Dear Family,

The first Unit in your child's mathematics class this year is ***Thinking With Mathematical Models: Linear and Inverse Variation***. In this Unit, we will explore situations that can be represented with various mathematical models, including graphs and equations. We will also examine variability and association between two numerical or categorical variables.

Unit Goals

Students will review, extend their understanding of, and improve their skills in working with linear functions and equations. This Unit also introduces concepts associated with nonlinear functions.

Algebraic functions that represent patterns in experimental data are called *mathematical models*. Students will use these functions to estimate answers to questions about relationships in the data.

This Unit also introduces inverse variation. Students work with inverse variations in several real-world contexts. The Unit also develops student understanding of associations between variables using basic ideas of correlation and two-way tables.

Helping with Homework

You can help with homework and encourage sound mathematical habits as your child studies this Unit by asking questions such as:

- *What are the key variables in this situation?*
- *What is the pattern relating these variables? Is it linear?*
- *What kind of equation will express the relationship among the variables?*
- *How can you use this equation to answer questions about the relationship?*
- *How can you decide if two categorical or numerical variables are associated?*

In your child's notebook, you can find worked-out examples, notes on the mathematics of the Unit, and descriptions of the vocabulary words.

Having Conversations About the Mathematics in Thinking With Mathematical Models

You can help your child with his or her work for this Unit in several ways:

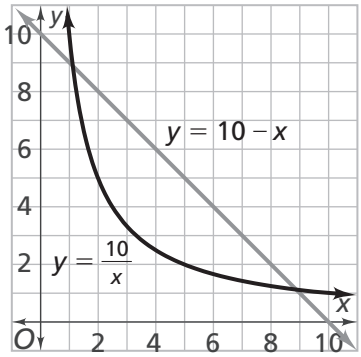
- Have your child share his or her mathematics notebook with you, showing you what he or she has recorded. Ask your child to explain why these ideas are important.
- Talk about situations in which a person might collect data and represent relationships with mathematical models, such as tables and graphs.
- Review your child's homework; make sure he or she has answered all the questions and provided clear explanations.

Common Core State Standards

Students develop and use all of the Standards of Mathematical Practice throughout the curriculum. In *Thinking With Mathematical Models*, students model with mathematics as they use functions to describe the relationship between two variables. This Unit focuses on using algebra to represent data using tables, graphs, equations or inequalities, and rules.

A few important mathematical ideas that your child will learn in *Thinking With Mathematical Models* are given on the next page. As always, if you have any questions or concerns about this Unit or your child's progress in the class, please feel free to call.

Sincerely,

Important Concepts	Examples
Mathematical Model An equation or a graph that describes the relationship between two variables. A mathematical model is made by graphing data and finding an equation or a curve to approximate it. A model lets you estimate values between and beyond the data points.	Students model bridge thickness and strength data by: 1. simulating the strength of bridges that have various layers of thickness and collecting data, 2. plotting the data and drawing a line of best fit, 3. finding an equation to model the data (e.g., $y = 8x$), 4. and using the equation to predict the breaking weights for other bridges. For example, using $y = 8x$, a bridge of thickness 3.5 layers can hold a load of 28 pennies.
Linear Relationships and Functions Students have learned how to recognize, represent, and analyze linear relationships. They have learned how to solve linear equations. Students will deepen these understandings in this Unit.	In the equation $y = mx + b$, m indicates the constant ratio $\frac{\text{change in } y}{\text{change in } x}$, which is the slope of the graph. The variable b indicates the y intercept $(0, b)$ of the graph. Students solve linear equations by • approximating (x, y) values in tables and graphs, • undoing the operations involved in linear function calculations by using the properties of equality, and • looking at the associated fact family equations.
Direct Variation Models that can be written in the form $y = kx$.	Students are familiar with direct variation as a special case of a linear function (that is, those with a y-intercept of zero).
Inverse Variation Models that can be written in the form $y = \frac{k}{x}$. The key learning goals for students are first, that an indirect variation gives a non-linear pattern of change and second, that its equation can be written in the form $y = \frac{k}{x}$.	The contrasting graphs of $y = 10 - x$ (line) and $y = \frac{10}{x}$ (curve) demonstrate that dividing by an increasing variable has a different effect than subtracting an increasing variable does. Students are familiar with the formula $A = \ell w$ for finding the area of a rectangle with given length and width. Now, students are asked to look for combinations of length and width that give a fixed area. This leads to the formula $\ell = \frac{A}{w}$. 
Patterns of Association in Numerical Data	Scatter plots can be used to model association between two quantities. Students describe patterns such as clustering, outliers, positive/negative association, and linear/nonlinear association. For linear data, students write a linear model and assess the fit of the model by judging the closeness of the data points to the line.
Patterns of Association in Categorical Data	Students construct and interpret two-way tables of categorical data and use relative frequencies calculated for rows or columns to describe the association between the two variables. In the two-way table below, students look for an association between gender and political party affiliation.

	Democrat	Independent	Republican
Boys	8	4	12
Girls	8	2	6