

MA 109
Essential Mathematics for Teachers
2023–24 First Semester

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Welcome, future Christian teachers! I hope that this course will give you the foundation and skills that you need to approach teaching math to your future students with confidence and enthusiasm, inspiring them to view the subject with confidence and enthusiasm as well!

Course Description

This course will give you an overview of mathematics properties, processes, and symbols used by teachers on the elementary/middle school level. Some topics covered will be problem solving and reasoning, sets, number theory, ratios and proportions, and the real number system.

Course Readings

Mathematics for Elementary School Teachers, Ricardo D. Fierro. 1st Edition. Cengage Learning.

Context

The faculty of the Division of Mathematical Sciences has developed five broad goals and has aligned these goals with the Bob Jones University Institutional Goals (IG) and the goals of the BJU Core (BJUC). We believe these goals support the IG/BJUC of the University. The Division Goals (DG) are designed to develop each student to:

1. Understand the essential theory of mathematics/computer science and appropriately apply the theory in solving problems.
2. Use critical-thinking/analytical skills.
3. Understand mathematical/computing problems and design solutions with the aid of appropriate tools.
4. Apply an understanding of how mathematics/computing can be used in service to Christ as tools to the examination of the world He created.
5. Construct a foundation upon which they, after graduation, can continue the development of their God-given abilities and the learning necessary for his work and life.

Because this course is required by the Education department for several of its majors, it also supports the following Education Department goals (EG):

The student will ...

1. Demonstrate a knowledge of content and pedagogy to be effective teachers.
2. Create short- and long-range plans that consider the needs of diverse learners using a variety of instructional strategies and appropriate assessments.
3. Demonstrate the ability to have a positive effect on student learning.

Course Goals (CG)

1. To develop content skills in the area of elementary/middle school mathematics. (DG 1, 2, 3 and EG 1)
2. To develop an understanding of the reasoning and modeling used when performing operations on numbers in our number system. (DG 1, 2, 3 and EG 1)
3. To develop communication skills in regard to elementary/middle school level mathematics. (DG 4, 5 and EG 1, 3)
4. To develop a love of mathematics in its consistency and accuracy which point to our Great Creator. (DG 4, 5, and EG 3)
5. To work in collaboration with others on completing group assignments that will develop mathematical reasoning skills. (DG 2, 4, 5 and EG 1, 3)

Course Objectives:

Some of the specific skills I hope you will obtain in this course are listed below. Upon completion of this course, you should be able to ...

1. Demonstrate competence in problem solving using inductive and deductive reasoning as well as algebraic reasoning. (CG 1, 2, 4) (Evaluated in Chap 1 Test and Final Exam)
2. Identify numbers, ways of representing numbers, relationships among numbers, and sets of numbers in our number systems. (CG 1, 2, 3) (Evaluated in Chapter 2&3 Test and Final Exam)
3. Develop concepts of counting and numerical relationships including cardinality and order. (CG 1, 2, 3) (Evaluated in Chapter 2&3 Test and Final Exam)
4. Define the four arithmetic operations, state the meaning of the operations, how they relate to one another, and identify those operations in the context of various models. (CG 1, 2, 3, 5) (Evaluated in Chapter 2&3 Test, Chapter 4&5 Test and Final Exam)
5. Demonstrate competence in base ten algorithmic calculations, including estimation and compute fluently with whole numbers, integers, rational numbers as both fractions and decimals, and real numbers. (CG 1, 2, 4) (Evaluated in Chapter 1 Test, Chapter 4&5 Test, Chapter 6 Test and Final Exam)
6. Know the meaning of divisibility and the divisibility tests. (CG 1, 2, 3) (Evaluated in Chapter 4&5 Test and Final Exam)
7. Compute the greatest common divisor and least common multiple of whole numbers. (CG 1, 2) (Evaluated in Chapter 4&5 Test and Final Exam)
8. Demonstrate an understanding of the real number properties by identifying which properties are used in a computation. (CG 2, 3) (Evaluated in Chapter 2&3 Test and Final Exam)
9. Model and solve ratio and proportion problems including the solution of problems using percent. (CG 1, 2, 3, 5) (Evaluated in Chapter 4&5 Test and Final Exam)
10. Work in groups with several of your classmates in order to explain mathematical solutions and to give mathematical instructions to elementary level students. (CG 3, 4, 5) (Evaluated with the Group Activities)

