

Educational Planning and Assessment System (EPAS) College Readiness Standards and *Program of Studies* Standards Alignment

Introduction

Test: Mathematics

Kentucky's *Program of Studies* (POS) and the College Readiness Standards (CRS)

The *Program of Studies*, Kentucky's mandated curriculum for all Kentucky schools, is a comprehensive document. Therefore, the CRS is embedded within the *Program of Studies*. While there has been an effort to align the standards as closely as possible in this document, readers will see that in some cases, there is not an exact match for the CRS within the POS. In these cases, the Kentucky Department of Education has found that the skill or skills identified within the CRS are often a component of a more complex POS standard and that the POS standard to which we have aligned the CRS may include the expectation that students demonstrate a variety of other, related skills.

In each tested area, educators should note the importance of reading and critical thinking skills necessary for students to perform well on the tests. It also is important to note that, from grade to grade, some standards may be the same or very similar. In these cases, teachers are expected to continually refine instruction so that students use increasingly complex skills to achieve the standards for each consecutive grade level.

How to Use the Document

This document is divided into tables with two columns. The left hand column contains the College Readiness Standards (CRS) and descriptions of the skills and knowledge associated with what students are likely to know and be able to do based on their EXPLORE, PLAN and ACT test scores. The second column contains the mathematics content standards from the *Program of Studies* that most closely match each CRS.

Teachers may use this document to link instruction with assessment. By identifying the connections between the CRS and the POS, educators may better understand how the ACT College Readiness Standards are embedded within Kentucky's curriculum.

Example

CRS Mathematics GRE (33 36) Solve problems integrating multiple algebraic and/or geometric concepts.

POS Mathematics

MA HS AT U3 Algebra Thinking

Students will representation mathematical situations and structures for analysis and problem solving.

The CRS statement is much more general than what the POS standards state. While these two standards do not provide an exact match, the POS standard identified most closely matches the CRS.

The Mathematics Test

The EPAS Mathematics test “requires students to analyze problems in real world and purely mathematical settings, plan and carry out solutions strategies, and verify the appropriateness of solutions.” Students must demonstrate understanding of mathematical terminology. Students will be required to apply definitions, algorithms, theorems, and properties to solve problems. Students also will be expected to analyze and interpret data.

Supplemental Information

The specifications for the Mathematics test on the EXPLORE, PLAN and ACT are located in the supplemental information section for Mathematics on page 52.

Mathematics

POS/CRS Alignment

Strand 1 – Basic Operations & Applications (BOA)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 13 15	
Perform one operation computation with whole numbers and decimals	MA-6-NPO-S-NO2 Students will add, subtract, multiply, divide and apply order of operations with whole numbers, fractions and decimals to solve real-world problems.
Solve problems in one or two steps using whole numbers	MA-7-AT-S-EI3 Students will model and solve real-world problems with one- or two-step equations or inequalities (e.g., $2x+1=9$, $3x+3<9$).
Perform common conversions (e.g., inches to feet or hours to minutes)	MA-4-M-S-SM1 Students will convert units (e.g., linear, weight, money, time) within a measurement system (e.g., 2 feet = 24 inches). MA-5-M-S-SM1 Students will relate and convert units (e.g., linear, volume, weight) within a measurement system (e.g., 125 cm = 1m 25 cm). MA-6-M-S-SM2 Students will estimate, compare and convert (meaning to make ballpark comparisons/not memorize conversion factors between U.S. and metric) units of measurement for length, weight/mass and volume/capacity within the U.S. customary system and within the metric system: <ul style="list-style-type: none"> • length (e.g., parts of an inch, inches, feet, yards, miles, millimeters, centimeters, meters, kilometers); • weight/mass (e.g., pounds, tons, grams, kilograms); • volume/capacity (e.g., cups, pints, quarts, gallons, milliliters, liters).
Score Range 16 19	
Solve routine one step arithmetic problems (using whole numbers, fractions, and decimals) such as single step percent	MA-7-NPO-S-NO2 Students will extend concepts and application of operations with fractions and decimals to include percents.

* PLAN and ACT only

† ACT only

Solve some routine two step arithmetic problems	MA-6-NPO-S-NO2 Students will add, subtract, multiply, divide and apply order of operations with whole numbers, fractions and decimals to solve real-world problems.
Score Range 20 23	
Solve routine two step or three step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average	MA-7-NPO-S-RP3 Students will develop proportional reasoning and apply to real-world and mathematical problems (e.g., rates, scaling, similarity).
Score Range 24 27	
Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour)	MA-8-NPO-S-RP2 Students will derive and use formulas for various rates (e.g., distance/time, miles per hour).
Score Range 28 32*	
Solve word problems containing several rates, proportions, or percentages	MA-HS-NPO-S-RP1 Students will calculate and apply ratios, proportions, rates and percentages to solve problems.

