Valparaiso University Course Syllabus

MATH 111: College Algebra

Description: *Self-paced course focused on mastering topics in the realm of College Algebra.*

Credit Hours: 1

Frequency: Offered every term

Audience: Completion of this course, or placement higher, is a prerequisite or corequisite for many quantitative courses across the University. This course may not be used to fulfill the General Education Requirement in the College of Arts and Sciences nor be counted toward a major or minor in mathematics.

Prerequisites: Grade of S in MATH 110, or placement higher than MATH 110 in the Math Placement process

Format: 1 class session (50 minutes) per week for 15 weeks, plus online work outside of class

Textbook: All required coursework will be completed in the ALEKS 360 platform, which includes access to tutorials, an e-textbook, and videos. The instructor will provide you with a course code to input into the ALEKS 360 platform, but you must also purchase an ALEKS access code. An ALEKS access code can be purchased through the University Bookstore, or through the ALEKS website after inputting the course code. (You can use a financial aid access code that will be provided from the instructor for the first two weeks if you are not able to purchase an ALEKS access code at the beginning of the term. However, you must purchase your own ALEKS access code within the first two weeks.)

AARC: The Access and Accommodations Resource Center (AARC) is the campus office that works with students to provide access and accommodations in cases of diagnosed mental or emotional health issues, attentional or learning disabilities, vision or hearing limitations, chronic diseases, or allergies. You can contact the office at aarc@valpo.edu or 219.464.5206. Students who need, or think they may need, accommodations due to a diagnosis, or who think they have a diagnosis, are invited to contact AARC to arrange a confidential discussion with the AARC office. Further, students who are registered with AARC are required to contact their professor(s) if they wish to exercise the accommodations outlined in their letter from the AARC.

Notice of Cancellation: Notifications of class cancellations will be made through Blackboard with as much advance notice as possible. It will be both posted on Blackboard and sent to your Valpo e-mail address. If you don't check your Valpo e-mail account regularly or have it set-up to be forwarded to your preferred e-mail account, you may not get the message. Please check Blackboard and your Valpo e-mail (or the e-mail address it forwards to) before coming to class.

Emergency Protocol: VU's Emergency Notification System (ENS) uses multiple forms of communication, including e-mail, building alarms, outdoor sirens, message boards, computer alerts, Twitter, and public address messaging. Please review the specific procedures for this class found in Blackboard. Remember: "Siren inside, GO outside; Siren outside, GO inside." To evacuate, gather your personal belongings quickly and proceed to the nearest exit. Do not use the elevator. To shelter in place, move away from the windows and stay low to the ground; lock or barricade the door if there is a threat of violence.

Student Learning Objectives:

A. Students will demonstrate mastery of a range of algebraic topics in the realm of College Algebra. (See attached example detailed syllabus from ALEKS 360.)

Class: MATH 111 Fall 2021 - A **Class Code:** X9ELE-NATUR

Subject: College Algebra with Trigonometry **Instructor:** Kolba

Class Dates: 08/25/2021 - 12/10/2021 **Class Content:** 207 topics / 167 accessible topics

Textbook: Miller: College Algebra & Trigonometry, 1st Ed. (McGraw-Hill)

Accessible Topic - Topics accessible to visually impaired students using a screen reader.

Course Readiness and Chapter R: Review of Prerequisites (37 Topics)

Course Readiness (1 Topic)

- Graphing a compound inequality on the number line

Section R.1 (6 Topics)

- Exponents and signed fractions
- Order of operations with integers
- Order of operations with integers and exponents
- Cube root of an integer
- Translating a sentence into a one-step equation
- Translating a sentence into a multi-step equation

Section R.2 (3 Topics)

- Product rule with positive exponents: Univariate
- Power rules with positive exponents: Multivariate products
- Simplifying a ratio of multivariate monomials: Advanced

Section R.3 (3 Topics)

- Square root of a rational perfect square
- Simplifying a higher root of a whole number
- Square root multiplication: Basic

