

|                             | EM*  | 0Q   | 100Q   | 200Q  | 300Q  | 400Q   | 500Q  | 600Q  | 700Q   | 800Q  | 900Q   | 1000Q   | 1100Q   | 1200Q   | 1300Q  | 1400Q   |
|-----------------------------|--|--|--|---|---|--|---|---|--|---|--|---|---|---|--|---|
| GEOMETRY                    | <b>EM</b><br>Use directional and positional words.                                       | <b>40Q</b><br>Combine simple figures to create a given shape.  | <b>160Q</b><br>Identify and name basic solid figures: rectangular prism, cylinder, pyramid, and cone; identify in the environment. | <b>200Q</b><br>Identify and name: hexagon, trapezoid, parallelogram and rhombus.  | <b>400Q</b><br>Identify intersecting, parallel, skew, and perpendicular lines and line segments. Identify midpoints of line segments. | <b>500Q</b><br>Identify angles (acute, right, obtuse, and straight).                             | <b>680Q</b><br>Classify plane figures according to type of symmetry (line, rotational).   | <b>770Q</b><br>Identify corresponding parts of similar and congruent figures.       | <b>880Q</b><br>Describe cross-sectional views of three-dimensional figures.  | <b>1020Q</b><br>Define and identify complementary and supplementary angles.                                   | <b>1170Q</b><br>Use properties of triangles to solve problems related to isosceles and equilateral triangles.            | <b>1280Q</b><br>Use trigonometric ratios to represent relationships in the coordinate plane.                              | <b>1340Q</b><br>Describe the transformations of solid figures in space.   | <b>1400Q</b><br>Graph polar equations; identify transformations related to changes in constants and coefficients.                   |  |   |
| MEASUREMENT                 | <b>EM</b><br>Measure length using nonstandard units.                                     | <b>70Q</b><br>Determine the value of sets of coins.  | <b>100Q</b><br>Measure lengths in inches/centimeters using appropriate tools and units.  | <b>210Q</b><br>Tell time at the five-minute intervals.  | <b>300Q</b><br>Make different sets of coins with equivalent values.   | <b>400Q</b><br>Determine perimeter using concrete models, nonstandard units, and standard units. | <b>560Q</b><br>Use grids to develop the relationship between the total numbers of square units in a rectangle and the length and width of the rectangle ( $l \times w$ ). | <b>640Q</b><br>Calculate distances from scale drawings and maps.                    | <b>840Q</b><br>Use models to find volume for prisms and cylinders as the product of the area of the base (B) and the height. Calculate the volume of prisms. | <b>920Q</b><br>Use proportions to express relationships between corresponding parts of similar figures.       | <b>1040Q</b><br>Use nets or formulas to find the surface area of prisms and cylinders.                                   | <b>1140Q</b><br>Find the slope of a line given the graph of the line, an equation of the line, or two points on the line. | <b>1230Q</b><br>Find the ratio of perimeters, areas, and volumes of similar geometric figures using formulas to solve problems. | <b>1360Q</b><br>Determine the area and volume of figures using right triangle relationships, including trigonometric relationships. | <b>1400Q</b><br>Determine the magnitude and direction of a vector and solve problems.                                    |   |
| & OPERATIONS                | <b>EM</b><br>Read, write, and count using whole numbers; rote count forward to 30.       | <b>30Q</b><br>Use place value with hundreds.   | <b>160Q</b><br>Read and write word names for numbers from 1,000 to 9,999.  | <b>210Q</b><br>Compare and order numbers less than 10,000.  | <b>320Q</b><br>Identify combinations of fractions that make one whole.  | <b>410Q</b><br>Round whole numbers to a given place value.                                       | <b>560Q</b><br>Use the distributive property to simplify numerical expressions.   | <b>600Q</b><br>Estimate products and quotients of decimals or of mixed numbers.     | <b>720Q</b><br>Read, write, or model numbers in expanded form using exponents.   | <b>830Q</b><br>Calculate unit rates to make comparisons.  | <b>900Q</b><br>Determine the absolute value of a number.   | <b>1000Q</b><br>Calculate using numbers expressed in scientific notation.   | <b>1130Q</b><br>Factor polynomials.   | <b>1210Q</b><br>Use rational exponents to simplify expressions.   | <b>1310Q</b><br>Find sums, differences, products, and quotients of rational algebraic expressions.                       | <b>1400Q</b><br>Simplify complex fractions.                             |