* PLAN and ACT only

† ACT only

Score Range 33 36†	
Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre algebra and/or pre geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings)	<p>MA-HS-NPO-S-RP1 Students will calculate and apply ratios, proportions, rates and percentages to solve problems.</p>

* PLAN and ACT only

† ACT only

Mathematics POS/CRS Alignment

Strand 2 – Probability, Statistics, & Data Analysis (PSD)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 13 15	
Calculate the average of a list of positive whole numbers	<p>MA-6-DAP-S-CD2 Students will determine and apply measures of distribution (mean, median, mode, range).</p> <p>MA-7-DAP-S-CD2 Students will determine, apply and compare measures of mean, median, mode and/or range, as appropriate to the problem situation.</p> <p>MA-8-DAP-S-CD3 Students will determine and interpret the mean, median, mode and range of a set of data.</p>
Perform a single computation using information from a table or chart	<p>MA-6-DAP-S-DR2 Students will collect, organize, construct, analyze and interpret data in a variety of graphical methods, including line plots, line graphs, circle graphs, bar graphs and stem-and-leaf plots.</p>
Score Range 16 19	
Calculate the average of a list of numbers	<p>MA-7-DAP-S-CD2 Students will determine, apply and compare measures of mean, median, mode and/or range, as appropriate to the problem situation.</p> <p>MA-8-DAP-S-CD3 Students will determine and interpret the mean, median, mode and range of a set of data.</p>
Calculate the average, given the number of data values and the sum of the data values	<p>MA-8-DAP-S-CD3 Students will determine and interpret the mean, median, mode and range of a set of data.</p>

* PLAN and ACT only

† ACT only

Read tables and graphs	<p>MA-6-DAP-S-DR2 Students will collect, organize, construct, analyze and interpret data in a variety of graphical methods, including line plots, line graphs, circle graphs, bar graphs and stem-and-leaf plots.</p> <p>MA-7-DAP-S-DR1 Students will collect, organize, construct, analyze and interpret data and data displays in a variety of graphical methods, including circle graphs, multiple line graphs, double bar graphs and double stem-and-leaf plots.</p> <p>MA-8-DAP-S-DR1 Students will collect, organize, construct, analyze and make inferences from data in a variety of graphical methods (e.g., drawings, tables/charts, pictographs, bar graphs, circle graphs, line plots, Venn diagrams, line graphs, stem-and-leaf plots, scatter plots, histograms, box-and-whiskers plots).</p>
Perform computations on data from tables and graphs	<p>MA-6-DAP-S-DR2 Students will collect, organize, construct, analyze and interpret data in a variety of graphical methods, including line plots, line graphs, circle graphs, bar graphs and stem-and-leaf plots.</p>
Use the relationship between the probability of an event and the probability of its complement	<p>MA-HS-DAP-S-P11 Students will determine the probability of an event and the probability of its complement.</p>
Score Range 20 23	
Calculate the missing data value, given the average and all data values but one	<p>MA-8-DAP-S-CD3 Students will determine and interpret the mean, median, mode and range of a set of data.</p>
Translate from one representation of data to another (e.g., a bar graph to a circle graph)	<p>MA-8-DAP-S-DR4 Students will relate different representations of data (e.g., tables, graphs, diagrams, plots) and explain how misleading representations affect interpretations and conclusions about data.</p>
Determine the probability of a simple event	<p>MA-6-DAP-S-P4 Students will determine simple probabilities based on the results of an experiment and make inferences based on the data.</p>
Exhibit knowledge of simple counting techniques*	<p>MA-6-DAP-S-P2 Students will investigate solutions to probability problems using counting techniques, tree diagrams, charts and tables.</p> <p>MA-7-DAP-S-P7 Students will apply counting techniques to determine the size of a sample space.</p> <p>MA-8-DAP-S-P4 Students will compute and interpret the expected value of random variables in simple cases.</p>