BIBLICAL MANDATE FOR THIS COURSE

The source of wisdom and knowledge is the Lord, and a keen mind is a gift from God. It is my hope that mathematical study will show you the greatness of God and increase Christlikeness in you (Colossians 1:17 and Philippians 2:5). God has given man the capacity to reason mathematically and expects you to be able to reason logically (Isaiah 1:18). The study of mathematics helps to develop your God-given ability to reason. As a Christian, you need to be able to discern truth and filter ideas through a biblical worldview. Also, mathematics is the study of the underlying structure of the universe and its intelligent design. Mathematics is an avenue of studying the God-created universe in its complexity, harmony, and precision. Math is a tool that can help you fulfill the God-given mandate found in Genesis 3:28 to exercise dominion over the earth.

The study of mathematics from a Christian perspective will help you to better know God and imitate Him more closely. You can see the consistency of God in the consistency of His universe. Because of this consistency, we can model a physical law and study it through mathematics. The study of mathematics can also help you to develop Christ-like character traits such as diligence, honesty, precision, perseverance, and humility.

Daily Expectations for Effective/Efficient Study:

Before class: Take a few minutes to look over what the next lesson will cover. Ask yourself (1) Is this a concept that I already know? (2) How was I taught to do this particular function? (3) Are the concepts presented here like the way I learned or possibly different? (4) Which way do I find easiest to understand/explain?

After class: Take a few minutes to look over your notes. Are the important terms/concepts there? Are the procedures that were presented in class clear to you? Could you teach them to someone if needed?

Course Requirements

1. Proficiency Test

You will be required to demonstrate competency in the essential skills of elementary mathematics. Competency is defined as at least 80% of the problems completed correctly on the proficiency test. **No calculators are allowed on this test.** You will have three attempts to pass the test. You will be given a Proficiency Test Practice Sheet prior to taking Proficiency Test 1. If you fail to pass the Proficiency Test after 3 tries your overall grade will be lowered one letter grade.

2. Homework

Homework problems are assigned for each section. Here are some tips for completing homework successfully:

- Try to complete the homework problems before the next class period after a section is finished.
- You are welcome to work together with classmates on the solutions.
- If you get stuck on a problem, leave space for it, and go on to the next one. There are many ways to get help outside of class (see next page). I will also be happy to take some time in class to work through problems that students are struggling with.
- You should make it a practice to do your work neatly and completely on full-sized notebook paper, working down the page (don't try to put 2-3 columns of work on the page—it is too crowded.) Be sure to number the problems and leave space as appropriate between problems as well for easy readability.
- Don't just turn in a list of answers—I already know the answers! Your job is to show the thinking that led you to the answers—convince me that you know what you are talking about. You should also be thinking ahead to your future students. Clear and complete explanations will be vital for their understanding.
- Part of the assignment is checking to make sure your answers are correct and fixing any that are not correct. There is a key with the answers available in Canvas. A fuller Solutions Manual with explanations of how to arrive at the answer is available in the Math Lab.

Homework will be assessed by a 10-point student reflection that will be due in Canvas before class on days indicated on the Course Schedule. You will report what percent of the assigned problems that you completed, checked, and corrected. For the first chapter, you will also need to upload pictures of your finished homework pages. After that, you will not need to upload your work unless the teacher asks you to.

Note that after the first test, students who earned an A on the previous test will automatically get full credit for the homework. So homework is more or less optional for them, though they still have to do the reflection. But A students know that the best way to *maintain* an A in the class is to be faithful to do their homework!

