MA 110
Foundations of Mathematics for Teachers
Spring 2023

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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 in the same way.

Catalog Description

Foundations of Mathematics for Teachers is a study of mathematical properties, processes and symbols for prospective teachers on the elementary or middle school level. Topics include measurement, the metric system, geometry, congruence, coordinate geometry, transformational geometry, probability, and statistics.

Course Readings

Mathematics for Elementary School Teachers, Richard D. Fierro, 1st Edition, Cengage Learning, ISBN 0-538-49363-1

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 their 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)

In this course, I will attempt to teach future teachers to…
1. Know that which they will teach. Therefore, each student must be able to identify geometric shapes, find basic measurements related to geometric shapes, understand the meaning of motion (transformational) geometry, use functions and basic algebra, and develop an understanding of probability theory and statistics. (DG 1, 2, 5 and EG 1)
2. Be able to communicate the meaning of elementary/middle school level mathematics so that their students can learn with understanding. (DG 3, 5 and EG 3)
3. Develop a love of mathematics in its consistency and accuracy which point to our Great Creator. (DG 3, 4 and EG 3)
4. Work in collaboration with others. (DG 4, 5)

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. Understand the meaning and use of variables and use them to describe a problem or pattern by formulating algebraic expressions. Solve equations and interpret the solutions. (CG 1 and 2) (Evaluated in Chapter 7 Test and Final)
2. Identify and use functions expressed in various forms. Formulate functions in equation form, graph them, and solve for the necessary variable. (CG 1) (Evaluated in Chapter 7 Test, Chapter 13 Test and Final)
3. Develop an understanding of the graphical presentation of data and the interpretation of the information presented by graphs. Compute the measures of central tendency and variability and use them to compare sets of data. (CG 2) (Evaluated in Chapters 8 & 9 Test and Final)
4. Distinguish between empirical and theoretical probability. Compute probabilities for various scenarios. (CG 1) (Evaluated in Chapters 8 & 9 Test and Final)
5. Demonstrate competence in the knowledge of the properties of points, lines, and plane figures. Know the definitions and concepts resulting from a study of curves and polygons in a plane. Develop competence in analyzing the properties and relationships of figures in space. (CG 1 and 2) (Evaluated in Chapters 10 and 11 Test and Final)
6. Perform basic compass and straight edge constructions. (CG 1-3) (Evaluated in Construction Project)
7. Develop an understanding of the meaning and practical use of measurement concepts using both the English and metric systems. Extend linear measure concepts to perimeter, area, and volume in the context of plane figures and space figures. (CG 1-3) (Evaluated in Chapters 10 and 11 Test and Final)
8. Develop an understanding of and competence in using transformations to solve problems and identify patterns and symmetries. (CG 1-3) (Evaluated in Chapter 13 Test and Final)
9. Understand the basic triangle congruence and similarity theorems. (CG 1-3) (Evaluated in Chapter 12 Quiz and Final)
10. Work in groups to explain mathematical solutions and to develop mathematical instruction appropriate for elementary/middle school students. (CG 3 and 4) (Evaluated in 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 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?

In Class: Participate, be excited to learn new ways to think about a topic, think about how you would like to approach the topic when you begin teaching so that your students will be able to proceed with understanding and be successful.

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?

Class Structure

Beginning (First 5 minutes) – DPP (Daily Practice Problems) Most days will begin as soon as you come into the classroom. Slips of paper will be on the front desk, pick one up as you enter the room. There will be two problems on the screen for you to attempt to complete. They will generally be about something we have been working on in class recently. After you hand them in, we will go over the problems.

Introduction (10 minutes) The topic for the day will be introduced and discussed briefly. A few Powerpoint slides may be shown concerning the topic.

Think-Pair-Share (5-10 minutes) You will be asked to think about how you learned the concepts for the day, your success at learning the task, and how you would teach the idea to your students. After thinking about this for a few

minutes, you will compare your ideas with your desk mate. Then I will ask you to share your pair thoughts with a larger group of classmates.

Structured Group Work (15-20 minutes) You will work with your group on a set of problems from your book exercises that I will display on the screen. Please use this time to solidify your understanding of the concepts and procedures to successfully work the problems.

Question and Answer (10 minutes) Please ask me questions any time during the class period but particularly during this closure time. The purpose is to help you feel successful as you work on your assigned homework.

Course Requirements

1. ### 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 with which students are struggling.

   - 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 as 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 have an A in the class going into each test will automatically get full credit for the homework. So homework is more or less optional for them. But A students know that the best way to *maintain* an A in the class is to be faithful to do their homework!

   Late Homework Reflections will reduce your grade by 10% per day.

2. ### Activities
   Class activities have been developed to reinforce 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 other times you will 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 participates will receive the same grade. Non-participates 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.

   Late activities will be reduced by 10% per day.

3. ### Article Readings
   There are four 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 is worth 10 points.

Late article readings will be reduced by 10% per day.