* PLAN and ACT only

† ACT only

Score Range 24 27	
Calculate the average, given the frequency counts of all the data values	MA-8-DAP-S-CD3 Students will determine and interpret the mean, median, mode and range of a set of data.
Manipulate data from tables and graphs	MA-6-DAP-S-DR2 Students will collect, organize, construct, analyze and interpret data in a variety of graphical methods, including line plots, line graphs, circle graphs, bar graphs and stem-and-leaf plots. MA-7-DAP-S-DR1 Students will collect, organize, construct, analyze and interpret data and data displays in a variety of graphical methods, including circle graphs, multiple line graphs, double bar graphs and double stem-and-leaf plots. MA-8-DAP-S-DR1 Students will collect, organize, construct, analyze and make inferences from data in a variety of graphical methods (e.g., drawings, tables/charts, pictographs, bar graphs, circle graphs, line plots, Venn diagrams, line graphs, stem-and-leaf plots, scatter plots, histograms, box-and-whiskers plots).
Compute straightforward probabilities for common situations	MA-6-DAP-S-P4 Students will determine simple probabilities based on the results of an experiment and make inferences based on the data.
Use Venn diagrams in counting*	MA-8-DAP-S-DR1 Students will collect, organize, construct, analyze and make inferences from data in a variety of graphical methods (e.g., drawings, tables/charts, pictographs, bar graphs, circle graphs, line plots, Venn diagrams, line graphs, stem-and-leaf plots, scatter plots, histograms, box-and-whiskers plots).
Score Range 28 32*	
Calculate or use a weighted average	MA-8-DAP-S-CD3 Students will determine and interpret the mean, median, mode and range of a set of data.
Interpret and use information from figures, tables and graphs	MA-8-DAP-S-DR1 Students will collect, organize, construct, analyze and make inferences from data in a variety of graphical methods (e.g., drawings, tables/charts, pictographs, bar graphs, circle graphs, line plots, Venn diagrams, line graphs, stem-and-leaf plots, scatter plots, histograms, box-and-whiskers plots).
Apply counting techniques	MA-8-DAP-S-P4 Students will investigate counting techniques (e.g., networks).
Compute a probability when the event and/or sample space are not given or obvious	MA-HS-DAP-S-P2 Students will apply the concepts of sample space and probability distribution to construct sample spaces and distributions in simple cases.

* PLAN and ACT only

† ACT only

Score Range 33 36†	
Distinguish between mean, median, and mode for a list of numbers	<p>MA-7-DAP-S-CD2 Students will determine, apply and compare measures of mean, median, mode and/or range, as appropriate to the problem situation.</p>
Analyze and draw conclusions based on information from figures, tables, and graphs	<p>MA-8-DAP-S-DR1 Students will collect, organize, construct, analyze and make inferences from data in a variety of graphical methods (e.g., drawings, tables/charts, pictographs, bar graphs, circle graphs, line plots, Venn diagrams, line graphs, stem-and-leaf plots, scatter plots, histograms, box-and-whiskers plots).</p>
Exhibit knowledge of conditional and joint probability	<p>MA-HS-DAP-S-P5 Students will apply the concepts of conditional probability and independent events and be able to compute those probabilities.</p> <p>MA-HS-DAP-S-P6 Students will compute the probability of a compound event.</p>

* PLAN and ACT only

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Mathematics
POS/CRS Alignment

Strand 3 – Number: Concepts & Properties (NCP)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 13 15	
Recognize equivalent fractions and fractions in lowest terms	MA-7-NPO-S-NS5 Students will compare, order and determine equivalent relationships among fractions, decimals and percents.
Score Range 16 19	
Recognize one digit factors of a number	MA-4- NPO-S-PNO1 Students will determine factors/multiples of a whole number.
Identify a digit's place value	MA-6-NPO-S-NS3 Students will develop place value of large and small numbers, including decimals.

* PLAN and ACT only

† ACT only

Score Range 20 23	
Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor	<p>MA-6-NPO-S-NS5 Students will compare, order and convert between whole numbers, fractions, decimals and percents using concrete materials, drawings or pictures and mathematical symbols.</p> <p>MA-6-NPO-S-E1 Students will estimate and mentally compute to solve real-world and/or mathematical problems with whole numbers, fractions, decimals and percents, checking for reasonable and appropriate computational results.</p> <p>MA-6-NPO-S-PNO1 Students will determine prime numbers, composite numbers, prime factorization, factors, multiples, greatest common factor and least common multiple.</p> <p>MA-6-NPO-S-PRF1 Students will recognize, create and extend patterns (give an informal description of the continuation of a pattern and/or generalize a pattern through a verbal rule).</p> <p>MA-8-NPO-S-NS2 Students will provide examples of, describe and compare irrational and rational numbers (e.g., magnitude, order on a number line, scientific notation, very large and very small integers, numbers close to zero).</p>
Score Range 24 27	
Find and use the least common multiple	MA-6-NPO-S-PNO1 Students will determine prime numbers, composite numbers, prime factorization, factors, multiples, greatest common factor and least common multiple.
Order fractions	MA-6-NPO-S-NS5 Students will explore, investigate, compare, relate and apply relationships among whole numbers, fractions, decimals and percents.
Work with numerical factors	MA-6-NPO-S-PNO3 Students will use prime numbers, composite numbers, factors, multiples and divisibility to solve problems.
Work with scientific notation	MA-8-NPO-S-NS2 Students will provide examples of, describe and compare irrational and rational numbers (e.g., magnitude, order on a number line, scientific notation, very large and very small integers, numbers close to zero).
Work with squares and square roots of numbers	MA-8-NPO-S-NS1 Students will continue to develop number sense to include irrational numbers (e.g., square roots, cube roots, π).

