Unit 2 Title	**Estimated Time Frame**
Linear Equations (continued) and **Functions** and **Bivariate Data**	**20 days**

Big Idea (s)

Define, evaluate, and compare functions.
Use functions to model relationships between quantities.
Investigate patterns of association in bivariate data.

Essential Question(s)

How can you use functions to model linear relationships?
What is a function?
How can I use a model to represent a function?
How is bivariate data used to help me solve math problems?
How can knowing the slope and y-intercept help me solve problems involving linear relationships?
How can a model be used to help me represent and investigate relationships between varying quantities?
How can you represent the relationship between paired data and use the representation to make predictions?

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

Common Preconceptions/Misconceptions
Students model relationships between variables using linear and nonlinear functions. They interpret models in the context of the data, and reflect on whether or not the models make sense based on slopes, initial values, or the fit to the data. Many real-world problems can be modeled with linear functions, including instances of constant payment plans (phone plans), costs associated with running a business, and relationships between associated bivariate data. Sometimes students confuse the terms input and output, knowing that each input can have only one output. A function machine can help. Students can make it using the enVision template or draw their own. When students are analyzing graphs, they focus on how the function is changing. A common error students make when working with slopes in context is understanding what the slope represents. The most common error is confusing the rise and run in the ratio for slope. Vocabulary foldable may help. Mathematical modeling is a process that uses mathematics to represent, analyze, make predictions, or otherwise provide insight into real-world phenomena. in the recommended ***FAL: Distance Time Graphs,*** a common error students make is that they do not read the labels on the axes carefully. Students should be asked to describe what the axes mean on the graph before they begin to analyze.

KAS Standards	**Prerequisite Skill, Considerations, and Coherence**	**Samples of Learning Intentions and Success Criteria**
KY.8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. **MP.2, MP.3, MP.4, KILP.2, KILP.3, KILP.9** **Grade Level Proportional Skills:** ● Identify and calculate unit rates and use them to compare proportional relationships ● Represent proportional relationships with tables, linear graphs, equations, and ordered pairs. ● Identify the unit rate in each representation as to its rate of change between quantities and recognize this is also known as the slope or steepness of the line ● Compare the rate of change, or slope, in two different proportional relationships by looking at	**Considerations:** Emphasis is on relating previous knowledge of unit rate to slope in tables, graphs, equations, and sets of ordered pairs and comparing the slopes of two different proportional relationships. Different ways the proportional relationships can be represented include tables, graphs, equations, or sets of ordered pairs. **Prerequisite Proportional Skills:** ● Understand, compute and compare ratios, written in fraction form or in tables. ● Determine if quantities represent a proportional relationship using unit rates to compare. ● Understand and write expressions using variables to represent unknown quantities to solve problems. Coherence	We are learning to compare proportional relationships.**(Lesson 2-5)** ● I can graph a proportional relationship given a table or equation. ● I can determine the unit rate of data in a table and graph to compare proportional relationships. ● I can determine the unit rate of data in graphs and equations to compare proportional relationships. ● I can determine the unit rate of a verbal description and a graph to compare proportional relationships. We are learning to connect proportional relationships to slope. **(Lesson 2-6)** ● I can represent proportional relationships using different models, including graphs, tables, and equations. ● I can compare proportional relationships represented in different ways. ● I can understand the slope of a line as its steepness and as the rate of change

