VYRSITY

MATH2101 College Algebra
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I. VYRSITY PROFESSOR BIO

Jeffrey R. Christianson, Ph.D., is Professor of Science and Worldview at Vyrsity and Colorado Biblical University. He is also a Data Scientist, has previously held a Postdoctoral Researcher appointment (computational chemistry) in the Chemical Engineering department at the University of Delaware, and has served as a Graduate Researcher (theoretical physical chemistry) and Teaching Assistant (general chemistry) in the Chemistry department at the University of Wisconsin – Madison, where he received his Ph.D. in Physical Chemistry. He received B.S. degrees in Chemistry and Mathematics from Truman State University.

II. COURSE DESCRIPTION

This course provides a survey of college-level algebra for non-STEM majors. The primary topics involve understanding and applying key properties of common functions including linear, polynomial (including those representing conic sections), rational, exponential, and logarithmic. Additional topics include designing and solving systems of linear equations, observing and understanding patterns represented by sequences and series, and an introduction to using mathematics as a tool for deductive reasoning. Each topic will be motivated by and applied to historical and/or practical applications. The course is designed to equip the Learner with an understanding of, appreciation for, and ability to confidently use the language of algebra as a tool in transformative learning and leadership.

Module 1: Foundations of Algebra
College Algebra (1.1 – 1.6, 2.1 – 2.7)
Problem Set #1
Module Assessment #1
Journal Question #1

What is algebra and why is it useful? Upon successful completion of this module, the Learner will be able to define and explain the importance of algebra and will demonstrate both practical proficiency with and a worldview-informed understanding of fundamental concepts of high-school-level arithmetic and algebra including real and complex numbers, the Cartesian coordinate system, exponents, radicals, basic operations on polynomial and rational expressions, linear and quadratic equations, and linear and absolute value inequalities.

Module 2: Functions
College Algebra (3.1 – 3.7, 4.1)
Problem Set #2
Module Assessment #2

What are functions and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with functions and their properties including notation, domain and range, average rates of change, composition,

transformation, and inverse. The specific examples of linear and absolute value functions will be examined more closely.

Module 3: Polynomial Functions
College Algebra (5.1 – 5.4)
The Dance of Number (14.1 – 14.3)
Problem Set #3
Module Assessment #3

What are polynomial functions and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with polynomial functions and their properties including defining characteristics, zeros, end behavior, and divisibility.

Module 4: Rational Functions and Finding Zeros of Polynomial Functions
College Algebra (5.5 – 5.8)
Problem Set #4
Module Assessment #4
Journal Question #2

What is the meaning and relevance of zeros of polynomial and rational functions? Upon successful completion of this module, the Learner will be able to explain the importance of and demonstrate proficiency investigating zeros of and graphing polynomial and rational functions using the Remainder, Factor, Rational Zero, and Conjugate Pairs theorems.

Module 5: Exponential and Logarithmic Functions
College Algebra (6.1 – 6.6)
The Dance of Number (12.1 – 12.5)
Problem Set #5
Module Assessment #5

What are exponential and logarithmic functions and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with the number *e* and exponential and logarithmic functions and their properties including their graphical nature and algebraic operations.

Module 6: Systems of Equations and Inequalities
College Algebra (7.1 – 7.4)
Problem Set #6
Module Assessment #6

What are systems of equations and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with setting up, evaluating solvability, and solving systems of linear and quadratic equations and inequalities using methods such as substitution, addition, and elimination.

Module 7: Matrices and Solving Linear Systems of Equations
College Algebra (7.5 – 7.8)
Problem Set #7
Module Assessment #7
Journal Question #3

What are matrices and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with matrices, matrix operations including addition, subtraction, and multiplication, and representing systems of linear equations as matrices and solving them using Gaussian elimination, matrix inversion, and Cramer's Rule.

Module 8: Conic Sections
College Algebra (8.1 – 8.4)
The Dance of Number (13.8)
Problem Set #8
Module Assessment #8

What are conic sections and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with equations, graphs, and properties of circles, ellipses, parabolas, and hyperbolas.

Module 9: Sequences and Series
College Algebra (9.1 – 9.4)
Problem Set #9
Module Assessment #9

What are sequences and series and why are they useful? Upon successful completion of this module, the Learner will be able to define, explain the importance of, and demonstrate practical proficiency with arithmetic and geometric sequences and series, including writing and using recursive and explicit formulae and finding sums of finite and convergent infinite series.

Module 10: Mathematical Reasoning
The Dance of Number (13.1 – 13.3, 13.9)
Problem Set #10
Module Assessment #10
Journal Question #4
Course Assessment

What is mathematical reasoning and why is it useful? Upon successful completion of this module, the Learner will be able to explain the place and limitations of reasoning in mathematics and demonstrate practical proficiency with basic methods of direct and indirect proofs.