* PLAN and ACT only

† ACT only

Work problems involving positive integer exponents*	MA-8-NPO-S-NO1 Students will add, subtract, multiply, divide and apply order of operations (including positive whole number exponents) using rational numbers to solve real-world problems.
Work with cubes and cube roots of numbers*	MA-8-NPO-S-NS3 Students will describe and provide multiple representations of numbers (rational, square roots, cube roots and π) in a variety of equivalent forms using models, diagrams and symbols based on real-world and/or mathematical situations.
Determine when an expression is undefined*.	MA-HS-AT-S-VEO10 Students will determine when an expression is undefined.
Exhibit some knowledge of the complex numbers†	MA-HS-NPO-S-NO2 Students will add, subtract and multiply complex numbers.
Score Range 28 32*	
Apply number properties involving prime factorization	MA-6-NPO-S-PNO1 Students will determine prime numbers, composite numbers, prime factorization, factors, multiples, greatest common factor and least common multiple.
Apply number properties involving even/odd numbers and factors/multiples	MA-6-NPO-S-PNO1 Students will determine prime numbers, composite numbers, prime factorization, factors, multiples, greatest common factor and least common multiple.
Apply number properties involving positive/negative numbers	MA-7-NPO-S-PNO1 Students will identify, explain and apply properties (e.g., commutative, associative, inverse and identity for addition and multiplication; distributive).
Apply rules of exponents	MA-HS-AT-S-VEO5 Students will understand the properties of integer exponents and roots and apply these properties to simplify algebraic expressions.
Multiply two complex numbers†	MA-HS-NPO-S-NO2 Students will add, subtract and multiply complex numbers.
Score Range 33 36†	
Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers	MA-HS-AT-S-VEO3 Students will use symbolic expressions, including iterative and recursive forms, to represent relationships among various contexts.
Exhibit knowledge of logarithms and geometric sequences	MA-HS-AT-S-PRF19 Students will relate the patterns in geometric sequences to exponential functions.

* PLAN and ACT only

† ACT only

Apply properties of complex numbers

MA-HS-NPO-S-NO2

Students will add, subtract and multiply complex numbers.

* PLAN and ACT only

† ACT only

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Mathematics POS/CRS Alignment

Strand 4 – Expressions, Equations, & Inequalities (XEI)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 13 15	
Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$)	MA-6-AT-S-VEO1 Students will explore the use of variables in expressions and equations.
Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals	MA-6-AT-S-EI3 Students will model and solve real-world problems with one variable equations and inequalities (e.g., $8x=4$, $x+2>5$).
Score Range 16 19	
Substitute whole numbers for unknown quantities to evaluate expressions	MA-6-AT-S-VEO2 Students will substitute numerical values for variables and evaluate algebraic expressions.
Solve one step equations having integer or decimal answers	MA-7-AT-S-EI3 Students will model and solve real-world problems with one- or two-step equations or inequalities (e.g., $2x+1=9$, $3x+3<9$).
Combine like terms (e.g., $2x + 5x$)	MA-7-AT-S-VEO1 Students will simplify numeric and algebraic expressions.
Score Range 20 23	
Evaluate algebraic expressions by substituting integers for unknown quantities	MA-6-AT-S-VEO2 Students will substitute numerical values for variables and evaluate algebraic expressions.
Add and subtract simple algebraic expressions	MA-7-AT-S-VEO1 Students will simplify numeric and algebraic expressions.
Solve routine first degree equations	MA-6-AT-S-EI3 Students will model and solve real-world problems with one variable equations and inequalities (e.g., $8x=4$, $x+2>5$).
Perform straightforward word to symbol translations	MA-8-AT-S-VEO3 Students will describe, define and provide examples of variables and expressions with a missing value based on real-world and/or mathematical situations.

