CHAPTER 2

Recognizing a Proportional Situation

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You will need
- a ruler
- grid paper
- a calculator

Learn about the Math

Brooke receives an allowance of $3 per week. Her older sister gets $4 per week. Brooke’s parents say that it is fair, because the allowance is proportional to each child’s age. Brooke wants to test for proportionality to determine if her parents’ strategy is fair.

<table>
<thead>
<tr>
<th>Age</th>
<th>Allowance ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

Are the ages of Brooke's siblings and the amount of their allowance proportional?

A. Rewrite each row of data in the table as a ratio in the form: allowance/age.

B. Rewrite each ratio in lowest terms.

C. Determine if the ratios found in step B are equivalent. If they are, then the ratios are proportional.

D. Another way to check for proportionality is to use cross multiplication.
   a) To do this, again write each row of data as a ratio in the form of a fraction.
   b) Choose two of the ratios to check for proportionality using an equality.
   c) Multiply the numerator of one fraction and the denominator of the other fraction.
   d) Then, multiply the numerator of the other fraction with the remaining denominator.

   If these products are the same, the relationship is proportional. If they are different, the relationship is not proportional.

   e) Repeat these steps to check each pair of ratios for proportionality.
E. Another way to check whether two ratios are proportional is to use a graph. Plot a point for each set of data. If a straight line through all the points also passes through the point (0, 0) on your graph, then the relationship is proportional. If the line does not also pass through (0, 0) or if the points do not form a straight line, then the relationship is not proportional. Use a graph to determine if the relationship is proportional.

Reflecting

1. How could you determine if these two ratios are proportional: \( \frac{2}{5} \) and \( \frac{14}{17} \)?

2. Write two ratios that are not proportional. How do you know they do not form a proportion?

Work with the Math

Example 1: Testing for proportionality

Are \( \frac{3}{4} \) and \( \frac{27}{36} \) proportional?

Akeem’s Solution

Factors of 27: 1, 3, 9, 27
Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36
GCF is 9

\[
\frac{27}{36} \div \frac{9}{9} = \frac{3}{4}
\]

I can test for proportionality by rewriting each fraction in lowest terms. \( \frac{3}{4} \) is already in lowest terms, but \( \frac{27}{36} \) can be simplified by dividing both the numerator and denominator by the GCF of 27 and 36.

\[
\frac{27}{36} = \frac{3}{4}
\]

I then compare the ratios in lowest terms to decide if \( \frac{3}{4} \) and \( \frac{27}{36} \) are proportional.

I recognize that both ratios represent the same fraction in lowest terms, which means that they are proportional.
A Checking
3. Determine if the ratios \( \frac{12}{14} \) and \( \frac{60}{75} \) are proportional.

B Practising
4. Determine if the ratios are proportional.

a) \( \frac{9}{14} \) and \( \frac{25}{39} \)

b) \( \frac{6}{9} \) and \( \frac{12}{18} \)

c) \( \frac{7}{8} \) and \( \frac{49}{56} \)

d) \( \frac{10}{35} \) and \( \frac{8}{28} \)

e) \( \frac{18}{36} \) and \( \frac{9}{18} \)

f) \( \frac{5}{12} \) and \( \frac{25}{60} \)

g) \( \frac{7}{13} \) and \( \frac{21}{36} \)

h) \( \frac{6}{12} \) and \( \frac{41}{82} \)

i) \( \frac{2}{11} \) and \( \frac{4}{22} \)

j) \( \frac{11}{14} \) and \( \frac{33}{42} \)

k) \( \frac{3}{18} \) and \( \frac{6}{39} \)

5. Determine if the ratios are proportional.

a) \( \frac{6}{7} \) \( \frac{12}{14} \) and \( \frac{26}{28} \)

b) \( \frac{75}{100} \) \( \frac{3}{4} \) and \( \frac{15}{22} \)

c) \( \frac{4}{12} \) \( \frac{9}{27} \) and \( \frac{16}{48} \)

d) \( \frac{98}{112} \) \( \frac{770}{880} \) and \( \frac{63}{72} \)

e) \( \frac{7}{2} \) \( \frac{21}{6} \) and \( \frac{30}{20} \)

6. Use ratios to determine if the relationship represented by each table is proportional.

<table>
<thead>
<tr>
<th>Base of triangle (cm)</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of triangle (cm)</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gasoline (L)</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost ($)</td>
<td>$3.90</td>
<td>$6.50</td>
<td>$9.10</td>
<td>$11.70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Books ordered</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery charge ($)</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

7. Draw a graph for the data in each table in question 6 to determine if the relationship is proportional. (You can use this to check the answers you determined for question 6.)

C Extending
8. Use 2, 3, 4, 6, 8, and 9 to create four proportions. Explain why each is a proportion.

9. The ratios \( \frac{3}{2} \) and \( \frac{x}{100} \) are proportional. What is the value of \( x \) ?

10. You are given a list of ratios. Two of the ratios have the same numerator. In order for the list of ratios to represent a proportional relationship, what must be true of the denominators of the ratios that have the same numerator?