Section R.4 (7 Topics)

- Simplifying a sum or difference of two univariate polynomials
- Multiplying a univariate polynomial by a monomial with a positive coefficient
- Multiplying binomials with leading coefficients greater than 1
- Multiplying binomials in two variables
- Multiplying conjugate binomials: Univariate
- Squaring a binomial: Univariate
- Multiplying binomials with negative coefficients

Section R.5 (8 Topics)

- Greatest common factor of 2 numbers
- Factoring a linear binomial
- Factoring out a monomial from a polynomial: Univariate
- Factoring a quadratic with leading coefficient 1
- Factoring out a constant before factoring a quadratic
- Factoring a quadratic with leading coefficient greater than 1: Problem type 1
- Factoring a quadratic with a negative leading coefficient
- Factoring a difference of squares in one variable: Basic

Section R.6 (9 Topics)

- Restriction on a variable in a denominator: Linear
- Simplifying a ratio of factored polynomials: Linear factors
- Simplifying a ratio of polynomials using GCF factoring
- Simplifying a ratio of polynomials by factoring a quadratic with leading coefficient 1
- Multiplying rational expressions made up of linear expressions
- Least common multiple of 2 numbers
- Finding the LCD of rational expressions with linear denominators: Relatively prime

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- Finding the LCD of rational expressions with linear denominators: Common factors
- Complex fraction without variables: Problem type 1

Chapter 1: Equations and Inequalities (48 Topics)

Section 1.1 (14 Topics)

- Additive property of equality with signed fractions
- Multiplicative property of equality with signed fractions
- Solving a multi-step equation given in fractional form
- Solving a linear equation with several occurrences of the variable: Variables on both sides and distribution
- Solving equations with zero, one, or infinitely many solutions
- Solving a proportion of the form (x+a)/b = c/d
- Solving for a variable in terms of other variables using addition or subtraction: Advanced
- Solving for a variable in terms of other variables using multiplication or division: Advanced
- Solving for a variable in terms of other variables in a linear equation with fractions
- Solving a rational equation that simplifies to linear: Denominator x+a
- Solving a rational equation that simplifies to linear: Denominators a, x, or ax
- Solving for a variable in terms of other variables in a rational equation: Problem type 2
- Restriction on a variable in a denominator: Quadratic
- Solving a rational equation that simplifies to linear: Factorable quadratic denominator

Section 1.2 (4 Topics)

- Writing a multi-step equation for a real-world situation
- Solving a distance, rate, time problem using a linear equation
- Finding the sale price given the original price and percent discount
- Word problem on proportions: Problem type 1

Section 1.3 (2 Topics)

- Using i to rewrite square roots of negative numbers
- Adding or subtracting complex numbers

Section 1.4 (10 Topics)

- Pythagorean Theorem
- Word problem involving the Pythagorean Theorem
- Solving an equation written in factored form
- Finding the roots of a quadratic equation of the form $ax^2 + bx = 0$
- Finding the roots of a quadratic equation with leading coefficient 1
- Solving a quadratic equation needing simplification
- Solving an equation of the form $x^2 = a$ using the square root property
- Completing the square
- Solving a quadratic equation by completing the square: Exact answers
- Applying the quadratic formula: Exact answers

Section 1.5 (2 Topics)

- Solving a word problem using a quadratic equation with rational roots
- Using the Pythagorean Theorem and a quadratic equation to find side lengths of a right triangle

Section 1.6 (8 Topics)

- Solving an absolute value equation: Problem type 4
- Solving an absolute value equation of the form $|ax+b| = |cx+d|$
- Word problem involving multiple rates
- Solving a rational equation that simplifies to quadratic: Denominator x
- Algebraic symbol manipulation with radicals
- Solving an equation with a root index greater than 2: Problem type 1
- Solving an equation with exponent 1/a: Problem type 1
- Solving an equation that can be written in quadratic form: Problem type 1

Section 1.7 (8 Topics)