* PLAN and ACT only

† ACT only

Multiply two binomials*	MA-HS-AT-S-VEO6 Students will add, subtract and multiply polynomials.
Score Range 24 27	
Solve real world problems using first degree equations	MA-6-AT-S-EI3 Students will model and solve real-world problems with one variable equations and inequalities (e.g., $8x=4$, $x+2>5$).
Write expressions, equations, or inequalities with a single variable for common pre algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions)	MA-8-AT-S-VEO3 Students will describe, define and provide examples of variables and expressions with a missing value based on real-world and/or mathematical situations. MA-8-AT-S-EI4 Students will model and solve real-world problems with one- or two-step equations or inequalities (e.g., $4x+2=22$, $x-4<-60$).
Identify solutions to simple quadratic equations	MA-8-AT-S-PRF2 Students will represent, interpret and describe linear and simple quadratic functional relationships (input/output) through tables, graphs and symbolic rules.
Add, subtract, and multiply polynomials*	MA-HS-AT-S-VEO6 Students will add, subtract and multiply polynomials.
Factor simple quadratics (e.g., the difference of squares and perfect square trinomials)*	MA-HS-AT-S-VEO9 Students will factor quadratic polynomials.
Solve first degree inequalities that do not require reversing the inequality sign*	MA-8-AT-S-EI4 Students will model and solve real-world problems with one- or two-step equations or inequalities (e.g., $4x+2=22$, $x-4<-60$).
Score Range 28 32*	
Manipulate expressions and equations	MA-HS-AT-S-VEO 4 Students will judge the meaning, utility and reasonableness of the results of symbol manipulations, including those carried out using technology.
Write expressions, equations, and inequalities for common algebra settings	MA-HS-AT-S-VEO2 Students will use symbolic algebra to represent and explain mathematical relationships.
Solve linear inequalities that require reversing the inequality sign	MA-HS-AT-S-EI4 Students will solve linear equations and inequalities in one variable including those involving the absolute value of a linear function.

* PLAN and ACT only

† ACT only

Solve absolute value equations	MA-HS-AT-S-EI19 Students will use the skills learned to solve linear equations and inequalities to solve numerically, graphically or symbolically non-linear equations (e.g., absolute value, quadratic, exponential equations).
Solve quadratic equations	MA-HS-AT-S-EI19 Students will use the skills learned to solve linear equations and inequalities to solve numerically, graphically or symbolically non-linear equations (e.g., absolute value, quadratic, exponential equations).
Find solutions to systems of linear equations	MA-HS-AT-S-EI16 Students will solve systems of two linear equations in two variables.
Score Range 33 36†	
Write expressions that require planning and/or manipulating to accurately model a situation	MA-HS-AT-S-VEO4 Students will judge the meaning, utility and reasonableness of the results of symbol manipulations, including those carried out using technology.
Write equations and inequalities that require planning, manipulating, and/or solving	MA-HS-AT-S-VEO4 Students will judge the meaning, utility and reasonableness of the results of symbol manipulations, including those carried out using technology.
Solve simple absolute value inequalities	MA-HS-AT-S-EI4 Students will solve linear equations and inequalities in one variable including those involving the absolute value of a linear function.

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† ACT only

Mathematics POS/CRS Alignment

Strand 5 – Graphical Representation (GRE)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 13 15	
Identify the location of a point with a positive coordinate on the number line	MA-P-NPO-S-NS2 Students will apply multiple representations (e.g., drawings, manipulatives, base-10 blocks, number lines, expanded form, symbols) to describe and compare whole numbers and fractions (e.g., halves, thirds, fourths) in mathematical and real-world problems.
Score Range 16 19	
Locate points on the number line and in the first quadrant	MA-6-G-S-CG1 Students will identify and graph ordered pairs on a positive coordinate system, identifying the origin, axes and ordered pairs.
Score Range 20 23	
Locate points in the coordinate plane	MA-7-G-S-GC1 Students will identify and graph ordered pairs on a coordinate system, identifying the origin, axes and ordered pairs.
Comprehend the concept of length on the number line*	MA-HS-NPO-S-NS2 Students will locate the position of a real number on the number line, find its distance from the origin (absolute value/magnitude) and find the distance between two numbers on the number line (the absolute value of their difference).
Exhibit knowledge of slope*	MA-8-G-S-CG2 Students will analyze the graph of a line to determine the slope, y-intercept and equation of the line.
Score Range 24 27	
Identify the graph of a linear inequality on the number line*	MA-HS-AT-S-EI3 Students will solve one-variable equations and inequalities using manipulatives, symbols, procedures and graphing, including graphing the solution set on a number line.
Determine the slope of a line from points or equations*	MA-8-G-S-CG2 Students will analyze the graph of a line to determine the slope, y-intercept and equation of the line. MA-HS-G-S-CG1 Students will express the intuitive concept of the “slant” of a line as slope, use the coordinates of two points on a line to determine its slope and use slope to express the parallelism and perpendicularity of lines.

