Kentucky Alternate Assessment

Kentucky Academic Standards

Alternate Assessment Targets

High School Mathematics Grade 10

Kentucky Academic Standards Purpose: [KY Standards.Org]

The *Kentucky Academic Standards (KAS)* Grades Primary-12 help ensure that all students across the commonwealth are focusing on a common set of standards and have opportunities to learn at a high level. This site provides administrators, teachers, parents, and other stakeholders in local districts with a basis for establishing and/or revising their curricula (for additional guidance, see **Kentucky Model Curriculum Framework**).

The instructional program should emphasize the development of students' abilities to acquire and apply the standards and assure appropriate accommodations are made for the diverse populations of students found within Kentucky schools. The resources found in this site specifies only the content for the required credits for high school graduation (program completion) and primary, intermediate, and middle-level programs leading up to these requirements. Schools and school districts are charged with identifying the content for elective courses and designing instructional programs for all areas.

The purpose of the Kentucky Academic Standards is to outline the minimum content knowledge required for all students before graduating or exiting Kentucky public high schools. Kentucky schools and districts are responsible for coordinating curricula across grade levels and among schools within districts. A coordinated curricular approach ensures that all students have opportunities to achieve Kentucky's Learning Goals and Academic Expectations.

Alternate Assessment Targets: (not a standard)

An Alternate Assessment Target represents limits to a selected Kentucky Academic Standard. An Alternate Assessment Target may reduce parts of the standard with specific guidance to what an assessment item could represent. Not all Kentucky Academic Standards selected for assessments will have an Alternate Assessment Target and may display the language: "*No limitations. All parts of the Kentucky Academic Standard are eligible to be included as an assessment item."* This would mean that the entire standard in its original form is reduced in depth and breadth and is eligible in its entirety to be used in the development of assessment items.

Standards for Mathematical Practice: (MP.1-MP.8)

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the National Council of Teachers of Mathematics (NCTM) process standards of problem solving, reasoning and proof, communication, representation and connections. The second are the strands of mathematical proficiency specified in the National Research Council's 2001 report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately) and productive disposition (habitual inclination to see mathematics as sensible, useful and worthwhile, coupled with a belief in diligence and one's own efficacy).

MP.1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course, if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables and graphs, or draw diagrams of important features and relationships, graph data and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method and they continually ask themselves, "Does this make sense?" They can understand other approaches to solving complex problems and identify correspondences between different approaches.

MP.2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

MP.3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students also are able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense and ask useful questions to clarify or improve the arguments.

MP.4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems that arise in everyday life. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

MP.5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package or dynamic geometry software. Proficient students are sufficiently familiar with appropriate tools to make sound decisions about when each of these tools might be helpful, recognizing both the potential for insight and limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know technology can enable them to visualize the results of varying assumptions, explore consequences and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

MP.6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussions with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, and express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students provide carefully formulated explanations to each other. By the time they reach high school, they can examine claims and make explicit use of definitions.

MP.7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression x2 + 9x + 14, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also are able to shift perspectives. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 - 3(x - y)2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

MP.8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated and look both for general methods and shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y - 2)/(x - 1) = 3. Noticing the regularity in the way terms cancel when expanding (x - 1) (x + 1), (x - 1) (x2 + x + 1) and (x - 1) (x3 + x2 + x + 1) might lead to awareness of the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Clarifications:

The Clarification sections communicate expectations more clearly and concisely to teachers, parents, students and stakeholders through examples and illustrations.

Coherence:

- The Coherence/Vertical Alignment indicates a mathematics connection within and across grade levels.
- Coherence/Vertical Alignment is about math making sense. The standards are sequenced in a way that make mathematical sense and are based on the progressions for how students learn.
- The Coherence/Vertical Alignment component should help guide teachers when determining what standards students might need additional support with if they are struggling to understand certain content.