the table, graph, equation, or set of ordered pairs.	KY.7.RP.2→ KY.8.EE.5→ KY.HS.A.23	between quantities.
KY.8.EE.6b. Know the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b. **MP.3, MP.4, MP.7, KILP.1, KILP.8**	**Considerations:** Using the properties of similar triangles, demonstrate the slope between any two pairs of points on a non-vertical line create the same rise-run ratio when simplified. Understand yy = $mmmm$ and yy = $mmmm$ + bb differ in that yy = $mmmm$ only has the possibility of 0 being the y-intercept and that yy = $mmmm$ + bb has infinite possibilities, including 0, for the y intercept depending on the value of b. Coherence KY.7.RP.2→ KY.8.EE.6→ KY.HS.A.23	We are learning about linear equations. **(Lessons 2-7, 2-8, 2-9)** ● I can write linear equations in the form *y=mx* when the slope is given. ● I can graph a linear equation in the form *y=mx*. ● I can extend a table or graph of a linear relationship to find its y-intercept. ● I can analyze graphs to determine and explain the meaning of the y-intercept. ● I can graph a line from an equation in the form *y = mx + b*. ● I can write an equation that represents a line on a graph.
KY.8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. **MP.7, MP.8, KILP.7, KILP.8**	**Considerations:** Students understand the reasoning that not all relations are functions. Note: **Function notation is not required in grade 8.** Coherence KY.8.F.1→ KY.HS.F.1	We are learning to interpret a function. **(Lessons 3-1, 3-2)** ● I can identify functions using diagrams. ● I can identify functions using input/output tables. ● I can recognize a relation as a function if each input only has one output. We are learning to represent linear and nonlinear functions. **(Lesson 3-2)** ● I can represent a linear function with an equation and a graph. ● I can use a table and graph to represent a nonlinear function.
8.F.2 Compare properties of two functions, each represented differently (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the	**Considerations:** Given a linear function represented using one method listed and another linear function represented by a different method listed, determine which function has the greater or lesser rate of change or greater or lesser initial value.	We are learning to compare linear and nonlinear functions. **(Lesson 3-3)** ● I can compare the constant rate of change and the initial value of a function using a table. ● I can determine the rate of change and initial value of a function using a graph.

greater rate of change. **MP.1, MP.2, MP.4, KILP.2, KILP.5, KILP.8**	Coherence KY.7.RP.2→ KY.8.F.2→ KY.HS.F.1	• I can represent functions algebraically and determine the rate of change.
KY.8.F.3 Understand the properties of linear functions. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. **MP.7, KILP.7, KILP.8**	**Considerations:** a. For example, the equation c=3g+5 models the linear function for the total cost, c, of bowling, where g represents the number of games played and shoe rental is $5. b. For example, the function A = s², giving the area of a square as a function of its side length, is not linear because its graph contains the points (1,1), (2,4), and (3,9), which are not on a straight line. Coherence KY.7.EE.4→ KY.8.F.3→ KY.HS.F.11	We are learning about the properties of linear functions. **(Lesson 3-3)** • I can identify a linear function in the form y = mx + b. • I can give examples of functions that are not linear.
KY.8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. **MP.4, MP.5, MP.8, KILP.1, KILP.3, KILP.9**	**Considerations:** Examining a relationship between two quantities yields a function rule. This function rule can be described using its initial value and rate of change, from a variety of representations, including tables, graphs, equations, and verbal descriptions. Coherence KY.7.RP.2→ KY.8.F.4→ KY.HS.F.3	We are learning to construct functions to model linear relationships. **(Lesson 3-4)** • I can determine the rate of change (slope) of a graph. • I can determine the y-intercept from a graph. • I can write a function in the form y = mx + b from two values and from a graph.
KY.8.F.5 Describe the functional relationship between two quantities qualitatively by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. **MP.3, MP.7, KILP.7, KILP.10**	**Considerations:** Students describe whether a function is increasing or decreasing and linear or nonlinear. Function examples are described in contexts as well as in symbols. Coherence KY.7.RP.2→ KY.8.F.5→ KY.HS.F.4	We are learning to describe the functional relationship between two quantities by analyzing a graph. **(Lesson 3-5)** • I can determine the input variable, output variables, and intervals of a graph. • I can describe the intervals of a graph as increasing, decreasing, or constant. • I can interpret the graph of a nonlinear function as increasing, decreasing, or constant in each interval. • I can identify the variables of a given