* PLAN and ACT only

† ACT only

Match linear graphs with their equations*	MA-HS-G-S-CG2 Students will describe a line by a linear equation.
Find the midpoint of a line segment*	MA-HS-G-S-CG5 Students will find the midpoint of a segment when the coordinates of the endpoints are identified.
Score Range 28 32*	
Interpret and use information from graphs in the coordinate plane	MA-8-G-S-CG1 Students will identify and graph ordered pairs on a coordinate system, identifying the origin, axes and ordered pairs; apply graphing in the coordinate system to solve real-world problems.
Match number line graphs with solution sets of linear inequalities	MA-HS-AT-S-EI3 Students will solve one-variable equations and inequalities using manipulatives, symbols, procedures and graphing, including graphing the solution set on a number line.
Use the distance formula	MA-HS-G-S-CG3 Students will find the distance between two points using their coordinates and the Pythagorean theorem or the distance formula.
Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point	MA-HS-G-S-CG1 Students will express the intuitive concept of the “slant” of a line as slope, use the coordinates of two points on a line to determine its slope and use slope to express the parallelism and perpendicularity of lines.
Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle)†	MA-HS-G-S-CG4 Students will find the equation of a circle given its center and radius; given the equation of a circle, find its center and radius. MA-HS-AT-S-EI16 Students will graph a quadratic function and understand the relationship between its real zeros and the x-intercepts of the graph.
Score Range 33 36†	
Match number line graphs with solution sets of simple quadratic inequalities	MA-HS-AT-S-EI19 Students will use the skills learned to solve linear equations and inequalities to solve numerically, graphically or symbolically non-linear equations (e.g., absolute value, quadratic, exponential equations).
Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$	MA-HS-AT-S-PRF3 Students will analyze functions by investigating rates of change, intercepts, zeros, asymptotes and local and global behavior.
Solve problems integrating multiple algebraic and/or geometric concepts	MA-HS-AT-U3 Algebra Students will representation mathematical situations and structures for analysis and problem solving.

* PLAN and ACT only

† ACT only

Analyze and draw conclusions based on information from graphs in the coordinate plane

MA-HS-AT-PRF13

Students will graph linear, absolute value, quadratic and exponential functions and identify their key characteristics.

* PLAN and ACT only

† ACT only

Mathematics POS/CRS Alignment

Strand 6 – Properties of Plane Figures (PPF)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 16 19	
Exhibit some knowledge of the angles associated with parallel lines	MA-7-G-S-SR2 Students will identify characteristics of angles (e.g., adjacent, vertical, corresponding, interior, exterior).
Score Range 20 23	
Find the measure of an angle using properties of parallel lines	MA-7-G-S-SR2 Students will identify characteristics of angles (e.g., adjacent, vertical, corresponding, interior, exterior).
Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°)	MA-7-G-S-SR3 Students will identify properties for classifying, describe, provide examples of and identify elements (e.g., sides, vertices, angles, congruent parts) of two-dimensional figures (circles, triangles [acute, right, obtuse, scalene, isosceles, equilateral], quadrilaterals [square, rectangle, rhombus, parallelogram, trapezoid], regular and irregular polygons); apply properties of these figures to solve real-world problems.
Score Range 24 27	
Use several angle properties to find an unknown angle measure	MA-7-M-S-MPA2 Students will estimate and find angle measures and segment measures.
Recognize Pythagorean triples*	MA-8-M-S-MPA6 Students will develop and apply the Pythagorean theorem.
Use properties of isosceles*	MA-6-G-S-SR4 Students will identify, describe and provide examples and properties of two-dimensional figures (circles, triangles [acute, right, obtuse, scalene, isosceles, equilateral], quadrilaterals, regular polygons); apply these properties and figures to solve real-world problems.
Score Range 28 32*	
Apply properties of 30° 60° 90°, 45° 45° 90°, similar and congruent triangles	MA-HS-M-S-MPA7 Students will apply special right triangles and the converse of the Pythagorean theorem to solve realistic problems.