| NUMBER PROPERTIES           | <b>EM</b><br>Use ordinal numbers beyond tenth to describe order.                         | <b>60Q</b><br>Identify odd and even numbers using objects.   | <b>190Q</b><br>Represent fractions concretely and symbolically.  | <b>250Q</b><br>Subtract 2- and 3-digit numbers with regrouping.   | <b>330Q</b><br>Compare rational numbers in decimal form (tenths and hundredths) with and without models.                              | <b>450Q</b><br>Divide using single-digit divisors with and without remainders.                   | <b>580Q</b><br>Estimate and compute sums and differences with decimal numbers.  | <b>650Q</b><br>Use powers of ten to multiply and divide whole numbers and decimals. | <b>780Q</b><br>Write numbers using prime factorization.  | <b>890Q</b><br>Compute with rational numbers (positive and negative).   | <b>970Q</b><br>Add, subtract, and multiply matrices (including scalar multiplication).                                   | <b>1050Q</b><br>Add, subtract, and multiply polynomials.  | <b>1170Q</b><br>Describe, compare, and simplify imaginary numbers.  | <b>1210Q</b><br>Perform basic operations with complex numbers and graph complex numbers.  | <b>1370Q</b><br>Locate points in a polar coordinate system. Convert between rectangular and polar systems.               | <b>1400Q</b><br>Add and subtract vectors; multiply vectors by a scalar. |
| ALGEBRAIC THINKING          | <b>EM</b><br>Describe likenesses and differences between and among objects.              | <b>70Q</b><br>Identify a pattern and translate into another form (e.g., actions, words, objects).                                    | <b>150Q</b><br>Find the value of an unknown in a number sentence.  | <b>300Q</b><br>Write addition and subtraction sentences to represent a word problem.  | <b>430Q</b><br>Describe the meaning of an unknown in the context of a word problem.   | <b>530Q</b><br>Find the value of a variable in a number sentence.                                | <b>650Q</b><br>Use one-step equations and inequalities to model and solve problems.   | <b>780Q</b><br>Identify situations or solve problems with varying rates of change.  | <b>810Q</b><br>Determine the ratio or rate of change of a relation given a table or graph.   | <b>990Q</b><br>Use systems of linear equations in two or more variables to solve problems.                    | <b>1090Q</b><br>Find and interpret the maximum, the minimum, and the intercepts of a quadratic function.                 | <b>1140Q</b><br>Describe the slope of a line given in the context of a problem situation.                                 | <b>1200Q</b><br>Graph exponential functions of the form $f(x) = ab^x$ .   | <b>1340Q</b><br>Rename logarithmic expressions using properties of logarithms.  | <b>1400Q</b><br>Use the definition of an ellipse to identify characteristics, write an equation, and graph the relation. |   |
| DATA ANALYSIS & PROBABILITY | <b>EM</b><br>Organize, display, and interpret information in concrete or picture graphs. | <b>40Q</b><br>Describe the probability of chance events as certain, impossible, more likely, less likely or equally likely to occur. | <b>200Q</b><br>Organize, display, and interpret information in line plots and tally charts.  | <b>390Q</b><br>Organize, display, and interpret information in tables and graphs (frequency tables, pictographs, and line plots). | <b>440Q</b><br>Describe the probability of an event using a fraction or ratio.  | <b>600Q</b><br>Organize, display, and interpret information in circle graphs.                    | <b>730Q</b><br>Determine odds given an event or a probability.  | <b>850Q</b><br>Describe data using the mean.  | <b>960Q</b><br>Organize, display, and interpret information in box-and-whisker plots.  | <b>1050Q</b><br>Identify outliers and determine their effect on the mean, median, and range of a set of data. | <b>1100Q</b><br>Derive a linear equation that models a set of data using calculators. Use the model to make predictions. | <b>1230Q</b><br>Determine a simple probability using geometric figures.   | <b>1460Q</b><br>Model periodic phenomena using trigonometric functions.   |   |  |   |
|                             | EM*  | 0Q   | 100Q   | 200Q  | 300Q  | 400Q   | 500Q  | 600Q  | 700Q   | 800Q  | 900Q   | 1000Q   | 1100Q   | 1200Q   | 1300Q  | 1400Q   |