3. Activities

I have developed class activities to be helpful in reinforcing the concepts found in the textbook. As a future teacher of mathematics, you need to know that mathematics is not a spectator sport. You cannot learn mathematical ideas solely by watching someone else present them. Instead, you need to learn to actively think through mathematical ideas. By discussing mathematical ideas and explaining the solution methods to one another, you can deepen and extend your understanding of mathematics.

The class will be broken into small groups to do activities. Sometimes you will have time in class to work together, but you may need to get together outside of class. If meeting in person is not convenient, consider using a tool like Microsoft Teams to “meet” online.

For each activity, one activity per group will be **turned in at the beginning of the class** on the indicated day on the schedule. All students in the group are expected to contribute to the solutions. All participants will receive the same grade. Non-participants will receive a zero on that activity. Each Activity will be worth 10 points. There will be a total of 6 graded activities. The lowest grade will be dropped making your activity grade worth 50 points.

4. Article Readings

There will be 4 article reading assignments this semester. These articles will look at various topics on teaching mathematics and will include a summary activity to be turned in to Canvas before midnight on the day assigned. Each Article will be worth 10 points.

5. Bonus

The Review Questions at the end of each chapter may be completed and turned in the day of the test for 3 bonus points each. The assigned problems will be listed in the Homework section, and for these you will be required to turn in the actual work pages—either by handing them in in person or uploading pictures of the finished pages to Canvas. You must turn in your bonus work before the test to receive credit.

6. Tests

- a. 4 Unit Tests—100 points each
- b. Final Exam—150 points

Where to seek help for this class

- 1. Talk to your teacher during an office hour or make an appointment for non-office hour.
- 2. Study with another student in your class.
- 3. Visit the Math Lab in MB 201 (top of the stairs) on 2nd floor of the Mack Building. It is a free service and is open all of the hours that the library is open. The HW solutions manual is in the Math Lab.

Grading

Item	Pts.	Total	Scale	
Homework	10 each	60	90–100	A
Activities	10 each	50	80–89	B
Article Readings	10 each	40	70–79	C
Unit Tests	100 each	400	60–69	D
Final Exam	150	150	59 ↓	F
Total Points		700		

Cell Phones and Laptops

Keep your cell phone muted or off during class. The cell phone should be placed in your bag or pocket unless you are aware of an emergency call that might be coming. In that case, be sure to let your teacher know before the start of the class. There is little reason why a laptop should be used during a math class. You should have pencil, paper, and your textbook out and ready to use in class. If for some reason you have a legitimate need of a laptop in class, please see your teacher and we will discuss this need.

Attendance Policy

I want you to be successful in this class. The main sources of learning are the daily classroom activities and related discussions. Therefore, you are expected to attend and arrive on time for all class sessions. You will be held responsible for all information from each class session, whether you are in attendance or not.

There are two types of absences allowed by the University Attendance Policy (see the Student Handbook for details):

Personal Absences are for funerals, sickness, doctor’s or dentist’s appointments, visits and interviews at graduate school or for interviews for future employment.

Personal absences are **not “skips”**. They are not provided so that students can prepare for other classes or to extend official university breaks or simply because they do not feel 100% well (of course if you have a fever or any such symptoms I prefer that you not come to class!). *For a MWF class you are allowed 3 Personal Absences.*

Service Absences may be used to attend approved academic functions or conferences, approved Christian service projects, required military duty or as part of an intercollegiate athletic team. However, students who exceed the Personal Absence limit due to a chronic illness are not eligible to participate in events that require Service Absences. *For a MWF class you are allowed 4 Service Absences.*

For an excused planned personal or service absence, you are expected to **notify your teacher at least one week ahead of time**. Please do so by e-mail. Homework should be turned in and scheduled tests should be taken before your planned absence. If you do not turn in your work or take the test prior to your absence, a penalty will be applied to your grade.