* PLAN and ACT only

† ACT only

Use the Pythagorean theorem	MA-8-M-S-MPA6 Students will develop and apply the Pythagorean theorem.
Score Range 33 36†	
Draw conclusions based on a set of conditions	MA-HS-G-S-SR1 Students will identify and apply the definitions, properties and theorems about line segments, rays and angles and use them to prove theorems in Euclidean geometry, solve problems and perform basic geometric constructions using a straight edge and a compass.
Solve multistep geometry problems that involve integrating concepts, planning, visualization and/or making connections with other content areas	MA-HS-G-S-SR12 Students will use geometric models and ideas to gain insights into and answer questions in other areas of mathematics and into other disciplines and areas of interest, such as art and architecture.
Use relationships among angles, arcs and distances in a circle	MA-HS-G-S-SR5 Students will use the definitions and basic properties of a circle (e.g., arcs, chords, central angles, inscribed angles) to prove basic theorems and solve problems.

* PLAN and ACT only

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Mathematics POS/CRS Alignment

Strand 7—Measurement (MEA)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 13 15	
Estimate or calculate the length of a line segment based on other lengths given on a geometric figure	MA-6-G-S-SR4 Students will identify, describe and provide examples and properties of two-dimensional figures (circles, triangles [acute, right, obtuse, scalene, isosceles, equilateral], quadrilaterals, regular polygons); apply these properties and figures to solve real-world problems.
Score Range 16 19	
Compute the perimeter of polygons when all side lengths are given	MA-6-M-S-MPA1 Students will find perimeter of regular and irregular polygons in metric and U.S. customary units.
Compute the area of rectangles when whole number dimensions are given	MA-6-M-S-MPA3 Students will find area of plane figures composed of triangles, squares and rectangles by subdividing and measuring; use square units appropriately.
Score Range 20 23	
Compute the area and perimeter of triangles and rectangles in simple problems	MA-7-M-S-MPA5 Students will determine the length of sides (to the nearest eighth of an inch or nearest centimeter), area and perimeter of triangles, quadrilaterals (rectangles, squares, trapezoids) and other polygons. (Using the Pythagorean theorem will not be required as a strategy).
Use geometric formulas when all necessary information is given	MA-8-AT-S-VEO2 Students will given a formula, substitute appropriate elements from a real-world or mathematical situation.
Score Range 24 27	
Compute the area of triangles and rectangles when one or more additional simple steps are required	MA-8-M-S-MPA4 Students will determine the area of triangles and quadrilaterals.
Compute the area and circumference of circles after identifying necessary information	MA-7-M-S-MPA3 Students will estimate and find circle measurements in standard units (radius, diameter, circumference, area) and relationships among them.

* PLAN and ACT only

† ACT only

Compute the perimeter of simple composite geometric figures with unknown side lengths*	MA-8-M-S-MPA3 Students will determine measures of the lengths of sides and the perimeter both regular and irregular shapes, including lengths to the nearest sixteenth of an inch or the nearest millimeter.
Score Range 28 32*	
Use relationships involving area, perimeter, and volume of geometric figures to compute another measure	MA-7-M-S-MPA6 Students will explain how measurements and measurement formulas are related or different (e.g., perimeter and area of rectangles).
Score Range 33 36†	
Use scale factors to determine the magnitude of a size change	MA-8-G-S-SR5 Students will apply proportional reasoning to solve problems involving scale models and real objects and scale drawings and similar two-dimensional figures.
Compute the area of composite geometric figures when planning or visualization is required	MA-6-M-S-MPA3 Students will find area of plane figures composed of triangles, squares and rectangles by subdividing and measuring; use square units appropriately.

* PLAN and ACT only

† ACT only

Mathematics POS/CRS Alignment

Strand 9—Functions (FUN)

College Readiness Benchmarks	Kentucky Program of Studies
Score Range 20 23	
Evaluate quadratic functions, expressed in function notation, at integer values†	MA-HS-AT-S-VEO12 Students will evaluate polynomial and rational expressions and expressions containing radicals and absolute values at specified values of their variables.
Score Range 24 27	
Evaluate polynomial functions, expressed in function notation, at integer values†	MA-HS-AT-S-VEO12 Students will evaluate polynomial and rational expressions and expressions containing radicals and absolute values at specified values of their variables.
Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths†	MA-HS-M-S-MPA6 Students will apply definitions and properties of right triangle relationships (basic right triangle trigonometry and the Pythagorean theorem) to determine length and angle measures to solve realistic problems.
Score Range 28 32	
Evaluate composite functions at integer values†	MA-HS-AT-S-VEO12 Students will evaluate polynomial and rational expressions and expressions containing radicals and absolute values at specified values of their variables.
Apply basic trigonometric ratios to solve right triangle problems†	MA-HS-M-S-MPA7 Students will apply special right triangles and the converse of the Pythagorean theorem to solve realistic problems.