# The Quantile® Framework for Mathematics



Kentucky Department of Education  
**Next Generation Learners**  
[www.education.ky.gov/KDE/Instructional+Resources/High+School/Mathematics/Mathematics+Assessment.htm](http://www.education.ky.gov/KDE/Instructional+Resources/High+School/Mathematics/Mathematics+Assessment.htm)



The Quantile® Framework for Mathematics, developed by MetaMetrics®, comprises more than 500 skills and concepts taught from kindergarten through high school. The Quantile map shows that mathematics is developmental—readiness to learn a specific skill or concept depends on having learned more basic skills and concepts first. It also shows the connections between mathematics content across the strands (colored bars). By matching a student's Quantile measure (e.g., 650Q) to the Quantile measure of a mathematical skill or concept, you can see if the student is ready to learn that skill, needs to learn supporting concepts first, or has already mastered it. For more information and to use free Quantile resources, visit [www.Quantiles.com](http://www.Quantiles.com).



\*Emerging Mathematician (EM) represents a Quantile measure of 0Q and below.

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Dear Educators and Parents,

As we continue to focus on highly effective teaching and learning in Kentucky classrooms, a key component is measuring student achievement and adjusting instruction to support student learning. An additional measure of student achievement comes in the form of a Quantile® measure. Teachers and parents will be able to utilize this measure to assist students with the learning process in mathematics. Students in grades 3–8 and 11 will receive a Quantile measure on their KCCT score report.

A Quantile measure indicates which mathematical skills a learner is ready for and which ones will require further instruction. Teachers and parents are able to use this measure to determine how likely a student is to successfully solve more complex problems on the continuum when provided with targeted instruction. A lower Quantile measure indicates that a student most likely struggles to understand and succeed with appropriate level mathematics material. Likewise, a higher Quantile measure suggests that a student may be able to successfully handle more advanced problems on the continuum.

The Quantile measure will assist teachers and parents in identifying mathematical concepts and topics that are targeted to the student's individual achievement level. This will help guide teachers in the development and selection of appropriate materials and resources.

Quantile measures, along with the provided resources, have the potential to increase our students' mathematics achievement. Working together, educators and parents will be able to guide students to achieve proficiency in mathematics and develop into next generation learners who will be globally intelligent in an exceedingly competitive digital world.

Visit the Kentucky Department of Education's Next Generation Learner site at [www.education.ky.gov/KDE/Instructional+Resources/High+School/Mathematics/Mathematics+Assessment.htm](http://www.education.ky.gov/KDE/Instructional+Resources/High+School/Mathematics/Mathematics+Assessment.htm) for more information about Quantile measures.

Sincerely,

Terry Holliday, Ph.D.



## The Quantile® Framework for Mathematics

### Improving Student Achievement With The Quantile Framework for Mathematics

The Quantile Framework for Mathematics takes the guesswork out of mathematics instruction. The Quantile Framework uses a common, developmental scale to measure student mathematics achievement, the difficulty of mathematical skills and concepts, and the materials for teaching mathematics. By placing the curriculum, teaching materials and students on the same scale, Quantile measures enable educators to describe which mathematical skills and concepts a student is ready to learn and those that will require additional instruction. Then, students can be matched with the resources that meet their learning needs. With Quantile measures, educators have a proven measure of student mathematics achievement to target instruction, monitor student progress and forecast performance on high-stakes tests.

