

**MTH 410: Modern Algebra 2 --- Grand Valley State University**  
**Section 01, Winter 2015 Syllabus**

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**Course Description (from the GVSU Catalog)**

An introduction to groups, including homomorphisms and isomorphisms, LaGrange's Theorem, quotient groups, finite groups, and the Sylow theorems. Additional topics from ring theory including polynomial rings, ideals, and quotient rings.

**Ten Things you need to know about MTH 410**

1. **I want you to be successful in the class.** My job is to help you learn and develop a deep understanding of the course material. I am on your side! I would like our relationship to be like that between a client and a consultant who work together to achieve an end goal. Please feel free to come speak with me at any time.
2. **I expect you to be actively engaged in your learning.** In order to learn mathematics, you have to *do* mathematics. In MTH 410 you'll be expected to work actively, and contribute to others' work. There is very little lecture during class time; instead we'll be solving puzzles and asking and answering questions.
3. **You're expected to spend significant time working on this class.** For an upper-level course, GVSU expects a ratio of 3:1 of time spent outside class to time spent in class, so that's about 9 hours a week of purposeful work outside of class for MTH 410. You might need more, if your proof background is weak.
4. **This is an advanced, proof-based, abstract subject.** In this class we will study abstract ideas, and problem solving in abstraction is almost always done in the form of conjectures and proof. We will see computation and examples, but you won't be able to use examples as "templates". You will be writing proofs and lots of them.
5. **Preparation for class and fluency with basic concepts before coming to class is essential for success.** You'll be expected to prepare for class by reading your textbook, doing basic exercises, and answering questions *before* we meet. If you don't prepare for class, you won't be able to participate in the in-class work and therefore you'll not have the foundation for doing other work in the class. Take preparation seriously!
6. **This course uses a points-free, competency-based grading system.** Each student chooses the grade he or she wants to earn in the course and then works through assignments to demonstrate the level of competency that grade requires. Your grade is based on demonstrated competency, not on the accumulation of points.
7. **You will have opportunities to demonstrate mastery repeatedly on each objective throughout the semester.** You will have the chance to revise many of the items you submit for assessment. In return, you are expected to *master* the concepts in those items and not just get things mostly-right.
8. **Most work in this class is graded on a pass/no pass basis, so careful attention to the specifications for acceptable work is a must.** Work in the class is marked on the basis of whether it passes a set of specifications for professionally acceptable work. It's quite possible to earn Pass grades on every assessment item the first time, but this requires paying attention to your work and giving a strong effort to it.
9. **Academic honesty is taken very seriously.** We have simple and rigorously enforced policies in MTH 410 to ensure that the work you are submitting is your own. All violations of these policies, no matter how seemingly small, have serious repercussions. Make it a goal to ask for help instead of bending the rules.
10. **You may ask a question about anything at any time, especially in office hours.** The material in this course is not necessarily easy, and at some point you will get stuck or frustrated. Don't panic. Instead, seek out help. If you cannot make my office hours, you can always schedule an appointment and I will try to meet you. I won't do your work for you, but I will help you ask the right kinds of questions that will help you get unstuck.

## How to Be Successful in MTH 410

I want you to be successful in the course and will be working hard to make sure you always have a clear path to success. But I cannot walk that path for you! It will take considerable effort on your part. To do this and be successful, you will need to do the following:

1. **Prepare diligently outside of class and come to class ready to work.**
  - a. Get an early start on all class preparation assignments. These are usually posted several days in advance.
  - b. DON'T PROCRASTINATE on class preparation by waiting until the night before they are due. The ideas in MTH 410 are abstract and take time to settle. You can't force understanding of them on a tight time frame.
  - c. If you get stuck preparing for class, ask for help -- email me, work with a friend, whatever.
  - d. Review your preparatory work and prepare questions before arriving at class.
2. **Actually come to class.**
3. **When in class, be engaged and active in your learning.** This means:
  - a. Use what you learned in your class preparation to extend yourself to a harder problem.
  - b. Make effective use of the class environment to ask questions of your friends and me, and seek help where you need it and give help to others.
  - c. Choose to avoid inappropriate distractions in class such as Facebook or texting.
4. **Also be engaged and active in your learning after class.** This means:
  - a. Come to office hours, make appointments, or send email when you get stuck on a problem or have a question about something. I *expect* you to come to office hours; it's not something you do as a last resort.
  - b. Spend at least 3 hours outside of class for every hour you spend in class, so roughly 9 hours a week just on MTH 410.
  - c. The time you spend on MTH 410 is to spent *purposefully*, with a plan for what you will do and when you will do it as well as a plan for getting help if you get stuck.
5. **Adopt a "growth mindset" for your intellectual development.** According to Carol Dweck, the psychologist who coined this term, those with a "fixed mindset" believe their basic qualities such as intelligence or mathematical skill are fixed quantities. On the other hand those with a "growth mindset" believe that these basic qualities can be improved through dedication and hard work, and when they fail at something, they take it as a learning opportunity and get better by learning from their mistakes. (More at <http://edglossary.org/growth-mindset/>.)
6. **Practice self-regulated learning.** This means that you are paying attention not only to what you are learning but how you are learning it, and you are not dependent upon the instructor or anyone else to learn things. It means in particular:
  - a. Be aware at all times of what you are supposed to be learning.
  - b. When you work, work purposefully on activities that show where your learning is in relationship to the learning objectives for the course. Some of these activities are ones that you take on yourself, or you make them up yourself, even if no grade is involved
  - c. If you know there's a gap between your abilities and the learning objectives, take initiative to find things that will help you close it.

**I want you to be successful!** It is very easy in MTH 410 to cooperate with me on this by doing these things.

## Course Information and Policies

**Contacting the Instructor:** You can reach me by email at [talbertr@gvsu.edu](mailto:talbertr@gvsu.edu), and this is the best way to reach me. Please note that to respect time with my family, I typically do not answer email between 6pm and 6am unless it is urgent. You can also find me on Twitter at <http://twitter.com/RobertTalbert>, on Google+ at <http://google.com/+RobertTalbert>, and on Github at <https://github.com/RobertTalbert>. My office phone is (616)331-8968.

**Office hours:** Monday and Wednesday from 2:30--3:30, and Friday from 1:00--3:00; other times by appointment. If these times don't work, you can schedule an appointment with me; if there's no acceptable appointment time, just send me an email. Appointment time slots are typically 15 minutes long. When visiting office hours or appointment times, please plan ahead and bring a list of specific questions you'd like to ask. If your question is about a problem on a Learning Module, please come prepared to discuss the work you have already tried. Also please be advised that I do not proofread work on Learning Modules before they are submitted.

**Prerequisite:** Successful completion of MTH 310. This course assumes and requires a working knowledge of MTH 310 including the basics of rings and experience with working with abstract algebraic structures. Additionally, a strong proficiency with abstract mathematical reasoning and writing from MTH 210 (Communicating in Mathematics) is required. If you have a concern about your preparation for the course, please discuss it with me.

**Textbook:** *Abstract Algebra: An Inquiry-Based Approach* by Hodge/Schlicker/Sundstrom (1st edition).

**Announcements and Assignments:** All announcements and assignments will be given in class, posted on the course Blackboard site, and/or sent through email. You are responsible for checking your email twice daily and checking for all such announcements, including those given during classes in which you are absent or late. Please make sure to check Blackboard and your GVSU email address regularly.

**Important dates:** There will be no class on Monday, January 19 (due to the Martin Luther King, Jr. recess) and during the week of March 2--6 (Spring Break). Also, the last day to drop the class and receive a grade of W is Friday, March 6; note that this is during the week of Spring Break.

