| **Unit 1 Title** | **Estimated Time Frame** |
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| **Real Numbers** and **Linear Equations** | **Approximately 40 days** |

**Big Idea (s)**

Know that there are numbers that are not rational, and approximate them by rational numbers.
Work with integer exponents.
Analyze and solve linear equations.

**Essential Question(s)**

What are real numbers? How are real numbers used to solve problems?
How can approximations of irrational numbers be used to compare the size of irrational numbers?
Where do rational numbers and irrational numbers belong within *the entire* Number System? What is their importance?
Where in real life do we use very large and very small numbers?
How can I use a model to determine one solution, infinitely many solutions, or no solutions with equations?

| **Standards for Mathematical Practice (MP.) -** The practice standards in bold describe expertise to be intentionally developed in this unit. | **Kentucky Interdisciplinary Literacy Practices (KILP.) -** The practice standards in bold describe expertise to be intentionally developed in Mathematics. |
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| MP.1. Make sense of problems and persevere in solving them.<br>**MP.2. Reason abstractly and quantitatively.**<br>**MP.3. Construct viable arguments and critique the reasoning of others.**<br>**MP.4. Model with mathematics.**<br>**MP.5. Use appropriate tools strategically.**<br>MP.6. Attend to precision.<br>**MP.7. Look for and make use of structure.**<br>**MP.8. Look for and express regularity in repeated reasoning.** | KILP.1 Recognize that text is anything that communicates a message.<br>KLIP.2 Employ, develop, and refine schema to understand and create text.<br>KILP.3 View literacy experiences as transactional, interdisciplinary and transformational.<br>KILP.4 Utilize receptive & expressive language arts to better understand self, others, and the world.<br>KILP.5 Apply strategic practices, with scaffolding & then independently, to approach new literacy tasks.<br>**KILP.6 Collaborate with others to create new meaning.**<br>**KILP.7 Utilize digital resources to learn and share with others.**<br>**KILP.8 Engage in specialized, discipline specific literacy practices.**<br>**KILP.9 Apply high level cognitive processes to think deeply and critically about text.**<br>KILP.10 Develop a literacy identity that promotes lifelong learning. |

| **Common Preconceptions/Misconceptions** | | |
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| Rational/Irrational Numbers - distinguish between an irrational repeating pattern (1.010110111) and rational repeating digits (1.12121212)<br>Exponent Rules - Thinking 4^3 is 4 x 3 versus 4x4x4<br>Square and Cube Roots- Radical vs Division Symbol and Inverse Operation of a square root is squaring a number<br>Scientific Notation - counting place values (significant digits) rather than zeros only<br>Solving Linear Equations- Keeping the equation balanced by performing operations on both sides; Distribute to all term in the parenthesis | | |
| **KAS Standards** | **Prerequisite Skill, Considerations, and Coherence** | **Samples of Learning Intentions and Success Criteria** |
| **Cluster: Know that there are numbers that are not rational and approximate them by rational numbers** | | |
| KY.8.NS.1 Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.<br><br>☐ **Conceptual** ☐ **Procedural** ❑ Application<br><br>**MP.2, MP.6, MP.7, KILP.2, KILP.6** | **Considerations:** Emphasis is placed on how all rational numbers can be written as an equivalent decimal. The end behavior of the decimal determines the classification of the number.<br><br>**Prerequisite Skills:**<br>Rounding numbers<br><br>Coherence<br>KY.7.NS.2→ KY.8.NS.1→ KY.HS.N.3 | We are learning to understand real numbers.<br><br>● I can classify numbers.<br>● I can determine if a decimal is terminating or repeating.<br>● I can tell what an irrational number is. |
| KY. 8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2).<br><br>☐ **Conceptual** ☐ **Procedural** ❑ Application<br><br>**MP.2, MP.7, MP.8, KILP.5, KILP.8** | **Considerations:** For example, by shortening the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.<br><br>**Prerequisite Skills:**<br>Using and reading a number line<br><br>Coherence KY.8.NS.2→ KY.HS.N.3 | We are learning to use rational numbers to approximate irrational numbers.<br><br>● I can describe a perfect square.<br>● I can list perfect squares.<br>● I can use perfect squares to approximate irrational numbers.<br>● I can estimate the value of expressions that include irrational numbers.<br>● I can plot rational and irrational numbers (approximately) on a number line. |

| **Cluster: Work with radicals and integer exponents.** | | |
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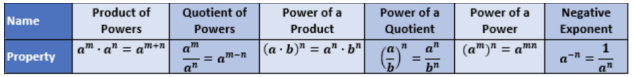
| KY.8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.<br><br>☐ **Conceptual** ☐ **Procedural** ❑ Application<br><br>**MP.5, KILP.6, KILP.8** | **Considerations:** Students do not prove these are the only solutions, but rather use informal methods, such as guessing and checking. Since √p is defined to mean the positive solution to the equation $x2 = p$ (when it exists), it is not correct to say (as is common) √64 = ±8<br><br>**Prerequisite Skills:**<br>Inverse operation - square ←→ square root<br><br>Coherence KY.8.EE.2→ KY.HS.A.12 | We are learning to evaluate square roots and cube roots.<br>● I can find the square root by finding the factor whose square is equal to that number.<br>● I can find the cube root by finding the factor whose cube is equal to that number.<br>● I can understand why some square roots are irrational.<br><br>We are learning to solve equations using square roots and cube roots.<br>● I can use square roots to solve equations involving squares ($x^2$).<br>● I can use cube roots to solve equations involving cubes ($x^3$). |
| KY.8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.<br><br>☐ **Conceptual** ☐ **Procedural** ❑ Application<br><br>**MP.3, MP.7, MP.8, KILP.1, KILP.9** |  <br><br><br>Coherence KY.8.EE.1→ KY.HS.N.1 | We are learning about the properties of exponent integers.<br>● I can know and use properties of exponents to write equivalent expressions.<br>● I can know and use the Product of Powers Property when multiplying powers with the same base.<br>● I can know and use the Quotient of Powers property when dividing powers with the same base.<br>● I can know and use the Power of a Quotient property when dividing exponential expressions with the same exponent and different bases.<br>● I can know and use the Power of Products Property when multiplying exponential expressions with the same exponent and different bases.<br>● I can know and use the Power of a Power property.<br>● I can know and use the negative exponent property to rewrite expressions with negative exponents. |