For absences due to incapacitating illness or emergency, you should **contact your teacher as soon as you are able**—within **24 hours** at the latest. When you contact your teacher, we will make arrangements for you to turn in homework and make up any test that you may have missed without penalty.

For an unacceptable absence (to work on an assignment, to study for a test, to visit with friends, etc.), no class work may be turned in resulting in a **0 for homework assignments**. You will receive a **10% penalty on a missed test**.

Partial Attendance marks will also contribute to your overall total Personal Absences. Part of your training for life while in college is to develop professional habits like being on time for required events and not leaving early just because you want to. Thus, the attendance policy includes partial absences that will be accrued if you arrive up to 15 minutes after the start of class or leave class up to 15 minutes early. *Three Partial Attendance marks will count as a Personal Absence.* If you miss more than 15 minutes of class you will be counted as absent.

Cheating

Cheating is defined as any use of unauthorized helps. In today’s age of technology, this includes getting unapproved help from a source on the internet (including generative AI tools such as Chat GPT, Bing Chat, etc.) and/or using your calculator to store formulas or information that you are to know from memory. If you have a question about any source you are considering using, please gain teacher approval before using it. The presence of any material on your desk containing formulas, notes, etc. (except those allowed by the instructor) while taking a test, will be construed as cheating and will be dealt with as such. Cheating on a test will result in a zero on the test plus any penalties imposed by the university.

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MA 109 Course Tentative Schedule: Fall 2023

Homework (HW) and Activities are due on the date listed.

Article instructions found on Canvas (listed as Article Reading Assignments)

Schedule subject to change. See Canvas Syllabus for the most up-to-date schedule.

Date	Day	Class	Due dates
Aug 23	W	Course Introduction	
Aug 25	F	Begin chapter 1	
Aug 28	M		
Sept 30	W		
Sept 1	F		
Sept 4	M	Labor Day, No Class	
Sept 6	W	Activity 1	Article 1 Due
Sept 8	F	Catch-up/Review	Activity 1 Due
Sept 11	M	Test: Chapter 1	HW Reflection 1 Due
Sept 13	W	Begin chapter 2	Article 2 Due
Sept 15	F		
Sept 18	M		
Sept 20	W		
Sept 22	F		
Sept 25	M	Activity 2	HW Reflection 2 Due
Sept 27	W	Begin chapter 3	Activity 2 Due
Sept 29	F		
Oct 2	M		
Oct 4	W	Activity 3	
Oct 6	F	Catch-up/Review	Activity 3 Due
Oct 9	M	Begin chapter 4	
Oct 11	W	Test: Chapters 2 & 3	HW Reflection 3 Due
Oct 13	F	Proficiency Test 1	
Oct 16	M	Fall Break, no class	
Oct 18	W		Article 3 Due
Oct 20	F		
Oct 23	M		
Oct 25	W	Activity 4	HW Reflection 4 Due
Oct 27	F	Begin chapter 5	Activity 4 Due
Oct 30	M		
Nov 1	W		
Nov 3	F	Activity 5	
Nov 6	M	Catch-up/Review	Activity 5 Due
Nov 8	W	Test: Chapters 4 & 5	HW Reflection 5 Due
Nov 10	F	Begin chapter 6 with section 5.4	Article 4 Due
Nov 13	M		
Nov 15	W		
Nov 17	F	Proficiency Test 2 (if needed)	
Nov 20-24		Thanksgiving Break	
Nov 27	M		
Nov 29	W		
Dec 1	F	Activity 6	
Dec 4	M	Catch-up/Review	Activity 6 Due
Dec 6	W	Test: Chapter 6 + 5.4	HW Reflection 6 Due
Dec 8	F	Final Exam Review	
Dec 12	T	Final Exam	9:30-10:40 am

Homework Problems

1.1: 2, 3, 5, 7, 8, 9, 10, 11, 12, 15, 16, 19, 20, 22, 24, 25, 31, 34, 36, 39, 41, 42, 48, 50 (24 problems)