**Attendance/Makeup policy:** You are expected to attend each class meeting unless your personal health or external circumstances (e.g. severe weather) prohibit it. If you miss a class meeting, you are solely responsible for the material discussed in class. If you miss a concept check or timed assessment period, you can get a makeup provided you spend a token (described elsewhere in the syllabus) and provided you contact me to arrange this makeup within 24 hours of the absence and provided that I approve your request. Makeups will be done at my discretion and on my schedule. Makeups for the final exam session are not allowed except in instances of documentable emergencies and severe illnesses; i.e. you cannot spend tokens to make this session up. Please contact me before class if you are going to miss a timed assessment period. Finally, I reserve the right to allow or disallow any makeup request based on the circumstances.

**Collaboration and Academic Honesty:** The policy for MTH 410 is as follows:

- You may collaborate with other students on class preparation assignments and any practice problems given in class. You may collaborate and use technology as much as you wish, and no disclosure of your collaboration is necessary.
- You may not collaborate with other students on timed assessments (Concept Checks and CORE-M problems done during timed assessment periods).

- For work on Learning Modules: you **may not** collaborate with any other student or seek help from any source other than your instructor and your textbook (including but not limited to tutors, other students, other textbooks, and internet resources such as Yahoo! Answers and Stack Exchange). **You may not discuss these problems in any way, shape, or form with anyone other than your instructor.**
- Enabling another student to violate these rules, or providing help to another student in violation of these rules, is a violation of the rules.
- For any assignments not listed here, assume that no collaboration is allowed.
- **The minimum penalty for plagiarism or inappropriate collaboration is a No Pass grade on the affected assignment and an elimination of any further chances to revise the work. In especially egregious cases, the penalty can be significantly more severe, up to and including automatic failure of the course and possible suspension from GVSU. In addition, all violations of academic integrity will be reported to the Dean of Students and the Dean of the College of Liberal Arts and Sciences.**

**Special Needs:** If you have special needs because of a physical, learning, or other type of disability, please feel free to discuss this with me. Furthermore, if you have a disability and think that you may need help evacuating our classroom or building in an emergency situation, please let me know so that I can develop a plan to assist you. For additional resources, please contact Disability Support Resources at (616)331-2490 or online at [www.gvsu.edu/dsr](http://www.gvsu.edu/dsr).

## Assessment and Grading

This course uses a points-free, competency-based assessment system that differs from traditional points-based systems in some very important ways. It is designed to provide you with control over the grading process, transparency as to your progress toward a course grade, and a final course grade that truly reflects your actual mastery of course concepts.

**Learning Objectives:** The entire course is organized around a list of Learning Objectives that specify individual tasks that demonstrate mastery of various items in the course. These objectives fall into three categories:

- **Concept Check (CC)** objectives that address basic terminology, results, and computations;
- **Module (M)** objectives that address higher-level tasks such as analysis, application, and creative work through programming or proof writing; and
- **Core Module (CORE-M)** objectives, which are a subset of the list of M objectives that are especially important for the course.

There are 30 CC objectives, and 37 M objectives, -- and 24 CORE-M objectives within the list of M objectives -- in the course, a full list of which is provided on the course Blackboard site. **The object of the course for each student is to demonstrate mastery on as many learning objectives as possible.**

**Ways of assessment:** Your mastery of the learning objectives is measured through different means:

- Mastery of the CC objectives will be assessed through **Concept Checks**, which are quizzes given roughly once a week in class.
- Your mastery of the M objectives will be assessed through **Learning Modules**, which are bundles of problems that are grouped around a particular theme and done individually outside of class. There are nine modules based on the content of the course plus two additional modules (Getting Started and Tech Competency). There are twelve Learning Modules planned for the course.
- Finally, your mastery of the CORE-M objectives will be assessed through **problems** (one problem for each CORE-M objective) done during **timed assessment periods** in class.

Additionally, all students will complete **Class Preparation** assignments to ensure adequate preparation for each class. Class Preparation involves reading the textbook, working with simple exercises and examples, and submitting work on these plus questions you have. At the beginning of each class meeting, one student will be selected to present his or her work on the Class Preparation and lead a discussion on the material.