- Finding the value for a new score that will yield a given mean
- Translating a sentence into a multi-step inequality
- Translating a sentence into a compound inequality

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- Graphing a compound inequality on the number line
- Solving a two-step linear inequality: Problem type 2
- Solving a compound linear inequality: Graph solution, basic
- Solving a compound linear inequality: Interval notation
- Solving an absolute value inequality: Problem type 4

Chapter 2: Functions and Relations (56 Topics)

Section 2.1 (5 Topics)

- Plotting a point in the coordinate plane
- Naming the quadrant or axis of a point given the signs of its coordinates
- Distance between two points in the plane: Exact answers
- Midpoint of a line segment in the plane
- Finding x- and y-intercepts of the graph of a nonlinear equation

Section 2.2 (3 Topics)

- Identifying the center and radius to graph a circle given its equation in standard form
- Writing an equation of a circle given its center and radius or diameter
- Writing an equation of a circle given its center and a point on the circle

Section 2.3 (9 Topics)

- Finding x- and y-intercepts given the graph of a line on a grid
- Vertical line test
- Evaluating functions: Linear and quadratic or cubic
- Evaluating functions: Absolute value, rational, radical
- Domain of a rational function: Excluded values
- Domain of a square root function: Basic
- Finding the domain of a fractional function involving radicals
- Domain and range from the graph of a continuous function
- Domain and range from the graph of a piecewise function

Section 2.4 (9 Topics)

- Graphing a linear equation of the form y = mx
- Graphing a line given its equation in slope-intercept form: Fractional slope
- Graphing a line given its equation in standard form
- Graphing a vertical or horizontal line
- Finding x- and y-intercepts of a line given the equation: Basic
- Finding slope given two points on the line
- Finding the slope of horizontal and vertical lines
- Graphing a line given its slope and y-intercept
- Graphing a line through a given point with a given slope

Section 2.5 (5 Topics)

- Writing an equation in point-slope form given the slope and a point
- Writing an equation of a line given the y-intercept and another point
- Finding slopes of lines parallel and perpendicular to a line given in slope-intercept form
- Scatter plots and correlation
- Classifying linear and nonlinear relationships from scatter plots

Section 2.6 (15 Topics)

- Graphing an absolute value equation of the form y = A|x|
- Graphing a parabola of the form $y = ax^2$
- Graphing a parabola of the form $y = ax^2 + c$
- Graphing a cubic function of the form $y = ax^3$
- Graphing an absolute value equation in the plane: Basic
- Graphing a function of the form $f(x) = ax^2$
- Graphing a function of the form $f(x) = ax^2 + c$
- Graphing a parabola of the form $y = (x-h)^2 + k$
- Graphing a square root function: Problem type 1
- Graphing a cube root function

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- Translating the graph of an absolute value function: Two steps
- Transforming the graph of a function by reflecting over an axis
- Transforming the graph of a function by shrinking or stretching
- Transforming the graph of a function using more than one transformation
- Transforming the graph of a quadratic, cubic, square root, or absolute value function

Section 2.7 (7 Topics)

- Determining if graphs have symmetry with respect to the x-axis, y-axis, or origin
- Evaluating a piecewise-defined function
- Finding where a function is increasing, decreasing, or constant given the graph
- Finding where a function is increasing, decreasing, or constant given the graph: Interval notation
- Finding local maxima and minima of a function given the graph
- Graphing a piecewise-defined function: Problem type 2
- Even and odd functions: Problem type 1

Section 2.8 (3 Topics)

- Sum, difference, and product of two functions
- Quotient of two functions: Basic
- Composition of two functions: Basic

Chapter 3: Polynomial and Rational Functions (21 Topics)

Section 3.1 (8 Topics)