1.2: 4, 8, 9, 13, 14, 18, 19, 21, 23, 25, 28, 31, 33, 38, 40, 47 (16 problems)

1.3: 1, 2, 3, 5, 7, 9, 12, 15, 16, 19, 20, 23, 24, 26, 29, 31, 33, 35, 38, 44, 46, 53, 55 (23 problems)

1.4: 1, 2, 4, 6, 8, 9, 11, 13, 14, 16, 18, 20, 22, 24, 25, 28, 30, 31, 32, 37, 39, 40, 42, 43 (24 problems)

Bonus Review Exercises Ch 1: 2, 4 (a), 6 (a, b, c), 11, 13, 14, 16, 17, 20, 23, 25, 28, 30, 32, 33, 35, 37, 38, 40, 41, 42, 43, 44, 45, 50, 52 (26 problems)

2.1: 1, 3, 5, 8, 9, 10, 11, 14, 15, 17, 20, 21, 24, 25, 27, 28, 30, 32 (d), 34, 39, 43, 46 (22 problems)

2.2: 2, 3, 4, 5 (a), 8, 13, 18, 19, 26, 27 (a), 28 (b), 29 (b), 30 (a), 31, 35, 36, 39, 40, 42, 44, 45, 48, 49, 55, 56, 61, 62 (27 problems)

2.3: 1, 2, 3, 5, 7, 11, 13, 19, 22, 36, 38, 39, 40, 42, 44, 45, 46, 49, 52, 53, 54, 55, 58, 62 (24 problems)

2.4: 1 (a, c), 2, 3, 5, 11 (a), 14 (a, b, c), 15, 16 (a), 17 (a), 18 (a, b), 21, 22, 24 (a, c), 27, 29, 31 (b), 32 (c), 36, 38, 39, 42, (a, b) 43 (a, b), 46, 47, 50 (a, c) (25 problems)

3.1: 1, 4, 5, 6 (a), 8, 11, 13, 17, 19, 20, 21, 23, 25, 29, 30, 31, 33, 34, 35 (d, e, f, g), 37, 39, 41, 44, 48, 51, 57, 58, 61 (28 problems)

3.2: 1, 2, 4, 5, 6, 7, 10, 11, 14, 15, 19, 20, 24, 25, 26 (b), 27 (b), 28 (c), 29, 33, 34, 35 (a), 36 (b), 37, 40, 42, 45, 50, 54, 56 (a), 58 (30 problems)

3.3: 1, 2, 3, 7, 8, 10, 13 (a), 15 (b, c, d), 16 (a, b), 17, 19, 20, 23, 24 (a), 28, 30, 32 (a), 33 (a), 34 (a), 35 (a, b), 36, 37, 42, 43 (a, b), 45, 47 (a, c), 48 (a, c), 51, 52, 55, 58 (31 problems)

Bonus Review Exercises Ch 2: 2, 3, 4, 6, 7, 10, 11, 14, 15, 16, 20, 22, 23, 25, 26, 35 (a, b), 36 (a), 37, 41, 44 (a, b), 48, 49, 52, 55, 59, 60 (26 problems); and **Ch 3:** 2, 4, 6 (a, b, c), 8, 9, 10, 11, 14 (a), 17 (a), 22, 24 (a), 25, 32 (a), 34, 37, 42, 50 (a), 52, 54(a), 56 (a) (20 problems)

4.1: 2, 3, 4, 5, 7, 8, 10, 12 (a, b, c, d, e), 13, 15 (a, c), 16, 25, 26, 30, 32 (a, b, c), 39, 40, 41 (a, b), 42 (a, b), 43 (a, b), 44 (a, b), 45, 48, 50, 56, 57 (26 problems)

