

# Higher Education Math Placement

This course covers the topics shown below.

Curriculum (314 topics)

- Whole Numbers, Fractions, and Decimals (37 topics)
  - Operations with Whole Numbers (9 topics)
    - Adding 2-digit numbers with regrouping a ten
    - Subtraction of 2-digit numbers with regrouping
    - Multiplying with regrouping
    - Introduction to multiplication of large numbers
    - Division with regrouping
    - Introduction to exponents
    - Order of operations with whole numbers
    - Order of operations with whole numbers and grouping symbols
    - Order of operations with whole numbers and exponents: Basic
  - Equivalent Fractions and Ordering (8 topics)
    - Equivalent fractions
    - Simplifying a fraction
    - Fractional position on a number line
    - Plotting fractions on a number line
    - Writing an improper fraction as a mixed number
    - Writing a mixed number as an improper fraction
    - Ordering fractions with the same denominator
    - Using a common denominator to order fractions
  - Operations with Fractions (9 topics)
    - Addition or subtraction of fractions with the same denominator
    - Introduction to addition or subtraction of fractions with different denominators
    - Addition or subtraction of fractions with different denominators
    - Product of a fraction and a whole number: Problem type 1
    - Introduction to fraction multiplication
    - Fraction multiplication
    - Fraction division
    - Division involving a whole number and a fraction
    - Mixed arithmetic operations with fractions
  - Decimal Place Value (2 topics)
    - Rounding decimals
    - Ordering decimals
  - Operations with Decimals (9 topics)
    - Addition of aligned decimals
    - Decimal addition with 3 numbers
    - Subtraction of aligned decimals
    - Multiplication of a decimal by a power of ten
    - Multiplying a decimal by a whole number
    - Decimal multiplication: Problem type 1
    - Division of a decimal by a power of ten
    - Division of a decimal by a whole number
    - Converting a fraction to a terminating decimal
- Percents, Proportions, and Geometry (32 topics)

- Percentages (8 topics)
  - Converting between percentages and decimals
  - Converting a percentage to a fraction in simplest form
  - Converting a fraction to a percentage: Denominator of 20, 25, or 50
  - Writing a ratio as a percentage without a calculator
  - Finding a percentage of a whole number without a calculator: Basic
  - Applying the percent equation
  - Finding the sale price without a calculator given the original price and percent discount
  - Finding the original price given the sale price and percent discount
- Proportions (4 topics)
  - Solving a proportion of the form  $x/a = b/c$
  - Solving a word problem on proportions using a unit rate
  - Word problem on proportions: Problem type 1
  - Word problem on proportions: Problem type 2
- Perimeter and Area (11 topics)
  - Perimeter of a square or a rectangle
  - Finding the missing length in a figure
  - Finding a side length given the perimeter and side lengths with variables
  - Area of a square or a rectangle
  - Area of a piecewise rectangular figure
  - Area of a triangle
  - Area of a parallelogram
  - Finding the side length of a rectangle given its perimeter or area
  - Circumference and area of a circle
  - Perimeter involving rectangles and circles
  - Area involving inscribed figures
- Volume and Surface Area (4 topics)
  - Volume of a rectangular prism
  - Volume of a cylinder
  - Surface area of a cube or a rectangular prism
  - Surface area of a cylinder: Exact answers in terms of pi
- Angles and Triangles (3 topics)
  - Solving equations involving vertical angles
  - Finding an angle measure of a triangle given two angles
  - Finding an angle measure for a triangle with an extended side
- Similar Figures (2 topics)
  - Similar polygons
  - Indirect measurement
- Signed Numbers, Linear Equations and Inequalities (53 topics)
  - Integers (7 topics)
    - Absolute value of a number
    - Integer addition: Problem type 1
    - Integer addition: Problem type 2
    - Integer subtraction: Problem type 1
    - Integer subtraction: Problem type 2
    - Integer subtraction: Problem type 3
    - Integer multiplication and division
  - Signed Fractions and Decimals (5 topics)
    - Signed fraction addition or subtraction: Basic
    - Signed fraction addition or subtraction: Advanced
    - Signed fraction multiplication: Basic
    - Signed fraction multiplication: Advanced

