

Dear Family,

The next Unit in your child's mathematics class this year is **Moving Straight Ahead: Linear Relationships**. In this Unit, students are developing skills in areas that are traditionally known as algebra. This Unit introduces them to situations that can be modeled with linear relationships and graphed with straight lines. In the Grade 8 Unit *Thinking With Mathematical Models*, they will revisit the use of linear models before shifting the focus to nonlinear relationships.

## ▶ Unit Goals

In this Unit, students identify, represent, and interpret linear relationships. They learn to recognize linear relationships by the constant rate of change between two variables in a verbal context, table, graph, and equation. This idea is introduced by way of an experiment in which students determine their walking rates. This experiment focuses on rates, which students have already studied, in order to access the central ideas surrounding constant rate of change between two variables. Students then learn to solve linear equations and write equations for lines.

## ▶ Helping With Homework and Conversations About the Mathematics

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

- *What are the variables in the problem, and how are they related?*
- *How can I recognize a linear pattern if it is represented in a problem, in a table, in a graph, or with an equation?*
- *How can I use these representations to answer given questions?*

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

- *Ask your child to describe some real-world situations in which linear relationships are used. Here are some examples:*
  - The distance traveled in a vehicle moving at a constant speed
  - The amount of water in a sink that is draining at a constant rate
- *Look at your child's mathematics notebook. Read some of the explanations they have written and, if they aren't clear, talk with your child about why you think they may need more explanation.*
- *Look at your child's homework; make sure all questions are answered and explanations are clear.*

## ▶ Common Core State Standards

Students develop and use all of the Standards for Mathematical Practice throughout the curriculum. In this Unit, particular attention is paid to modeling with mathematics as students solve problems involving linear relationships using tables, graphs, and equations. *Moving Straight Ahead* focuses largely on the Expressions and Equations domain. As students explore linear relationships, parts of the Ratio and Proportional Reasoning and Functions domains are also addressed.

A few important mathematical ideas that your child will learn in *Moving Straight Ahead* 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. We are interested in your child and want this year's mathematics experiences to be enjoyable and to promote a firm understanding of mathematics.

Sincerely,

## Important Concepts

## Examples

### Linear Relationships

A relationship is linear if there is a constant rate of change between the two variables. That is, for each unit change in  $x$ , there is a constant change in  $y$ .

### Tables

In the table, the **constant rate of change** can be observed as a pattern of consistent change in the variables.

For Gilberto's walking rate, as the time increases by 1 second, the distance increases by 2 meters. The constant rate of change is 2 meters per second.

**Gilberto's Walking Rate**

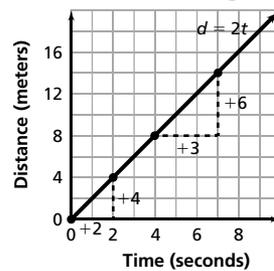
Time (seconds)	Distance (meters)
0	0
+2	1
2	4
3	6

### Graphs

If we graph the data, the constant rate of change between the two variables shows up as a straight line. This constant rate of change is called the **slope of the line**. It is the ratio of change between the two variables. For any two points on the line,

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}}$$

**Gilberto's Walking Rate**



Here, the slope is  $\frac{4}{2}$  or  $\frac{6}{3}$  or  $\frac{2}{1}$ .

### Equations

In the symbolic representation, the constant rate of change shows up as the **coefficient** of the independent variable.

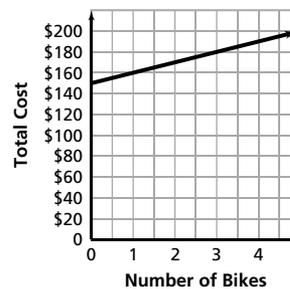
Here, the coefficient of  $t$  is 2.

Gilberto:  $d = 2t$

### y-intercept

On a graph, the y-intercept is the point at which the graph of a line crosses the y-axis (vertical axis).

**Cost of Bike Rental**



Suppose the cost to rent bikes is \$150 plus \$10 per bike. Symbolically, we can write  $C = 150 + 10n$ , where  $C$  is the cost in dollars and  $n$  is the number of bikes. The y-intercept is at  $(0, 150)$  because for 0 bikes, the cost is \$150. This means there is a fixed charge in addition to the cost per bike. The y-intercept is the constant term in the equation. The slope (or constant rate of change) of the line is 10, the coefficient of  $n$ .

### Solving Equations

To solve an equation, students write a series of equivalent equations until it is easy to read the value of the variable. Equivalent equations have the same solutions. Equality is maintained by adding, subtracting, multiplying, or dividing by the same quantity on each side of the equation. For multiplication and division, the quantity must not be zero. These procedures are called the **properties of equality**.

For the equation  $C = 150 + 10n$ , if  $C$  is 750, what is the value of  $n$ ?

Equation	Reason
$750 = 150 + 10n$	Original equation
$750 - 150 = 150 - 150 + 10n$	Subtract 150 from each side to undo adding 150.
$600 = 10n$	Simplify.
$\frac{600}{10} = \frac{10n}{10}$	Divide each side by 10 to undo multiplying by 10.
$60 = n$	Simplify.

Note that if you replace  $n$  with 60 in each step, the equation is true. For example, the original equation simplifies to  $750 = 750$ .