* PLAN and ACT only

† ACT only

Score Range 33 36	
Write an expression for the composite of two simple functions†	MA-HS-AT-S-PRF12 Students will combine functions by addition, subtraction, multiplication and compositions.
Use trigonometric concepts and basic identities to solve problems†	MA-HS-M-S-MPA6 Students will apply definitions and properties of right triangle relationships (basic right triangle trigonometry and the Pythagorean theorem) to determine length and angle measures to solve realistic problems.
Exhibit knowledge of unit circle trigonometry†	MA-HS-M-S-MPA5 Students will explore the relationships between the right triangle trigonometric functions, using technology (e.g., graphing calculator) as appropriate.
Match graphs of basic trigonometric functions with their equations†	MA-HS-M-S-MPA5 Students will explore the relationships between the right triangle trigonometric functions, using technology (e.g., graphing calculator) as appropriate.

* PLAN and ACT only

† ACT only

**Mathematics Test
EPAS Test Breakdown
Supplemental Information**

What does the Mathematics Test Measure? The mathematics test “requires students to analyze problems in real world and purely mathematical settings, plan and carry out solutions strategies, and verify the appropriateness of solutions.” Students must demonstrate understanding of mathematical terminology. Students will be required to apply definitions, algorithms, theorems and properties to solve problems. Students will also be expected to analyze and interpret data.

Mathematics Test		
EXPLORE	EXPLORE Mathematics Test Design — 30 minutes to answer 30 multiple choice questions	
	Content Area (Strands)	Percent of Questions
	Probability, Statistics, & Data Analysis includes Probability, Statistics and Data Analysis	13%
	Pre Algebra includes Basic Operations and Applications; Probability, Statistics and Data Analysis; Number Concepts and Properties; and Expressions, Equations, and Inequalities	33%
	Elementary Algebra includes Probability, Statistics and Data Analysis; Number Concepts and Properties; and Expressions, Equations and Inequalities	30%
	Pre Geometry includes Graphical Representations, Properties of Plane Figures and Measurement	23%
PLAN	PLAN Mathematics Test Design — 40 minutes to answer 40 multiple choice questions	
	Content Area (Strands)	Percent of Questions
	Pre Algebra includes Basic Operations and Applications; Probability, Statistics and Data Analysis; Number Concepts and Properties; and Expressions, Equations and Inequalities	35%
	Elementary Algebra includes Probability, Statistics and Data Analysis; Number Concepts and Properties; and Expressions, Equations and Inequalities	20%
	Coordinate Geometry includes Graphical Representations, Measurement and Functions	18%
	Plane Geometry includes Properties of Plane Figures and Measurement	27%

ACT Mathematics Test Design — 60 minutes to answer 60 multiple choice questions	
Content Area (Strands)	Percent of Questions
Pre Algebra includes Basic Operations and Applications; Probability, Statistics and Data Analysis; Number Concepts and Properties; and Expressions, Equations and Inequalities	23%
Elementary Algebra includes Probability, Statistics and Data Analysis; Number Concepts and Properties; and Expressions, Equations and Inequalities	17%
Intermediate Algebra includes Number Concepts and Properties, Functions	15%
Coordinate Geometry includes Graphical Representations, Measurement and Functions	15%
Plane Geometry Includes Properties of Plane Figures and Measurement	23%
Trigonometry includes Functions	7%

Mathematics Strands

Basic Operations and Applications (BOA)
Probability, Statistics and Data Analysis (PSD)
Numbers: Concepts and Properties (NCP)
Expressions, Equations and Inequalities (XEI)
Graphical Representations (GRE)
Properties of Plane Figures (PPF)
Measurement (MEA)
Functions (FUN)—This strand is tested ONLY on the ACT exam.

The Mathematics Test contains items that fall under four cognitive levels:

- Knowledge and Skills—these questions require the use of mathematical facts, definitions, formulas or procedures to solve problems that are strictly mathematical.
- Direct Application—these questions involve applying mathematical facts, definitions, formulas or procedures to solve problems with real world context.
- Understanding Concepts—these questions assess students’ understanding of concepts required to make an inference or draw a conclusion.
- Integrating Conceptual Knowledge—these questions appraise students’ ability to integrate understanding of major concepts to solve non routine problems.

References

The ACT: Connecting College Readiness Standards to the Classroom for Mathematics Teachers. ACT, Inc., Iowa City, IA. 2005: 17-18.

Your Guide to ACT. ACT. 27 May 2008.
<http://www.act.org/aap/pdf/YourGuidetoACT.pdf>