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| KY.8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.<br><br>☐ **Conceptual** ☐ **Procedural** ❑ Application<br><br>**MP.3, MP.5, MP.6, KILP.1, KILP.4, KILP.9**<br><br>*Supporting Standard KY.8.EE.4* | **Considerations:** Students conceptualize why a number could be written in scientific notation and the benefits of doing so and connect exponent rules learned earlier to the methods of writing a quantity in scientific notation.<br><br>**Prerequisite Skills:**<br>Exponent rules<br>Understand the effects of multiplying and dividing by ten or the power of 10 (5th grade)<br><br>Coherence KY.8.EE.3→ KY.HS.N.6 | We are learning how to use powers of 10 to estimate and write quantities.<br>● I can estimate very large and very small quantities by rounding.<br>● I can write the rounded number as a single digit times a power of 10.<br>● I can use scientific notation to write very large or very small quantities in real-world situations.<br>● I can determine how many times greater a number written in scientific notation is to another number. |
| **Cluster: Analyze and solve linear equations and pairs of simultaneous linear equations** | | |
| KY.8.EE.7b Solve linear equations in one variable.<br><br>☐ **Conceptual** ☐ Procedural ❑ Application<br><br>b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.<br><br>❑ Conceptual ☐ **Procedural** ❑ Application<br><br>**MP.2, MP.3, MP.7, KILP.5, KILP.6, KILP.8**<br>*Supporting Standard KY.8.EE.7a* | **Considerations:** Building upon skills from grade 7, students combine like terms on the same side of the equality and use the distributive property to simplify the equation when solving. The emphasis in this standard is also on using rational number coefficients. Solutions of certain equations may elicit infinitely, many, or no solutions.<br>Students should be exposed to equations involving fractions and decimals.<br><br>**Prerequisite Skills:**<br>Inverse operations<br><br>Coherence KY.7.EE.1→ KY.8.EE.7→ KY.HS.A.18 | We are learning how to solve linear equations.<br>● I can use inverse operations to move all variable terms to one side of the equation and constant terms to the other.<br>● I can combine like terms to solve equations.<br>● I can use inverse operations to isolate the variable.<br>● I can use the Distributive Property to expand equations with parentheses.<br>● I can solve a multi step equation.<br>● I can solve an equation with variables on both sides. |

## Essential Vocabulary

**approximation -** An inexact representation of something that is still close enough to be useful.
**combine like terms -** An algebraic expression with terms having the same variable raised to the same exponents.
**base -** The bottom of a plane figure or three-dimensional figure
**cubic root –** A cube root of a number, denoted $\sqrt[3]{x}$ or x^1/3, is a number such that a^3 = x.
**integer exponents** - Exponents that only have integer values.
**irrational numbers -** A number that cannot be expressed as the ratio of two integers.
**powers** - A number that indicates the operation of repeated multiplication.
**rational numbers -** A number that can be expressed as the ratio of two integers.
**real number -** The combined set of rational numbers and irrational numbers.
**repeating decimals -** When a common fraction is written as a decimal by dividing the numerator by the denominator, the result is a repeating decimal if a digit or block of digits repeats endlessly as the remainder. Also called: non-terminating, unending, infinite, and periodic.
**scientific notation** - A method for writing extremely large or small numbers in which the number is shown as the product of two factors.
**slope -** "Rise over Run." Rise is how much the graph goes up or down between points, and run is how far the graph goes right or left between points.
**slope-intercept form -** An equation in the form $y=mx + b$, where $m$ is the rate of change or slope, and $b$ is the initial value or y-intercept.
**square root -** The square root of x is the number that, when multiplied by itself, gives the number, x.
**terminating decimals -** A decimal is called terminating if its repeating digit is 0. When a common fraction is written as a decimal by dividing the numerator by the denominator, the result is a finite decimal if the remainder is zero.
**y-intercept -** The y-coordinate of the point where the line crosses the y-axis.

## Supporting Standards

KY.8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. **MP, 2, MP.5, MP.6** *Choose appropriate units for real-life situations and note how the technology denotes scientific notation.*

☐ **Conceptual** ☐ **Procedural** ❑ Application

KY.8.EE.7a Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of form x = a, a = a, or a = b results (where a, and b are different numbers). **MP.2, MP.3, MP.7**

☐ **Conceptual** ☐ **Procedural** ❑ Application

| Benchmark Assessment |
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| Anchor Resources |
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| **Standard Resource Pages Hyperlinked to Each Standard**<br>**enVision Crosswalk Unit 1**<br>**enVision Language Support Handbook**<br>**Three Reads Routine**<br>**Notice and Wonder Routine**<br>**MILC Resources** |

*Disclaimer: Success Criteria is the evidence students must produce to demonstrate learning. This example is not comprehensive.
** Mathematical Practices (MP.1- 8) should be evidenced at some point throughout.
*** Modeling Standards: 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 star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to *all* standards in that group.