		situation. ● I can analyze the relationship between the two variables. We are learning to sketch functions from verbal descriptions. **(Lesson 3-6)** ● I can sketch and label a graph to represent the behavior of the function.
8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association **MP.2, MP.7, KILP.2, KILP.3, KILP.10**	**Considerations:** For example, given the data and scatter plot to the left, students explain the relationship between students' absences and math scores shows a negative, linear association and has no obvious outliers Coherence KY.8.SP.1→ KY.HS.SP.8	We are learning to construct and interpret scatterplots. (**Lesson 4-1**) ● I can determine ordered pairs for a set of data. ● I can plot ordered pairs on a coordinate grid ● I can describe the association of a scatter plot as positive, negative, or no association.
8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. **MP.2, KILP.7, KILP.8**	**Considerations:** Students are informally fitting a line to data; they judge whether or not a given line is a good fit for the data and describe needed adjustments. Recognize some scatter plots cannot be described by a line. Coherence KY.8.SP.2→ KY.HS.SP.8	We are learning to analyze linear associations. (**Lesson 4-2**) ● I can determine whether the paired data has a linear association, nonlinear association, or no association. ● I can draw a trend line to determine if the linear association is positive or negative. ● I can determine if the data has a strong or weak association by judging the closeness of the data points on the scatter plot to the line of "Best Fit" (trend line).
8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. **MP.2, MP.4, KILP.5, KILP.8**	**Considerations:** For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height and an initial value of 4 cm means the plant was 4 cm tall when measuring began. Coherence KY.8.SP.3→ KY.HS.SP.7	We are learning to use the equation of a linear model to make predictions and solve problems. (**Lesson 4-3**) ● I can write an equation for the trend line of a scatter plot. ● I can use the trend line of a scatter plot to make predictions. ● I can interpret the slope (rate of change) and the y-intercept of the trend line on the scatter plot.

Supporting Standards

KY.7.RP.2 Recognize and represent proportional relationships between quantities.

Essential Vocabulary

data set - Numeric information, usually gathered for analysis.
function - A correspondence between two sets, the domain, and range, that assigns to each member of the domain exactly one member of the range.
input - The number substituted for the variable in a function or rule machine.
linear function - A function defined by f(x) = mx + b.
non-linear - Not on a line.
output - The number that is the result of a function or rule machine.
rate of change - The speed at which a variable changes over a specific period of time. Also the same as the slope of a function.
bivariate data- Involves two variables and deals with causes or relationships. Major purpose of bivariate data analysis is to explain.
data set - Numeric information usually gathered for analysis.
categorical data- Data separable into categories that are mutually exclusive, for example, age groups.
clusters- Small group or bunch of something resulting from a "natural" grouping evident in a data set.
frequency- The number of times a particular item appears in a data set.
linear association- Having a strong resemblance or relation to a line; points that are clustered close to a line.
negative association- Large values of one tend to occur with small values of the other and vice versa.
non-linear association- Not having a resemblance to a line.
positive association- Large values of one variable tend to occur with large values of another; small values of one tend to occur with small values.
relative frequency - The proportion of all given values in an interview; the frequency of the event/value divided by the number of data points.
two-way frequency table- A table used to show frequencies for two different variables within the same population.

Common Assessment

Common Assessment Unit 2 Grade 8 Math

Anchor Resources

enVision Topic 3 - Use Functions to Model Relationships
MILC - MILC Topic 3 resources **MILC Functions Resources**

I can statements for Content Standards- enVision Topics 1-4 (Volume 1)
I can statements for Math Practices

FAL (one per semester):

- **Interpreting Distance–Time Graphs** **** Recommended for Semester One FAL ****

Create a 'Function Machine for function concepts

Function Tables TT7

enVision Topic 4 - Investigate Bivariate Data

MILC - MILC Topic 4 resources
MILC Topic 4 Resources

*****Disclaimer: Success Criteria is the evidence students must produce to demonstrate learning. This example is not comprehensive.

** Mathematical Practices (A.MP.1- 8) should be evidenced at some point throughout each unit.

******* 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.