4. **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 during class or uploading pictures of the finished pages to Canvas. You must turn in your bonus work before the test to receive credit.

There will be no late bonus accepted.

5. **Tests**
   a. 5 Unit Tests—60-100 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 section or in the other section.
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	70		90–100	A
Activities	10 each	50		80–89	B
Article Readings	10 each	40		70-79	C
Unit Tests	60-100 each	395		60–69	D
Final Exam	150	150		59 $\downarrow$	F
Total Points		**705**			

Other Policies

Classroom Deportment

The classroom is a professional environment. Students are expected to be respectful to their instructor and peers in behavior, attitude, attire, and use of technology. The instructor has the right to require students who are participating in distracting behavior to leave the class.

Absences

Students who miss more than <u>three</u> lectures may be dropped from the course. Missing more than 20 minutes of any part of a lecture may count as a full absence. Students should notify the instructor by email as soon as possible after an absence (preferably within 24 hours). If the absence is planned, the student should notify the instructor before missing class. Students who are absent are personally responsible to obtain notes from fellow classmates. BJU attendance policy is in effect (see https://home.bju.edu/bju-policies/ for details.

Academic Honesty and Integrity Policy

BJU academic honesty and integrity policy is in effect (see https://home.bju.edu/bju-policies/ for details).

Changes to Syllabus

This syllabus is a guide to course goals and objectives, procedures, requirements, assignments and grading. The instructor reserves the right to amend the syllabus when circumstances warrant.

Tentative Course Schedule (Spring 2023)

HW is due on the date listed. Activities are group assignments. All assignments are due the day that they are listed. All late work will receive a 10% penalty for each calendar day late.

Schedule			
Date	Day	Class	Assignment
1/ 11	W	Course Introduction	
1/ 13	F	Begin chapter 7	
1/ 16	M	MLK Jr. Day	
1/ 18	W		
1/ 20	F		
1/ 23	M	**Activity ch 7**	
1/ 25	W	Catchup/Review	Activity ch 7 due
1/ 27	F	**Chapter 7 Test**	HW Reflection ch 7 due
1/ 30	M	Begin chapter 8	Article 1 Due
2/ 1	W		
2/ 3	F		
2/ 6	M	**Activity ch 8**	HW Reflection ch 8 due
2/ 8	W	Begin chapter 9	Activity ch 8 due
2/ 10	F		
2/ 13	M		
2/ 14 – 17	T-F	**BIBLE CONFERENCE**	
2/ 20	M	**Activity ch 9**	
2/ 22	W	Catchup/Review	Activity ch 9 due
2/ 24	F	**Chapter 8 & 9 Test**	HW Reflection ch 9 due
2/ 27	M	Begin chapter 10	Article 2 due
3/ 1	W		
3/ 3	F		
3/ 6	M	**Activity ch 10**	HW Reflection ch 10 due
3/ 8	W	Begin chapter 12	Activity ch 10 due
3/ 10	F		
3/ 13	M		
3/ 15	W	Catchup/Review	
3/ 17	F	**Chapter 10 & 12 Test**	HW Reflection ch 12 due
3/ 20-24	M	**SPRING BREAK**	
3/ 27	M	Begin chapter 11	Article 3 due
3/ 29	W		Construction Project due (12.2)
3/ 31	F		
4/ 3	M		
4/ 5	W	**Activity ch 11**	
4/ 7	F	Catchup/Review	Activity ch 11 due
4/ 10	M	**Chapter 11 Test**	HW Reflection ch 11 due
4/ 12	W	**UNIVERSITY SERVICE DAY**	
4/ 14	F	Begin chapter 13	Article 4 due
4/ 17	M		
4/ 19	W		
4/ 21	F	**Activity ch 13**	
4/ 24	M	Catchup/Review	Activity ch 13 due
4/ 26	W	**Chapter 13 Test**	HW Reflection ch 13 due
4/ 28	F	Final Exam Review	
May 1 May 3	M(Sec 1 – 8 am) W(Sec 2 – 3:30 pm)	**Final Exam**	

Homework Problems

7.1: 1, 2, 3, 5 (a, b, e), 6 (a, c), 7, 10, 12, 15, 16 (a), 20 (a, b), 24, 27, 28, 30, 31, 36, 40, 41, 42, 45 (a), 51, 54 (23 problems)

7.2: 2, 3 (a, b), 5 (a, c), 6, 7 (a), 9, 11, 17, 18 (a, b), 20, 21, 25, 31, 33, 40, 42, 43, 45, 47, 51 (20 problems)

7.3: 1 (a), 2 (a), 3 (a), 4 (b), 5 (a), 7, 9, 12 (a), 24, 28, 31, 37 (12 problems)

EC Review Questions, chapter 7: 1-2, 5-6, 9, 11-12, 14, 19, 25, 32, 34-41, 43-48 (25 problems)