- Signed decimal addition and subtraction with 3 numbers
- Signed Numbers and Exponents (3 topics)
  - Exponents and integers: Problem type 1
  - Exponents and signed fractions
  - Order of operations with integers and exponents
- Algebraic Expressions (3 topics)
  - Writing a one-step expression for a real-world situation
  - Evaluating a linear expression: Integer multiplication with addition or subtraction
  - Evaluating a quadratic expression: Integers
- Properties of Real Numbers (4 topics)
  - Distributive property: Whole number coefficients
  - Distributive property: Integer coefficients
  - Combining like terms: Integer coefficients
  - Combining like terms: Advanced
- Solving a Linear Equation with One Occurrence of the Variable (9 topics)
  - Additive property of equality with decimals
  - Additive property of equality with integers
  - Additive property of equality with a negative coefficient
  - Multiplicative property of equality with whole numbers
  - Multiplicative property of equality with decimals
  - Multiplicative property of equality with integers
  - Multiplicative property of equality with signed fractions
  - Solving a two-step equation with integers
  - Solving a two-step equation with signed fractions
- Solving a Linear Equation with Several Occurrences of the Variable (4 topics)
  - Solving a linear equation with several occurrences of the variable: Variables on the same side and distribution
  - Solving a linear equation with several occurrences of the variable: Variables on both sides and distribution
  - Solving a linear equation with several occurrences of the variable: Fractional forms with binomial numerators
  - Solving equations with zero, one, or infinitely many solutions
- Applications with Linear Equations (5 topics)
  - Translating a sentence into a one-step equation
  - Translating a phrase into a two-step expression
  - Solving a one-step word problem using the formula  $d = rt$
  - Solving a word problem with two unknowns using a linear equation
  - Solving a value mixture problem using a linear equation
- Solving an Inequality (8 topics)
  - Graphing a linear inequality on the number line
  - Graphing a compound inequality on the number line
  - Solving a linear inequality: Problem type 1
  - Solving a linear inequality: Problem type 2
  - Solving a linear inequality: Problem type 3
  - Solving a linear inequality: Problem type 4
  - Solving a compound linear inequality: Graph solution, basic
  - Solving a compound linear inequality: Interval notation
- Solving an Equation or Inequality with Absolute Value (2 topics)
  - Solving an absolute value equation of the form  $ax + b = c$
  - Solving an absolute value inequality: Basic
- Solving a Multivariable Equation for a Variable (3 topics)
  - Introduction to algebraic symbol manipulation
  - Algebraic symbol manipulation: Problem type 1
  - Algebraic symbol manipulation: Problem type 2

- Lines and Systems of Linear Equations (27 topics)
  - Graphing Lines (5 topics)
    - Plotting a point in the coordinate plane
    - Finding a solution to a linear equation in two variables
    - Graphing a line given its equation in slope-intercept form
    - Graphing a line given its equation in standard form
    - Graphing a vertical or horizontal line
  - Slope of a Line (4 topics)
    - Finding slope given the graph of a line on a grid
    - Finding slope given two points on the line
    - Finding the slope of a line given its equation
    - Finding slopes of lines parallel and perpendicular to a line given in the form  $Ax + By = C$
  - Equation of a Line (3 topics)
    - Finding x- and y-intercepts of a line given the equation: Advanced
    - Writing the equation of a line given the slope and a point on the line
    - Writing the equation of the line through two given points
  - Solving a System of Linear Equations (4 topics)
    - Graphically solving a system of linear equations
    - Solving a system of linear equations using substitution
    - Solving a system of linear equations using elimination with multiplication and addition
    - Solving a  $2 \times 2$  system of linear equations that is inconsistent or consistent dependent
  - Graphing Linear Inequalities in the Plane (3 topics)
    - Graphing a linear inequality in the plane: Standard form
    - Graphing a linear inequality in the plane: Vertical or horizontal line
    - Graphing a system of two linear inequalities: Basic
  - Applications with Lines and Systems (8 topics)
    - Interpreting a line graph
    - Interpreting the graphs of two functions
    - Writing an equation and drawing its graph to model a real-world situation: Advanced
    - Application problem with a linear function: Finding a coordinate given the slope and a point
    - Solving a value mixture problem using a system of linear equations
    - Solving a distance, rate, time problem using a system of linear equations
    - Solving a percent mixture problem using a system of linear equations
    - Solving a word problem using a  $3 \times 3$  system of linear equations: Problem type 1
- Relations and Functions (22 topics)
  - Sets and Intervals (2 topics)
    - Set-builder and interval notation
    - Union and intersection of finite sets
  - Evaluating Functions (4 topics)
    - Evaluating functions: Linear and quadratic or cubic
    - Evaluating a piecewise-defined function
    - Variable expressions as inputs of functions: Problem type 1
    - Sum, difference, and product of two functions
  - Domain and Range (4 topics)
    - Domain and range from ordered pairs
    - Domain and range from the graph of a continuous function
    - Domain of a square root function: Advanced
    - Domain of a rational function: Excluded values
  - Graphs of Functions and their Transformations (9 topics)
    - Vertical line test