### More Information, Not More Testing

Rather than requiring an additional assessment, Quantile measures add value to already existing tests and instructional programs. A growing number of classroom, norm-referenced and state-level assessments are linked with the Quantile Framework. Students who take these assessments receive a Quantile measure—a number followed by a “Q.” A Quantile measure indicates that the student is ready for instruction of a particular mathematical concept and has knowledge of the required skills necessary to learn it. Mathematics textbooks and other instructional resources also are linked with the Quantile Framework, allowing educators to match students with targeted materials to help them better understand mathematical concepts or skills.

### Learning on a Developmental Scale

The Quantile Framework has five content strands—Number Properties & Operations, Geometry, Measurement, Algebraic Thinking, and Data Analysis & Probability. The Quantile scale ranges from Emerging Mathematician (0Q and below) to above 1600Q, and spans the mathematics continuum from concepts taught in kindergarten to those typically taught in Algebra II, Geometry, Trigonometry and Precalculus.

The Quantile scale is a taxonomy—or classification system—of mathematical skills and concepts along the continuum of mathematics development. Each content strand is annotated by “QTaxons,” which describe specific skills, objectives or grade-level expectations as defined by each state's curriculum. Each QTaxon has a Quantile measure that estimates how difficult it will likely be for a student to learn, as compared with other skills in the taxonomy.

A Quantile measures students' mathematics achievement, not their grade level. A class of 30 sixth graders will likely have students with a range of Quantile measures. Educators use those varied Quantile measures to target instruction and remediate as necessary, using tools and resources that match the students' Quantile measures.

### Using Quantile Measures in the Classroom

- Activate prior knowledge with activities related to the prerequisite skills from a knowledge cluster.
- Enhance major themes of mathematics by building a bank of learning targets at varying levels that not only support them, but also provide a way for all students to participate in the theme successfully. For example, consider how addition progresses from single numbers to multi-digit numbers and then moves to decimals and fractions.
- Sequence mathematical learning targets according to their difficulty as much as possible.
- Develop a mathematics folder that goes home with students and returns weekly for review. The folder can contain examples of learning targets within a student's Quantile range, applications of topics outside the classroom, reports of recent assessments, and a parent form to record the amount of time spent on mathematics investigations at home.
- Choose concepts lower in a student's Quantile range when factors make students view mathematics as more challenging, threatening or unfamiliar. Select concepts at or above a student's Quantile range to stimulate growth when a topic holds high interest for the student or when additional support, such as background teaching or peer tutoring, is provided.
- Develop lists of learning targets that are tailored to provide appropriately challenging and curriculum suitable for students.

### Using Quantile Measures at Home

- Ensure that a child gets plenty of mathematical experiences, concentrating on concepts within his or her Quantile range. Parents can ask the child's teacher to print a list of appropriate learning targets or search the mathematical skills database at [www.Quantiles.com](http://www.Quantiles.com).
- Communicate with the child's teachers about his or her mathematical needs and accomplishments. Teachers can use the Quantile scale to describe their assessment of the child's mathematical achievement.
- When a new topic proves too challenging for a child, use activities or other materials from the Quantile website to help. Review the prerequisite QTaxons to ensure that gaps or misconceptions are not interfering with the current topic.
- Celebrate a child's mathematical accomplishments. The Quantile Framework provides an easy way for students to track their own growth. Parents and children can set goals for mathematics—spending so much time daily working on math investigations; discussing situational topics, like statistics from a newspaper or discounts at the store; reading a trade book about a mathematical topic; or trying new kinds of websites and games. When children reach the goal, make it an occasion!