High School Mathematics Grade 10 Kentucky Academic Standards Assessed by Window

Window	**Standard**
1	KY.HS.N.5*
1	KY. HS.A.1*
1	KY. HS.A.16*
1	KY. HS.F.1*
1	KY. HS.F.3
1	KY. HS.G.1
1	KY. HS.G.24

Window	**Standard**
2	KY. HS.N.5*
2	KY. HS.A.1*
2	KY. HS.A.12
2	KY. HS.A.16*
2	KY. HS.F.1*
2	KY. HS.G.23
2	KY. HS.SP.6

* In mathematics, some standards are tested across both testing windows (in both Windows 1 and 2).

Math – Grade 10

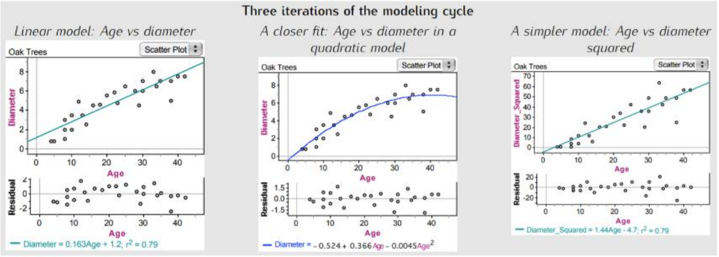
DOMAIN		Standard Clarifications
	Number and Quantity	Clarifications
KY.HS.N.5 Test Window 1 Test Window 2	Kentucky Academic Standard : Define appropriate units in context for the purpose of descriptive modeling. ★ MP.1, MP.6 *Alternate Assessment Target: No limitations. All parts of the Kentucky Academic Standard are eligible to be included as an assessment item.*	In real-world situations, answers are usually represented by numbers with units. Units involve measurement, which requires precision and accuracy. For example, students should recognize that units measuring speed would not be appropriate for situations involving volume. Additionally students should understand when one dimensional, two dimensional, or three dimensional units are most applicable.
	Algebra	Clarifications
KY.HS.A.1 Test Window 1 Test Window 2	Kentucky Academic Standard : Interpret expressions that represent a quantity in terms of its context. ★ a. Interpret parts of an expression, such as terms, factors and coefficients. b. Interpret complicated expressions, given a context, by viewing one or more of their parts as a single entity. MP.2, MP.6 *Alternate Assessment Target: No limitations. All parts of the Kentucky Academic Standard are eligible to be included as an assessment item.*	Students encounter simpler scenarios where they interpret r·t as the product of a given rate and time or interpret the perimeter expression (2l+2w) contextually as the sum of twice the length and twice the width of a rectangle. Students encounter more complicated scenarios where they interpret P(1+r)n contextually as the product of a principal investment, P and (1+r)n which represents an investment rate, compounding factor and time.

KY.HS. A.12 Test Window 2	**Kentucky Academic Standard :** Create equations and inequalities in one variable and use them to solve problems. **MP.1, MP.4** *Alternate Assessment Target: Limit to numbers within negative 20 to 20. Limit to linear equations and exponential functions.*	Students use the addition, subtraction, multiplication and division properties for both equations and inequalities to solve problems. These equations may arise from linear and quadratic functions and simple rational and exponential functions.
KY.HS.A.16 Test Window 1 Test Window 2	**Kentucky Academic Standard :** Understand each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **MP.1, MP.3** *Alternate Assessment Target: Limit coefficients to integers from negative 20 to 20.*	Students reason with and about collections of equivalent expressions to see how all the expressions in the collection are linked together through the properties of operations. They discern patterns in sequences of solving equation problems that reveal structures in the equations themselves: $2x+4=10$, $2(x-3)+4=10$, $2(3x-4)+4=10$, etc. After solving many linear equations in one variable, students look for general methods for solving a generic linear equation in one variable by replacing the numbers with letters: $ax + b = cx + d$. They have opportunities to pay close attention to calculations involving the properties of operations, properties of equality and properties of inequality as they find equivalent expressions and solve equations, noting common ways to solve different types of equations.
Functions		Clarifications
KY.HS.F.1 Test Window 1	**Kentucky Academic Standard :** Understand properties and key features of functions and the different ways functions can be represented. a. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain	a. When describing relationships between quantities, the defining characteristic of a function is the input value determines the output value or, equivalently, the output value depends upon the input value. In some