- Graphing a parabola of the form $y = (x-h)^2 + k$
- Finding the vertex, intercepts, and axis of symmetry from the graph of a parabola
- Graphing a parabola of the form $y = x^2 + bx + c$
- Finding the x-intercept(s) and the vertex of a parabola
- Rewriting a quadratic function to find its vertex and sketch its graph
- Finding the maximum or minimum of a quadratic function
- Word problem involving the maximum or minimum of a quadratic function
- Range of a quadratic function

Section 3.2 (1 Topic)

- Determining the end behavior of the graph of a polynomial function

Section 3.3 (3 Topics)

- Writing a quadratic function given its zeros
- Polynomial long division: Problem type 1
- The Factor Theorem

Section 3.4 (2 Topics)

- Descartes' Rule of Signs
- Multiplying expressions involving complex conjugates

Section 3.5 (7 Topics)

- Finding the asymptotes of a rational function: Constant over linear
- Finding the asymptotes of a rational function: Quadratic over linear
- Graphing a rational function: Constant over linear
- Graphing a rational function: Linear over linear
- Graphing a rational function: Quadratic over linear
- Graphing rational functions with holes
- Graphing a rational function with more than one vertical asymptote

Chapter 4: Exponential and Logarithmic Functions (36 Topics)

Section 4.1 (4 Topics)

- Horizontal line test
- Determining whether two functions are inverses of each other
- Inverse functions: Cubic, cube root
- Inverse functions: Rational

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Section 4.2 (10 Topics)

- Graphing an exponential function and its asymptote: $f(x)=b^x$
- Graphing an exponential function and its asymptote: $f(x) = a(b)^x$
- Graphing an exponential function and its asymptote: $f(x)=b^{-x}$ or $f(x)=-b^{ax}$
- Translating the graph of an exponential function
- The graph, domain, and range of an exponential function
- Graphing an exponential function and its asymptote: $f(x) = a(e)^{x-b} + c$
- Introduction to compound interest
- Finding a final amount in a word problem on exponential growth or decay
- Finding the final amount in a word problem on compound interest
- Finding the final amount in a word problem on continuous compound interest

Section 4.3 (6 Topics)

- Converting between logarithmic and exponential equations
- Converting between natural logarithmic and exponential equations
- Evaluating logarithmic expressions
- Translating the graph of a logarithmic function
- Graphing a logarithmic function: Basic
- The graph, domain, and range of a logarithmic function

Section 4.4 (4 Topics)

- Basic properties of logarithms
- Expanding a logarithmic expression: Problem type 1
- Writing an expression as a single logarithm
- Change of base for logarithms: Problem type 1

Section 4.5 (8 Topics)

- Graphically solving a system of linear equations
- Solving an equation of the form $\log_b a = c$
- Using properties of logarithms to evaluate expressions
- Solving a multi-step equation involving a single logarithm: Problem type 1
- Solving a multi-step equation involving natural logarithms
- Solving an equation involving logarithms on both sides: Problem type 1
- Solving an exponential equation by finding common bases: Linear exponents
- Solving an exponential equation by using logarithms: Decimal answers, basic

Section 4.6 (4 Topics)

- Finding the initial amount and rate of change given an exponential function
- Writing an equation that models exponential growth or decay
- Finding the time given an exponential function with base e that models a real-world situation
- Finding half-life or doubling time

Chapter 9: Systems of Equations and Inequalities (12 Topics)

Section 9.1 (5 Topics)

- Identifying solutions to a system of linear equations
- Graphically solving a system of linear equations
- Classifying systems of linear equations from graphs
- Solving a word problem involving a sum and another basic relationship using a system of linear equations
- Solving a distance, rate, time problem using a system of linear equations

Section 9.2 (1 Topic)

- Solving a 3x3 system of linear equations: Problem type 1

Section 9.5 (4 Topics)

- Graphing a linear inequality in the plane: Slope-intercept form
- Graphing a system of two linear inequalities: Basic
- Graphing a system of three linear inequalities
- Solving a word problem using a system of linear inequalities: Problem type 1

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Section 9.6 (2 Topics)

- Linear programming
- Solving a word problem using linear programming

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