

Kentucky Department of Education

Course Standards for 2019-2020 and Beyond



Kentucky Department of
EDUCATION

Personalized Option Courses

Grade Level: 9-12

Course standards documents are designed to show how specific standards align to courses. For instructional planning and assessment, please access the complete [Kentucky Academic Standards for Mathematics](#) for the full scope of what students should know and be able to do.

These remaining required standards, listed here, must be taught during the 3rd course, the 4th course or through a combination of 3rd/4th courses.

Upon course completion students should be able to:

Standards

Standards for Mathematical Practice

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Modeling Standards: Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data. Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (*).

The high school standards are listed in conceptual categories:

- Number and Quantity (N)
- Algebra (A)

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- Functions (F)
- Geometry (G)
- Statistics and Probability (SP)

Conceptual Category Number and Quantity (N) – Standards

KY.HS.N.5

Define appropriate units in context for the purpose of descriptive modeling. ★

KY.HS.N.6

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

KY.HS.N.7

Understanding properties of complex numbers.

- a. Know there is a complex number i such that $i^2 = -1$ and every complex number has the form $a + bi$ with a and b real.
- b. Use the relation $i^2 = -1$ and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.

KY.HS.N.9

Solve quadratic equations with real coefficients that have complex solutions.

KY.HS.N.14

Use matrices to represent and manipulate data.

KY.HS.N.15

Perform operations with matrices.

- a. Add, subtract and multiply matrices of appropriate dimensions.
- b. Multiply matrices by scalars to produce new matrices.

Conceptual Category Algebra (A) – Standards

KY.HS.A.1

Interpret expressions that represent a quantity in terms of its context. ★

- b. Interpret complicated expressions, given a context, by viewing one or more of their parts as a single entity.

KY.HS.A.2

Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.

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KY.HS.A.3

Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★

- a. Write the standard form of a given polynomial and identify the terms, coefficients, degree, leading coefficient and constant term.

KY.HS.A.7

Identify roots of polynomials when suitable factorizations are available. Know these roots become the zeros (x-intercepts) for the corresponding polynomial function.

KY.HS.A.12

Create equations and inequalities in one variable and use them to solve problems.

KY.HS.A.13

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

KY.HS.A.14

Create a system of equations or inequalities to represent constraints within a modeling context. Interpret the solution(s) to the corresponding system as viable or nonviable options within the context.

KY.HS.A.15

Rearrange formulas to solve a literal equation, highlighting a quantity of interest, using the same reasoning as in solving equations.

KY.HS.A.17

Solve and justify equations in one variable. Justify the solutions and give examples showing how extraneous solutions may arise.

- a. Solve rational equations written as proportions in one variable.
- b. Solve radical equations in one variable.

KY.HS.A.19

Solve quadratic equations in one variable.

- a. Solve quadratic equations by taking square roots, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .

KY.HS.A.21

Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

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KY.HS.A.24

Justify that the solutions of the equations $f(x) = g(x)$ are the x-coordinates of the points where the graphs of $y = f(x)$ and $y = g(x)$ intersect. Find the approximate solutions graphically, using technology or tables. ★

Conceptual Category Functions (F) – Standards

KY.HS.F.1

Understand properties and key features of functions and the different ways functions can be represented.

- c. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
- d. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- e. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

KY.HS.F.3

Understand average rate of change of a function over an interval.

- a. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
- b. Estimate the rate of change from a graph. ★

KY.HS.F.4

Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). ★

- b. Graph square root, cube root and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior.
- d. Graph exponential and logarithmic functions, showing intercepts and end behavior.

KY.HS.F.6

Write a function that describes a relationship between two quantities. ★

- b. Combine **standard function types using arithmetic operations.**

KY.HS.F.8

Understand the effects of transformations on the graph of a function.

- a. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$ and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs.

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- b. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

KY.HS.F.9

Find inverse functions.

- a. Given the equation of an invertible function, find the inverse.

KY.HS.F.10

Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents with the use of technology.

KY.HS.F.13

Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Conceptual Category Statistics and Probability[★] (SP) – Standards

KY.HS.SP.1

Represent the distribution of data with plots on the real number line (stem plots, dot plots, histograms and box plots).

KY.HS.SP.2

Use statistics appropriate to the shape of the numerical data distribution to compare center (median, mean) and spread (interquartile range when comparing medians and standard deviation when comparing means) of different data distributions.

KY.HS.SP.3

Interpret differences in shape, center and spread in the context of the distributions of the numerical data, accounting for the presence and possible effects of extreme data points (outliers).

KY.HS.SP.5

Summarize categorical data for two or more categories in frequency tables. Calculate and interpret joint, marginal and conditional relative frequencies (probabilities) in the context of the data, recognizing possible associations and trends in the data.

KY.HS.SP.9

Understand statistics as a process for making inferences and justifying conclusions about population parameters based on a random sample from that population.

KY.HS.SP.10

Decide if a specified model is consistent with the results from a simulation.

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KY.HS.SP.11

Recognize the purposes of and differences among sample surveys, experiments and observational studies; explain how randomization relates to each.

KY.HS.SP.12

Use data from a sample survey to estimate a population mean or proportion and explain how bias may be involved in the process.

KY.HS.SP.13

Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between estimates or statistics are significant.

KY.HS.SP.14

Describe events as subsets of a sample space. Use characteristics (or categories) of the outcomes, such as,

- as unions, “A or B,” that are mutually exclusive events and
- as unions, “A or B,” that are non-mutually exclusive events and
- as intersections, “A and B,” and
- as complements of other events, “not A.”

to calculate basic probabilities.

KY.HS.SP.15

Understand the concept of independence.

- a. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their individual probabilities, $P(A) \times P(B)$
- c. Recognize and explain the concept of independence in everyday language and everyday situations.

KY.HS.SP.16

Understand the concept of conditional probability.

- a. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$.
- c. Recognize and explain the concept of conditional probability in everyday language and everyday situations.
- d. Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A and interpret the answer in terms of the model.

KY.HS.SP.19

Use permutations and combinations to compute probabilities.

- a. Distinguish between situations that can be modeled using counting techniques, including Fundamental Counting Principle, permutations and combinations.

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- b. Perform calculations using the appropriate counting technique, including simple probabilities.