you need help. *Ask questions!*