Representing Relationships
Lesson 4.1

Vocabulary:

**Linear Equation** – an equation with a graph that is a straight line

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**Examples**

The table shows the number of liters in quarts of liquid.

<table>
<thead>
<tr>
<th>Quarts, q</th>
<th>Liters, ℓ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.95</td>
</tr>
<tr>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>3</td>
<td>2.85</td>
</tr>
<tr>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>5</td>
<td>4.75</td>
</tr>
</tbody>
</table>

1. Write an equation to find the number of liters in any number of quarts. Describe the relationship in words.

   a) Find the rate of change or slope for the table.

   * Choose any 2 points for slope formula *
   or

   * Find the pattern in the table *

   \[
   \frac{l}{q} = \frac{1.9 - 0.95}{2 - 1} = \frac{0.95}{1} = 0.95
   \]

   There are 0.95 liters for each quart.

   b) Explain what the slope represents.
c) Write an equation in slope-intercept form \( y = mx + b \).

\[ \ell = 0.95q. \]

* \( b \) represents liters at 0 quarts *

**About how many liters are in 8 quarts?**

a) Write the equation from the table.

\[ \ell = 0.95q \]

b) Substitute the given value and multiply.

\[ \ell = 0.95(8) \]

\[ \ell = 7.6 \]

There are about 7.6 liters in 8 quarts.
2. The total cost of tickets to the school play is shown in the table.

<table>
<thead>
<tr>
<th>Number of Tickets, t</th>
<th>Total Cost ($) , c</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.50</td>
</tr>
<tr>
<td>2</td>
<td>9.00</td>
</tr>
<tr>
<td>3</td>
<td>13.50</td>
</tr>
<tr>
<td>4</td>
<td>18.00</td>
</tr>
</tbody>
</table>

a. Write an equation to find the total cost of any number of tickets. Describe the relationship in words.

a) Find the rate of change or slope for the table.

\[
\frac{c}{t} = \frac{9.00 - 4.50}{2 - 1} = \frac{4.5}{1} = 4.5
\]

b) Explain what the slope represents.

Each ticket costs $4.50.

c) Write an equation in slope-intercept form \((y = mx + b)\).

\[c = 4.5t\]

* b represents the cost of 0 tickets *
b. Use the equation to find the cost of 15 tickets.

\[ c = 4.5t \]

\[ c = 4.5(15) \]

\[ c = $67.50 \]

\[ \text{Got It?} \quad \text{Do these problems to find out.} \]

The table shows the total number of text messages that Brad sent over 4 days. (Examples 1 and 2)

\[ \begin{array}{c|cccc}
\text{Number of Days, } d & 1 & 2 & 3 & 4 \\
\hline
\text{Total Messages, } m & 50 & 100 & 150 & 200 \\
\end{array} \]

a. Write an equation to find the total number of messages sent in any number of days. Describe the relationship in words.

\[ 50\% = 50 \quad 50 \text{ messages per day} \quad m = 50d \]

b. Use the equation to find how many text messages Brad would send in 30 days.

\[ m = 50d \]

\[ = 50(30) \]

\[ = 1500 \]
Examples

The total distance Marlon ran in one week is shown in the graph.

3. Write an equation to find the number of miles run \( y \) after any number of days \( x \).

![Graph showing total distance run over time]

a) Find the rate of change or slope for the table.

* Choose any 2 points for slope formula *

or

* Find the rise and run in the graph *

\[ m = \frac{14 - 7}{4 - 2} \]

\[ m = \frac{7}{2} \]

\[ m = 3.5 \]

b) Write an equation in slope-intercept form \( (y = mx + b) \).

\[ y = 3.5x \]

* \( b \) represents the miles for 0 days *
How many miles will Marlon run after 2 weeks?

a) Write the equation from the table.

\[ y = 3.5x \]

b) Substitute the given value and multiply.

\[ y = 3.5(14) \]

\[ y = 49 \]

Marlon will run 49 miles in 2 weeks.

Got It? Do these problems to find out.

The number of trees saved by recycling paper is shown.

c. Write an equation to find the total number of trees \( y \) that can be saved for any number of tons of paper \( x \).

\[ \frac{34 - 17}{2 - 1} = \frac{17}{1} = 17 \]

\[ y = 17x \]

d. Use the equation to find how many trees could be saved if 500 tons of paper are recycled.

\[ y = 17(500) \]

\[ = 8,500 \text{ trees} \]
4. **Financial Literacy** Paul earns $7.50 an hour working at a grocery store.

Write an equation to find the amount of money Paul earned $m$ for any number of hours $h$.

\[ m = 7.5h \]

Make a table to find his earnings if he works 5, 6, 7, or 8 hours. Then graph the ordered pairs.

<table>
<thead>
<tr>
<th>$h$</th>
<th>$7.5h$</th>
<th>$m$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>7.5(5)</td>
<td>37.50</td>
</tr>
<tr>
<td>6</td>
<td>7.5(6)</td>
<td>45.00</td>
</tr>
<tr>
<td>7</td>
<td>7.5(7)</td>
<td>52.50</td>
</tr>
<tr>
<td>8</td>
<td>7.5(8)</td>
<td>60.00</td>
</tr>
</tbody>
</table>

[Graph showing earnings vs. hours]
A store receives an average of 7 new movies per week.

(Examples 5 and 6) \[ y = mx \]

a. Write an equation to find the number of new movies \( m \) in any number of weeks \( w \).

b. Make a table to find the number of new movies received in 4, 5, 6, or 7 weeks. Then graph the ordered pairs.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( w )</td>
<td>( 7w )</td>
</tr>
<tr>
<td>4</td>
<td>( 7(4) )</td>
</tr>
<tr>
<td>5</td>
<td>( 7(5) )</td>
</tr>
<tr>
<td>6</td>
<td>( 7(6) )</td>
</tr>
<tr>
<td>7</td>
<td>( 7(7) )</td>
</tr>
</tbody>
</table>