**Method of marking:** Generally speaking, each assessment item is marked on a two-level scale: either **Pass** or **No Pass**, on the basis of whether or not the work satisfies a list of specifications for acceptable work.

- For *Class Preparation*, you receive a mark of **Pass** if (and only if) each item you are asked to submit provides evidence of a good-faith effort to give a correct answer. If you are asked to present your work, a successful presentation consists of presenting legible work that results from a good-faith effort, and you are able to answer questions about your work and field questions from others.
- On *Concept Checks*, each CC objective is assessed by a single item to be completed. These usually are objective items such as stating definitions, multiple-choice, true/false, fill-in-the-blank, or simple calculations where only the answer is checked. You will **Pass** a CC objective if you answer correctly, and receive **No Pass** otherwise.
- On *CORE-M objectives assessed during a timed assessment period*, each individual objective is given a separate problem to work that assesses it. Your work is marked **Pass** or **No Pass** using a simplified list of specifications based on the larger list of specifications for Modules.
- On *Learning Modules* (untimed), we use a three-level scale: **Pass**, **Progressing**, or **No Pass**. A mark of **Pass** is reserved for a submission for a module that meets the specifications for professionally acceptable

work throughout the entire submission. A mark of **Progressing** is for work that meets many of the specifications but has a small number of critical errors or otherwise fails to meet specifications -- but it's close. **No Pass** is given to work that does not reach the level of **Progressing**.

**Timed assessment periods:** At four different times during the semester, we will set aside the entire class period for you to attempt problems aimed at the 24 CORE-M objectives. Before each timed assessment period, you will be surveyed as to which CORE-M objectives you would like to be assessed on during that period. You may attempt as many or as few as you like. For all the ones you select, you will receive a problem that assesses that CORE-M objective. If your work on a timed problem is **Passing**, then you have demonstrated mastery on that learning objective, and you will not be tested on it again. If your work does **Not Pass**, then you can elect to try a new instance of that problem at a later timed assessment period. You may also elect to be re-assessed on CC objectives during timed assessment periods if you have not passed some of those; as with CORE-M objectives, you will need to specify which CC objectives you want to be assessed on in advance.

The table below shows the requirements necessary for each letter grade. To earn the grade listed in each row, a student must satisfy ALL the criteria in that row.

To earn grade of:	Pass this many CC objectives (30 max):	Pass this many CORE-M objectives (24 max):	Pass these Learning Modules:	Meet this Class Preparation:
<b>A</b>	30	22	Getting Started + Applications + 11 additional Learning Modules	Complete at least 75% of CP; and One successful CP presentation
<b>B</b>	25	20	Getting Started + Applications + 9 additional Learning Modules*	Complete at least 75% of CP; and One successful CP presentation
<b>C</b>	20	18	Getting Started + 7 additional Learning Modules*	Complete at least 75% of CP; and One successful CP presentation
<b>D</b>	15	16	Getting Started + 6 additional Learning Modules*	Complete at least 50% of CP

\* At least one of the additional Learning Modules for a grade of B, C, or D must be from the “Rings and Ideals” grouping.

#### Earning plus/minus grades:

- To earn a “plus” grade for a letter: Meet all the requirements for the letter plus **either** the required number of CC and CORE-M objectives for the next level up, **or** the required Learning Modules for the next level up. Note: Grand Valley State University does not award a grade of A+.
- To earn a “minus” grade for a letter: Meet all the requirements for the letter **except** for **exactly one** of the following: the required number of CC objectives, **or** the required number of CORE-M objectives, **or** the

required number of Learning Modules. The category not met must meet the requirements for the next lower letter, and only one category can fail to be met.

- The exception to the minus rule is for grades of D; Grand Valley State University does not award a grade of D-, and if **any of the requirements for a D are not met, the graded awarded will be F.**

**Partial credit:** Note that **partial credit is not awarded on any assessed item.** Rather, your work is given a mark based on whether, in my best professional judgement, it meets the appropriate specifications for acceptable work.