Test Window 2	exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. b. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context. 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). MP.2, MP.4, MP.7 *Alternate Assessment Target: Limit full standard to input and output numbers from negative 20 to 20.* *a. No further limitations* *b. No further limitations* *c. Limit to situations that do not include identification of symmetries, end behavior, or periodicity* *d. No further limitations* *e. Excluded from assessment*	situations where two quantities are related, each can be viewed as a function of the other. c. A function is often described and understood in terms of the output behavior, or over what input values is it increasing, decreasing, or constant. Important questions include, "For what input values is the output value positive, negative, or 0? What happens to the output when the input value gets very large in magnitude?" Graphs become useful representations for understanding and comparing functions because these behaviors are often easy to see in the graphs of functions. Key features include, but are not limited to: intercepts; intervals where the function is increasing, decreasing, or remaining constant; relative maxima and minima; symmetries; end behavior; periodicity. e. Students compare characteristics from various representations for one type of family of function at a time. For quadratics, students might determine which function has the larger maximum when given two different representations of quadratic functions.

KY.HS.F.3 Test Window 1	**Kentucky Academic Standard :** 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. ★ **MP.2, MP.4** *Alternate Assessment Target: Limit the average rate of change to integers from negative 20 to 20 for full standard.*	The rate of change over an interval is equivalent to the slope between the endpoints of the interval. For linear functions, the rate of change is constant, over all intervals. However, for nonlinear functions, the average rate of change may vary depending on the interval.
	Geometry	Clarifications
KY.HS.G.1 Test Window 1	**Kentucky Academic Standard :** Know and apply precise definitions of the language of Geometry: a. Understand properties of line segments, angles and circle. b. Understand properties of and differences between perpendicular and parallel lines. **MP.3, MP.6** *Alternate Assessment Target: No limitations. All parts of the Kentucky Academic Standard are eligible to be included as an assessment item.*	Students in high school start to formalize the intuitive geometric notions they developed in grades 6–8 and give specificity to geometric concepts that can serve as a good basis for developing precise definitions and arguments. a. Students understand a more formal knowledge of postulates, theorems and various properties relating to line segments, angles and circles. This knowledge is based on the undefined notions of point, line, distance along a line and distance around a circular arc. b. Students understand important properties of both parallel and perpendicular lines, prior to making the connections between these types of lines and how they relate to their calculated or given slope.

KY.HS.G.23 Test Window 2	Kentucky Academic Standard : Find measurements among points within the coordinate plane. a. Use points from the coordinate plane to find the coordinates of a midpoint of a line segment and the distance between the endpoints of a line segment. b. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. MP.2, MP.8 *Alternate Assessment Target:* *a. Limit to midpoint and endpoints with coordinates within negative 20 and 20.* *b. Excluded for assessment*	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
KY.HS.G.24 Test Window 1	Kentucky Academic Standard : Use coordinates within the coordinate plane to calculate measurements of two dimensional figures. a. Compute the perimeters of various polygons. b. Compute the areas of triangles, rectangles and other quadrilaterals.★ MP.2, MP.4 *Alternate Assessment Target: Limit full standard to coordinates from negative 20 to 20.* *a. Limit to rectangles, triangles and pentagon* *b. Limit to triangles and quadrilaterals (rectangles, parallelograms and trapezoids)*	Students utilize the distance formula to find distances between points in order to find the area and/or perimeter of various geometric figures.

Statistics and Probability		Clarifications
KY.HS.SP.6 Test Window 2	**Kentucky Academic Standard :** Represent data on two quantitative variables on a scatter plot and describe how the explanatory and response variables are related. a. Calculate an appropriate mathematical model, or use a given mathematical model, for data to solve problems in context. b. Informally assess the fit of a model (through calculating correlation for linear data, plotting, calculating and/or analyzing residuals). MP.3, MP.4, MP.5 *Alternate Assessment Target:* *a. Limit to a given mathematical model in quadrant one* *b. Limit comparison to examining the plot of the original data*	Emphasize linear, quadratic and exponential models as illustrated below. 

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