4.2: 3, 4, 6, 7, 8, 9 (a), 10, 13, 14, 17, 20, 24 (a, c), 25, 26, 27 (a, b), 30, 32, 36, 38 (a), 39 (a, c), 40, 46 (a), 49 (a, b), 51, 53 (a), 55, 57, 58 (a, b), 59, 63, 64 (b) (31 problems)

4.3: 1, 2 (a, b), 3 (a, b), 4, 5 (a, b), 6, 7 (a, b), 11, 12, 14, 22, 23, 24, 26, 28, 31, 32, 33, 34, 35, 39, 40, 45, 46, 48, 49, 50 (a, b), 51, 55 (a, b), 56, 59 (a, b), 61 (a, b) (34 problems)

5.1: 1, 3 (a, c), 4, 6, 7, 8, 9, 13, 15, 16, 17, 20, 22, 25, 26, 28, 30 (a, b), 31 (b, d), 32 (a), 33 (a, c), 34 (a, c), 35 (a, b), 37 (a, b, c), 38, 41 (a), 44, 46, 48 (a, b), 49 (a, b), 53, 55, 60, 61 (a, c) (33 problems)

5.2: 2, 4, 5 (a, b), 6 (a, b), 7, 8, 9, 14 (a, b, c), 15 (a), 16 (b), 19, 21, 26, 30 (a), 31 (a), 32 (b), 33 (b), 34, 35, 36, 37, 38, 39 (b, c), 41, 42 (a, b, d), 46, 47, 50, 52, 53 (30 problems)

5.3: 1, 2 (a), 3 (a), 4, 5, 6, 8, 9, 13, 14, 16 (c), 17 (a), 18, 19 (a), 22, 28, 29 (a, c), 30 (a), 31 (a), 34, 36, 38, 39, 42, 43 (a, d), 44, 47 (a), 48 (a), 49, 51, 57 (a), 58, 59, 62, 63 (35 problems)

Bonus Review Exercises Ch 4: 4, 6, 8, 14, 15, 23, 28 (a, b), 29 (a), 30, 35 (a, b), 36, 38 (a), 39 (a), 42, 45, 47, 49, 52, 53, 54 (20 problems) and **Ch 5:** 2, 3, 4, 5, 8, 10, 14, 18, 19, 23, 24, 25, 28, 31 (a), 33, 36, 39, 40 (18 problems)

5.4: 1, 3, 4, 7, 10, 13, 15, 17, 18, 21, 23, 24, 27, 29, 32, 33, 34, 35, 38, 40, 42, 44, 45, 47, 50 (25 problems)

6.1: 1, 2 (a, b), 3, 4, 6, 8 (a, c), 9, 10 (c, d), 12, 15, 17, 19, 20, 21 (a, b), 22 (a, b, c), 24 (b), 26, 28, 30 (a), 31 (b), 32 (a), 33, 35, 37, 39, 40, 41, 43, 46 (b, c), 47, 48, 49, 51, 55, 57, 58 (a, c), 59 (a, c), 63 (a, b), 64, 67, 68 (41 problems)

6.2: 1, 5, 6, 7 (a, b), 8, 9, 10, 14, 16, 19, 21, 22, 25, 26, 27, 29, 33, 34, 37 (a, b), 38 (a, c), 39 (a, b), 44 (b, c), 45 (a, b), 47 (b, c), 54, 57, 58, 66 (28 problems)

6.3: 1, 2, 4, 6, 9, 12, 15, 17, 18, 19, 20, 24, 25, 27, 31, 33, 34, 36, 38, 40, 44, 46, 47, 48 (a, b), 49 (a, b), 52, 53, 59, 60, 61, 62 (31 problems)

Bonus Review Questions Ch 5: 43 (a), 44 (a), 45, 47, 49 and **Ch 6:** 3 (a, b), 4, 5, 6 (b), 9, 11, 17, 19, 20 (a), 24, 25, 28 (a, b, c), 29, 30, 32, 35, 36, 39, 42, 44, 45 (26 problems)