**Revision:** Much of the work in the course can be revised and resubmitted in the case of non-Passing marks. Concept Checks and CORE-M problems that are not passed during a Concept Check or timed assessment period can be re-attempted in a later timed assessment period with no penalty. For Learning Modules, *a submission for a Learning Module must receive a mark of **Pass** for it to count toward the grade requirements.* However revision of Learning Module work is allowed:

- Learning Module submissions marked **Progressing** may be revised without penalty.
- Learning Module submissions marked **No Pass** may be revised by spending a token (see below).

Some limitations on revision are in place: You are allowed a maximum of three submissions of Learning Module work in any given week, where a “week” is defined to begin at 12:01am every Sunday and end at 11:59pm the following Saturday. (So for example, you can submit two new submissions and one revision in a week; or three revisions; but not three new submissions and one revision.) In order to avoid running out of revision attempts in a week, you must pace yourself and not procrastinate.

**Tokens:** Each student will be given five “tokens” at the beginning of the semester. Each token can be cashed in for one of the following:

- A do-over on a Learning Module that received a **No Pass** mark. (Learning Module submissions marked **Progressing** can be revised “for free”.)
- A 24-hour extension on a deadline.
- You may also spend a token to make up a missed timed assessment period or concept check, provided that you make a good-faith effort to contact me about this makeup within 24 hours of the miss. Also, I will only approve makeups of timed assessment periods for serious causes; frivolous makeup requests, for example for oversleeping or simply missing because you felt like it, may or may not be approved. *This does not apply to the final exam session (below)* for which there are no makeups except in cases of extreme emergency.

Opportunities to earn additional tokens may be given during the semester. (For example, you will have such an opportunity on the Getting Started module.) Suggestions for other uses of tokens are always welcome.

**Final exam:** There is no final exam for this course. Instead, the entire 110-minute final exam period will be used for you to re-attempt any CC objective or CORE-M objective that you have not passed yet. Each CC or CORE-M objective that has not been passed may be re-attempted during the final exam period only once, but you may re-attempt as many of these objectives as you need. If you are satisfied with your situation regarding CC and CORE-M objectives prior to the final, you are not required to attend the exam session.

**Appealing marks on your work:** If you believe that your work has truly met the specifications for acceptable work but it did not receive a Pass mark, I encourage you to schedule an appointment with me to discuss it. I will ask you to make a case for why your work satisfies the specifications, and I will carefully and respectfully consider your case. No tokens need to be spent for this. However, make sure that you have a legitimate case to make and are not frivolously asking for credit.

### Course Calendar (tentative)

Week	Topics	Monday	Wednesday
1	Startup and Symmetry	Jan 5 Startup presentations	7 CP 19
2	Introduction to Groups	12 CP 20.1	14 CP 20.2
3	Integer powers of elements in a group	19 MLK recess - NO CLASS	21 CP 21 CC #1
4	Subgroups; Subgroups of cyclic groups	26 CP 22	28 CP 23
5	Dihedral and symmetric groups	Feb 2 CC #2 CP 24/25	4 Timed assessment period
6	Cosets and Lagrange's Theorem	9 CC #3 CP 26.1	11 CP 26.2
7	Normal subgroups and quotient groups	16 CC #4 CP 27.1	18 CP 27.2
8	Products of groups	23 CP 28	25 Timed assessment period
March 2--6: Spring Break (Last day to drop with W = March 6)			
9	Group isomorphism and invariants	Mar 9 CC #5 CP 29.1	11 CP 29.2
10	Homomorphism and isomorphism theorems	16 CC #6 CC 30.1	18 CC 30.2
11	Sylow Theorems	23 CC #7 CP 31/32/33	25 Timed assessment period
12	Rings and Ideals pt 1	30 CP 16.1	Apr 1 CC #8 CP 16.2
13	Rings and Ideals pt 2	6 CP 16.3	8 CC #9 CP 16.4
14	Finishing up + debrief	13 Timed assessment period	15 Course debrief