Further investigations:
Using data from your student’s baby book, work with her to make a scatter plot of her height over time. When did she grow the fastest? What would the plot look like if there had been no growth in a particular time period? Could the plot decrease? What would that mean?

Look for tables and scatter plots in newspapers and magazines. With your student, identify the variables. Which one is independent? How do you know? Discuss how the variables are related. Talk about what the graph shows. Could a table provide the same information?

Identify relationships between varying quantities in everyday experiences and discuss which quantity depends on the other. For example, consider temperature and time of day, inches of rainfall and the height of grass, price of movies and number of people attending. Are the relationships likely to be linear (have a constant rate of change)? Are they increasing (as one increases, the other increases)?

Using scores from football games, challenge your student to write algebraic expressions that could produce those scores. For a score of 28, a team could have made $4t + 4p$ (4 touchdowns and 4 points after) or $2t + 2p + 4f + 1s$ where $f$ represents field goal and $s$ stands for safety.

Terminology:

Algebraic expression: Mathematical phrase involving at least one variable.

Dependent variable: The quantity being measured or counted whose value is determined by the independent variable.

Equation: A mathematical sentence that shows that two expressions represent the same value.

Independent variable: The quantity being measured or counted whose value is determined by choice.

Linear equation: An equation in which all the variables have exponents of 1 and none of the variables is multiplied by other variables.

Rational number: A number that can be written as $\frac{a}{b}$ where $a$ and $b$ are integers, but $b$ does not equal 0.

Real numbers: All the rational and the irrational numbers.

Variable: A symbol (often a letter) that represents a number.

Patterns and Relationships

Students will:

1. Collect, organize, and graph data that relates two variables
2. Analyze graphs and tables to determine relationships between quantities
3. Represent relationships with descriptions, tables, graphs, and equations
4. Translate verbal phrases to algebraic expressions and simplify using properties of Real numbers
5. Use addition and multiplication properties of equality to solve linear equations
6. Solve problems by defining a variable, writing and solving an equation, and interpreting the solution in the context of the problem

Classroom Cases:

1. The table below lists weights (in pounds) of plastic discarded by a sample of households along with the size of the households. Make a scatter plot and discuss the relationship between the variables.

<table>
<thead>
<tr>
<th>Plastic (lb)</th>
<th>1.27</th>
<th>1.41</th>
<th>2.19</th>
<th>2.83</th>
<th>1.93</th>
<th>1.81</th>
<th>0.85</th>
<th>3.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Case Closed - Evidence:
I think the amount of plastic discarded depends on the number of people in the household. So, pounds of plastic will be the dependent variable and number in household will be the independent variable. Household size will be my horizontal axis and plastic (lbs.) will be the vertical axis. Since my data values are small, I will scale my axes in increments of 1. Because household sizes are measured in Whole numbers (we don’t have 2.3 households), the data is discrete and I will not connect the points.

Since the points go up from left to right as I look at the graph, the relationship between household size and pounds of plastic discarded is increasing. More people throw away more plastic. The points seem to form a line. So the relationship is linear. That means the amount of plastic thrown away increases by about the same amount each time the household size increases by one person.

The relationship between household sizes and pounds of plastic discarded is linear and increasing.

2. Esta has four cousins. Let $a$ represent Esta’s age. Represent her cousins’ ages with algebraic expressions in terms of Esta’s age. If Esta is 10 years old, how old are her cousins?

A. Paul is 4 years more than twice Esta’s age.
B. Sara is 2 years younger than Paul.
C. Mona is half as old as Sara.
D. Luis’s age is 100 less than the square of Mona’s age.

Case Closed - Evidence:

<table>
<thead>
<tr>
<th>Cousins’ Ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul: $2a + 4$</td>
</tr>
<tr>
<td>Sara: $2a - 2 = (2a + 4) - 2 = 2a + 4 - 2 = 2a + 2$</td>
</tr>
<tr>
<td>Mona: $\frac{1}{2} (Sara) = \frac{1}{2} (2a + 2) = a + 1$</td>
</tr>
<tr>
<td>Luis: $(Mona)^2 - 100 = (a + 1)^2 - 100$</td>
</tr>
</tbody>
</table>

3. Kiki wants to buy an MP3 player. She has saved $22 so far. She makes $20 per week by tutoring younger neighbors. She saves $14 of her earnings each week. If the MP3 player costs $158.00, when will Kiki be able to make her purchase? (Show how you know.)

Case Closed - Evidence:

$\$ she has + $ she saves per week • number of weeks ≥ cost of MP3 player

I know values for everything in the sentence above except number of weeks.

So let $w$ = number of weeks. Then I substitute to get:

\[
\begin{align*}
22 + 14 \cdot w & \geq 158 \\
22 & \geq 158 - 14w \\
4w & \geq 136 \\
w & \geq \frac{136}{4} = 34
\end{align*}
\]

Kiki will have enough money to buy the MP3 player in 10 weeks.