8.1: 1, 4, 6, 7, 10, 11, 13 (a), 14, 21 (b, c), 29, 33, 34 (b), 39, 47, 49, 54 (16 problems)

8.2: 2, 4, 5, 10, 11 (a), 12 (c), 15, 17 (a), 20, 21, 22 (a), 28, 33, 34, 37, 41, 43, 50 (a), 51, 52, 54 (a), 56 (22 problems)

8.3: 1, 2, 4, 6, 11, 12 (b, c), 19, 21, 22, 24 (a, d), 26, 27, 28 (c), 34, 35 (a), 39 (16 problems)

9.1: 1, 3, 6 (a), 8 (b, d), 10, 12, 17 (b), 19, 21, 23, 30, 31, 34, 36, 41, 43, 45, 48, 61 (a), 62 (c), 67 (21 problems)

9.2: 4, 5, 8, 13, 15, 18 (a, b), 19, 23, 25, 26, 30, 35, 39, 42 (b), 44, 48 (16 problems)

EC Review Questions, chapters 8 & 9: ch 8 – 2, 3, 4, 5, 8, 10, 13, 18, 20, 24, 25, 29, 31, 32, 35, 38, 40, 41, 44, 45, 48 (21 problems) ch 9 – 1, 3, 4, 6, 10, 12, 14, 16, 18, 20, 22, 23, 26, 27, 28, 29, 30, 32, 34 (19 problems)

10.1: 1, 3, 6, 10, 12, 13, 15, 18, 20, 21 (b), 23 (a, d), 33, 34 (a), 35 (a), 36 (a), 37, 39, 44, 46 (19 problems)

10.2: 2, 4, 8, 9 (a), 11, 12, 14, 16, 19 (a), 21, 24, 27, 30, 31, 35 (a, c, e), 37, 38, 41, 47, 49, 53, 54, 59, 62 (24 problems)

10.3: 2 (a, c, e, g, h), 5 (b), 8 (b), 9 (a, c, e, g, h), 10, 13, 14, 19, 20 (a, b, c, d), 26, 32, 37, 42, 43, 50, 51 (16 problems)

12.1: 1 (c), 3 (a), 4 (a), 5 (b, c, e), 7, 9, 11, 12, 13 (a, c), 17 (a), 18 (b), 24, 27, 34, 35 (a), 41, 42, 43 (a) (18 problems)

12.3: 1, 3, 4, 5, 9, 12, 13, 15 (a), 17, 23, 31, 39 (a, c) [error in the problem; should say, the two given triangles are <u>similar</u> not congruent.], 40, 42, 46, (15 problems)

EC Review Questions, chapters 10 & 12: ch 10 – 5, 8, 10, 11, 13-15, 17, 18, 20-22, 24-26, 29-33, 38, 40, 41, 44 (24 problems) ch 12 – 1, 6, 8, 11, 12, 15, 28, 33, 37-40, 43-46 (16 problems)

11.1: 2, 4, 6 (b, d), 9, 11, 14, 16, 17, 19, 20, 23, 29, 30 (a), 34, 37, 39, 42, 45, 48, 50, 55 (a), 56, 59 (a, d) (23 problems)

11.2: 7, 8 (a, c), 12, 14, 16, 19, 21, 23, 25, 28, 30 (d), 38, 41, 42, 53, 58, 61 (a), 63 (a, c), 68 (19 problems)

11.3: 1, 4, 5 (a), 7, 9 (a), 10, 11 (a), 14 (a, b), 15, 16 (a, c), 20, 23, 31, 33 (c), 34, 37 (a, c), 39, 43 (a), 45 (19 problems)

11.4: 1 (a), 5 (c, d), 7 (c, d), 8, 10, 11, 16, 20 (c, d), 22 (a, c), 24, 27, 37 (c, d), 39 (c, d), 42 (c, d), 51, 52, 54 (17 problems)

EC Review Questions, chapter 11: 4, 5, 7, 9, 10, 12, 14, 16, 18, 20, 21, 23 (a,b), 28, 29, 31, 33, 34, 37, 38, 39, 40, 41, 42, 43, 48, 49, 51, 52, 53, 57 (30 problems)

13.1: 1, 2, 3, 6, 9 (a), 10 (a), 11 (a, b, d), 17, 19, 21, 22, 24, 28, 29, 30, 34 (a, c), 36 (a), 37 (b), 39 (a), 41 (a), 43, 47 (a, d, e), 49 (23 problems)

13.2: 1, 4, 5, 10, 13, 16 (a), 20, 21, 26, 27, 30, 31 (a), 33, 40, 42 (a), 47 (a) (16 problems)

13.3: 1, 2, 3, 5, 7, 8, 10, 11, 17, 20 (a), 22 (c), 27 (a, b), 35, 45, 46, 58 (16 problems)

EC Review Questions, chapter 13: 1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 24, 25, 26, 29, 32, 34, 42, 45, 47, 51, 54, 57, 58, 64, 68, 69 (30 problems)