- Finding local maxima and minima of a function given the graph
- Translating the graph of a function: One step
- Transforming the graph of a function by reflecting over an axis
- Transforming the graph of a function by shrinking or stretching
- Writing an equation for a function after a vertical translation
- Writing an equation for a function after a vertical and horizontal translation
- Graphing a cubic function of the form  $y = ax^3$
- Graphing a square root function
- Composition of Functions and Inverse Functions (3 topics)
  - Composition of two functions: Basic
  - Inverse functions: Linear, discrete
  - Inverse functions: Rational
- Integer Exponents and Factoring (30 topics)
  - Properties of Exponents (13 topics)
    - Evaluating an expression with a negative exponent: Positive fraction base
    - Evaluating an expression with a negative exponent: Negative integer base
    - Introduction to the product rule of exponents
    - Product rule with positive exponents: Multivariate
    - Product rule with negative exponents
    - Introduction to the quotient rule of exponents
    - Quotient of expressions involving exponents
    - Quotient rule with negative exponents: Problem type 1
    - Introduction to the power rules of exponents
    - Power rules with positive exponents
    - Power of a power rule with negative exponents
    - Power rules with negative exponents
    - Power and product rules with positive exponents
  - Scientific Notation (2 topics)
    - Scientific notation with positive exponent
    - Scientific notation with negative exponent
  - Operations with Polynomials (7 topics)
    - Simplifying a sum or difference of two univariate polynomials
    - Multiplying a univariate polynomial by a monomial with a positive coefficient
    - Multiplying a multivariate polynomial by a monomial
    - Multiplying binomials with leading coefficients of 1
    - Multiplying conjugate binomials: Univariate
    - Squaring a binomial: Univariate
    - Multiplication involving binomials and trinomials in two variables
  - Factoring Polynomials (8 topics)
    - Greatest common factor of two multivariate monomials
    - Factoring out a monomial from a polynomial: Univariate
    - Factoring out a monomial from a polynomial: Multivariate
    - Factoring a quadratic with leading coefficient 1
    - Factoring a quadratic with leading coefficient greater than 1
    - Factoring a product of a quadratic trinomial and a monomial
    - Factoring a difference of squares
    - Factoring a polynomial by grouping: Problem type 1
- Quadratic and Polynomial Functions (21 topics)
  - Solving a Quadratic Equation (9 topics)
    - Solving an equation written in factored form
    - Completing the square
    - Finding the roots of a quadratic equation with leading coefficient 1

- Finding the roots of a quadratic equation with leading coefficient greater than 1
- Solving a quadratic equation needing simplification
- Applying the quadratic formula: Exact answers
- Discriminant of a quadratic equation
- Solving a word problem using a quadratic equation with rational roots
- Solving a word problem using a quadratic equation with irrational roots
- Solving a Quadratic Inequality (1 topics)
  - Solving a quadratic inequality written in factored form
- Graphing a Quadratic Function (5 topics)
  - Graphing a parabola of the form  $y = ax^2$
  - Graphing a parabola of the form  $y = (x-h)^2 + k$
  - Graphing a parabola of the form  $y = ax^2 + bx + c$ : Integer coefficients
  - Rewriting a quadratic function to find the vertex of its graph
  - Finding the x-intercept(s) and the vertex of a parabola
- Polynomial Functions (4 topics)
  - Finding zeros of a polynomial function written in factored form
  - Finding x- and y-intercepts given a polynomial function
  - Determining the end behavior of the graph of a polynomial function
  - Inferring properties of a polynomial function from its graph
- Circles (2 topics)
  - Graphing a circle given its equation in standard form
  - Graphing a circle given its equation in general form
- Rational Expressions and Functions (23 topics)
  - Simplifying Rational Expressions (12 topics)
    - Least common multiple of two monomials
    - Simplifying a ratio of polynomials: Problem type 1
    - Simplifying a ratio of multivariate polynomials
    - Adding rational expressions with common denominators and binomial numerators
    - Adding rational expressions with different denominators:  $ax, bx$
    - Adding rational expressions with different denominators:  $x+a, x+b$
    - Multiplying rational expressions involving multivariate monomials
    - Multiplying rational expressions involving quadratics with leading coefficients of 1
    - Dividing rational expressions involving multivariate monomials
    - Complex fraction without variables: Problem type 1
    - Complex fraction involving multivariate monomials
    - Complex fraction: GCF and quadratic factoring
  - Division of Polynomials (2 topics)
    - Dividing a polynomial by a monomial: Univariate
    - Polynomial long division: Problem type 1
  - Solving Rational Equations (4 topics)
    - Solving a rational equation that simplifies to linear: Denominator  $x$
    - Solving a rational equation that simplifies to linear: Denominator  $x+a$
    - Solving a rational equation that simplifies to linear: Unlike binomial denominators
    - Solving a rational equation that simplifies to quadratic: Binomial denominators and numerators
  - Direct and Inverse Variations (3 topics)
    - Word problem on direct variation
    - Word problem on inverse variation
    - Writing an equation that models variation
  - Graphing Rational Functions (2 topics)
    - Sketching the graph of a rational function: Constant over linear