III. COURSE READING

Abramson, Jay *et al*. *College Algebra* (Houston, TX: OpenStax, 2017), ISBN: 1938168380, https://openstax.org/books/college-algebra/pages/1-introduction-to-prerequisites, Free Online (open source, hard copy retail: $52), sections as specified for each module.

Nickel, James D. *The Dance of Number: Dance Moves – Mastering Algebra and Mathematical Reasoning, Part 2, Volume 2* (Wenatchee, WA: Sound Mind Press, 2018), ISBN 9780999105474, Retail: $55), sections as specified. **[Available to rent from the Agathon Research Library]**

IV. LEARNING OUTCOMES

Course Learning Outcomes (CLOs)

1. Demonstrate an intuitive understanding of the language of algebra (VLO 1, 2, BPCO 1).
2. Apply this understanding to define and solve practical problems (VLO 2, 3, BPCO 2, APCO 1).

3. Analyze mathematical reasoning and thought within the context of worldview considerations (VLO 4, 5, BPCO 3, 4, APCO 2, 3).

Bachelor's Program Competency Outcomes (BPCOs)

1. To prepare Learners for roles in transformative education teaching and service.
2. To provide Learners a foundation for effective individual and organizational leadership in diverse environments.
3. To ensure Learners demonstrate worldview foundation for empowering people and building communities.
4. To help Learners formulate a Biblical approach to transformative learning and leadership.

Associate's Program Competency Outcomes (APCOs)

1. To prepare Learners for specialized undergrad study in transformative education theory and in leadership strategies.
2. To provide Learners key worldview foundations for critical thinking and study.
3. To provide Learners with practical experience germane to their transformative learning and leadership.

Vyrsity Learning Outcomes (VLOs)

1. Critical Thinking, Problem Solving, and Research – Learners will demonstrate ability to think critically, solve problems, and conduct interdisciplinary research at a level appropriate to their program.

2. Personal Growth – Learners will understand how learning is related to personal growth, and will be challenged to grow in their thinking, communication, conduct, and engagement with others.

3. Skills Development – Learners will advance in skills related to their program, demonstrating a level of competency appropriate to their program.

4. Social Responsibility – Learners will appreciate the diversity in and value of others as designed by our Creator, and will grow in willingness and capability to serve others.

5. Worldview Applications – Learners will become capable at thinking from a worldview perspective understanding the relationship of description and prescription, so that they can ground their actions in sound principles.

V. GRADING RUBRIC (1000 POINTS)

Module Assessments (50 points each x 10)	500 Points (Multiple Choice + Short Answer)
Journals (50 points each x 4)	200 Points (Essays)
Problem Sets (5 points each x 10)	50 Points (Completion)
Course Assessment	250 Points (Multiple Choice + Short Answer)

Problem sets are assigned for each module and are essential to achieving CLOs 1-2. Answers to each problem in the problem set will be provided so that the Learner may self-assess his or her understanding prior to taking a graded assessment. As such, it is highly recommended that the Learner thoroughly work through each problem set using available resources (course textbook, lecture material, mentor, etc.) prior to looking up the answers and grading the problem set. After self-grading, any incorrect answers should then be thoroughly investigated until the correct understanding and answer is achieved. Problems sets are then submitted and graded for completion.

Module and Course Assessments are the graded components of the course that will evaluate the Learner's progress in achieving CLOs 1-2. Each assessment will have a time limit for completion that reflects minimal time required to answer all questions if CLOs 1-2 have been achieved. Each question will be multiple choice, but most questions require work to be shown. In this case, the Learner must write down the key computation(s) required to answer the question. Immediately following the exam, a copy of this work (e.g., scan or picture) must be uploaded to ELUX for review. Uploaded work should reflect the answers that were selected, in which case the points reserved for showing work will be assigned at the same percentage as the percentage of correct answers selected on the assessment (for example, if 80% of the multiple-choice questions were answered correctly and 15 points are reserved for showing work, then 12 of those 15 points will be credited).

Competency Assessments are the graded components of the course that will evaluate the Learner's progress in achieving CLO 3. Each one will consist of a journal question that will require the Learner to analyze the course material from the perspective of his or her worldview. The first submitted response should be a critical analysis with a coherent written structure. In most cases, at least one subsequent response based on mentor feedback or questions will also be required. Points will be assigned based on all submitted responses.

VI. GRADING SCALE

91-100%	A
81-90%	B
71-80%	C
61-70%	D
0-60%	F

VII. CARNEGIE UNIT CREDIT HOUR EQUIVALENT

Total Hours of Module Content:	30 hours
Total Hours of Reading Content:	35 hours
Total Hours of Practice Problems:	40 hours
Total Hours of Journal Questions:	15 hours
Total Hours of Minor Assessments:	10 hours
Total Hours of Major Assessment:	5 hours

Equivalent of 3 Credit Hours (135 hours of total course time)