



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 302 ABSTRACT ALGEBRA & MATH 399 GROUP THEORY
SPRING 2019-20

Catalog Description	(3 credits) An introduction to algebraic structures such as groups, rings and fields. Prerequisite: Math 211 and either Math 205 or 212. An introduction to algebraic structures such as groups, rings and fields.
Content	The planned focus will be on groups.
Learning Objectives	<p>The student will be able to do the following.</p> <ol style="list-style-type: none">1. State and use arithmetic, definitions, axioms, and theorems related to the integers and functions, including the division algorithm, greatest common divisor, extended Euclidean algorithm, Fundamental Theorem of Arithmetic, one-to-one, onto, inverse, and modular arithmetic.2. State and use the definitions of group and related concepts to identify examples and prove theorems about their properties, including subgroup, generator, relation, coset, normal group, quotient group, homomorphism, isomorphism, permutation, cycle, direct product, Abelian group, automorphism, group center, simple group, and conjugacy class.3. Apply group theory concepts and theorems to RSA encryption, geometric symmetries, and Rubrik's Cube type puzzles.4. Learn mathematics by reading, listening, exploring, and conversing in an effective manner;5. Explain mathematical reasoning through writing in a precise and articulate manner in both informal and formal settings; and6. Exhibit curiosity, playfulness, creativity, confidence, perseverance, interest in multiple perspectives, and a collaborative spirit.
Activities	<p>We will learn mathematics by reading, solving problems, and communicating our solutions and questions with each other orally and in writing.</p> <p>An average student can obtain an average grade with an average of nine hours each week devoted to this course—adjust if you are not average or desire a grade that is not average.</p>
Instructor	David Housman, SC 117, dhousman@goshen.edu, 535-7405 (office), 612-7185 (cell) See office door or Moodle for availability.
Class Time	MWF 9:00-9:50AM in SC 107.
Textbook	<i>Abstract Algebra: An Interactive Approach</i> , Second Edition (Textbooks in Mathematics) 2nd Edition by William Paulsen, Chapman and Hall/CRC Press, 2016, ISBN-13: 978-1498719766. The plan is to cover chapters 0 – 8. The publisher has posted an online preview of chapters 0-2 and 6.
Software	Sage (sagemath.org) and its collaborative notebook interface CoCalc (cocalc.com) will be used for computation. Free basic private server access will be provided.
On-line	Moodle https://moodle.goshen.edu contains all course information. Announcements posted to the forum will be emailed to all students.
Other Materials	A three-ring binder with loose-leaf lined paper is highly recommended so that you can keep a written record of problem-solving attempts, questions, math discoveries, and skill assessments. An iPad or cell phone can be useful for taking pictures of board work.
Grading	Course grades will be based on performance on class participation (10%), assignments (60%), two midterm exams (20%), and a comprehensive final exam (10%). If helpful, the final exam grade will replace one of the midterm exam scores.

Class Participation	<p>Come to class having read and engaged in the preparatory activities. Be prepared to ask questions about parts you did not fully understand and to present solutions to parts you did understand. Students who come to class having done the preparatory reading and activities, regularly ask constructive questions and present solutions, and fully engage in all other class activities will earn full credit.</p>
Assignments	<p>Achieve and demonstrate understanding by completing the assigned exercises. Exercises may involve computation, evaluating and writing proofs, constructing examples, or other elements of problem solving. Your solutions will be evaluated on the correctness of your mathematical descriptions and arguments, the clarity of your writing, and the quality of your presentation.</p> <p>It may be helpful for you to distinguish between the process of figuring out an exercise and the process of writing up your results. Normally, what a person writes down during the process of figuring out an exercise is not sufficiently clear or complete for another person to read and understand, unless they have already done the same exercise. Imagine that your audience is a student taking a similar abstract algebra class at a different college, who does not happen to have a copy of the book in their hands. Write up the results of the exercise in a clear and readable form.</p> <p>For exercises that are primarily computational, it is sufficient to show the steps for the computation and clearly state the final solution with appropriate context. For example, exercise 0.1 #1 could consist of a long hand division of 815 by 32 and the summary $815 = (25)(32) + 15$. Exercises requiring a proof require adherence to a higher standard.</p> <p>Some basics on writing clearly: Restate the question as a claim that can be understood on its own. Write in complete sentences. Define any variables that you use. Consider computations and drawings as supplemental to your verbal description of the mathematics. If you include a lengthy computation or a drawing, describe it verbally. Check for spelling, grammar, punctuation, and readability.</p> <p>Some basics on presentation: Write your name and the assignment number on the front page. Staple all the pages of your homework into one neat packet. Trim the frayed edges of paper with scissors. Write neatly, and make sure that there is adequate space between exercises. If your handwriting is illegible, use a word processor. If a mathematical expression is longer than a long word, put it on a line by itself. If you include a drawing or a graph, make sure it is clearly labeled.</p> <p>Unless otherwise announced, assignments are due at the <i>start</i> of the class after it is assigned. Resubmissions and late submissions of individual exercises are due at the start of the next class after the original submissions were graded, and they will be assessed a 20% penalty</p> <p>You are encouraged to collaborate and seek assistance when having difficulties. You will have achieved the expected level of understanding when you are able to obtain your own solutions, independently reproduce solutions developed in collaboration or with assistance, and/or explain a solution to others.</p>
Exams	<p>Demonstrate a basic understanding of the course content by stating major definitions, axioms, theorems, and proofs from memory during in-class portions of exams. Demonstrate mastery of solving problems, discerning the truth of conjectures, and writing proofs during take-home portions of exams. In-class portions of exams are to be completed without any resources. Take-home portions of exams are to be completed using only the text, your notes, and notes provided on Moodle.</p>
Extra Credit	<p>Receive extra credit toward your assignment grade by doing one or more of the following: (1) find errors in the text or posted course materials and describe the error; (2) attend a quantitative presentation (e.g., Science Speakers) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a Career Networks event and describe your most important discovery. Turn in to the instructor a single piece of paper containing your description.</p>
Tutoring	<p>The Academic Success Center provides limited tutoring and writing support for free to all undergraduate students. Make an appointment at goshen.edu/asc. However, it is unlikely that the ASC can hire someone with adequate knowledge of this course. Your best option is to ask the instructor!</p>

Disability Services

Goshen College is committed to providing all students equal access to programs and facilities. Students who need accommodations based on disability should contact the Director of the Academic Success Center (ASC). Students must register with ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of the ASC, Judy Weaver, Good Library 112, jweaver@goshen.edu or 574-535-7560. To ensure that learning needs are met, contact the director of the ASC the first week of classes.

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 homework and labs, you may look at and discuss another student's work, but any written work developed during collaboration with another student should be destroyed before writing your own solutions. You should 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 zero on the assignment or exam. 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.

Due Date Policy

Class participation, assignments, labs, and exams can only be excused, rescheduled, or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.