- Sketching the graph of a rational function: Linear over linear
- Radicals and Rational Exponents (20 topics)
  - Simplifying Expressions with Radicals (8 topics)
    - Square root of a rational perfect square
    - Simplifying the square root of a whole number less than 100
    - Square root of a perfect square monomial
    - Simplifying a radical expression with an even exponent
    - Simplifying a sum or difference of radical expressions: Multivariate
    - Simplifying a product of radical expressions: Multivariate
    - Rationalizing the denominator of a radical expression
    - Rationalizing the denominator of a radical expression using conjugates
  - Solving Equations with Radicals (3 topics)
    - Solving a radical equation that simplifies to a linear equation: One radical, basic
    - Solving a radical equation that simplifies to a linear equation: Two radicals
    - Solving a radical equation that simplifies to a quadratic equation: One radical
  - Pythagorean Theorem and the Distance Formula (2 topics)
    - Pythagorean Theorem
    - Distance between two points in the plane: Exact answers
  - Higher Roots (3 topics)
    - Cube root of an integer
    - Simplifying a higher root of a whole number
    - Simplifying a higher radical expression: Multivariate
  - Rational Exponents (4 topics)
    - Rational exponents: Non-unit fraction exponent with a whole number base
    - Rational exponents: Negative exponents and fractional bases
    - Rational exponents: Powers of powers with negative exponents
    - Rational exponents: Products and quotients with negative exponents
- Exponentials and Logarithms (20 topics)
  - Properties of Logarithms (7 topics)
    - Converting between logarithmic and exponential equations
    - Converting between natural logarithmic and exponential equations
    - Evaluating a logarithmic expression
    - 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
  - Solving Logarithmic and Exponential Equations (8 topics)
    - Solving an equation of the form  $\log_b a = c$
    - Solving an equation involving logarithms on both sides: Problem type 1
    - Solving a multi-step equation involving a single logarithm
    - Solving a multi-step equation involving natural logarithms
    - Solving an equation involving logarithms on both sides: Problem type 2
    - Solving an exponential equation by using logarithms: Exact answers in logarithmic form
    - Solving an exponential equation by finding common bases: Linear and quadratic exponents
    - Solving exponential equations by using logarithms and natural logarithms: Decimal answers
  - Graphing Logarithmic and Exponential Functions (3 topics)
    - The graph, domain, and range of an exponential function
    - The graph, domain, and range of a logarithmic function
    - Translating the graph of a logarithmic or exponential function
  - Applications with Exponential Functions (2 topics)

- Evaluating an exponential function that models a real-world situation
- Finding a final amount in a word problem on exponential growth or decay
- Trigonometry (29 topics)
  - Angles (5 topics)
    - Converting between degree and radian measure: Problem type 1
    - Sketching an angle in standard position
    - Reference angles: Problem type 1
    - Coterminal angles
    - Arc length and central angle measure
  - Right Triangle Trigonometry (6 topics)
    - Sine, cosine, and tangent ratios: Variables for side lengths
    - Using a trigonometric ratio to find a side length in a right triangle
    - Using a trigonometric ratio to find an angle measure in a right triangle
    - Finding trigonometric ratios given a right triangle
    - Solving a triangle with the law of sines: Problem type 1
    - Solving a triangle with the law of cosines
  - Unit Circle (5 topics)
    - Finding coordinates on the unit circle for special angles
    - Trigonometric functions and special angles: Problem type 1
    - Trigonometric functions and special angles: Problem type 2
    - Finding values of trigonometric functions given information about an angle: Problem type 1
    - Finding values of trigonometric functions given information about an angle: Problem type 2
  - Graphing Trigonometric Functions (4 topics)
    - Amplitude and period of sine and cosine functions
    - Amplitude, period, and phase shift of sine and cosine functions
    - Sketching the graph of  $y = a \sin(x+c)$  or  $y = a \cos(x+c)$
    - Sketching the graph of  $y = a \sin(bx)$  or  $y = a \cos(bx)$
  - Inverse Trigonometric Functions (2 topics)
    - Values of inverse trigonometric functions
    - Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 2
  - Trigonometric Identities (3 topics)
    - Simplifying trigonometric expressions
    - Sum and difference identities: Problem type 2
    - Double-angle identities: Problem type 2
  - Trigonometric Equations (4 topics)
    - Finding solutions in an interval for a basic equation involving sine or cosine
    - Finding solutions in an interval for a basic tangent, cotangent, secant, or cosecant equation
    - Finding solutions in an interval for a trigonometric equation using Pythagorean identities: Problem type 1
    - Solving a basic trigonometric equation involving sine or cosine