8.2 Ratio and Rates

Ratio: two numbers are involved for comparison. 2 : 3

Example: the ratio of water to flour is
water to flour
water : flour
1 : 3

How about?
flour to water
flour : water
1 cup : 3 (cups)

\[ \frac{a}{b} \text{ or } a \text{ to } b \]
\[ a : b = \frac{a}{b} = a \div b = a \cdot \frac{1}{b} \]

Rate:

Examples of rates:
65 mph = 65 miles per hour
= 65 \( \frac{\text{miles}}{\text{hour}} \)

<table>
<thead>
<tr>
<th>Unit ratio rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>tsp 2 tsp: 5 tsp</td>
</tr>
<tr>
<td>count 4 (men): 3 (women)</td>
</tr>
<tr>
<td>count 8 (pupils): 1 (teacher)</td>
</tr>
</tbody>
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#2. For every nine girls in a Brownie troop, there must be two adults.

a. What is the ratio of girl to adults?
girls to adults = 9 : 2 = \( \frac{9}{2} \) = 9 \( \div \) 2

b. What is the ratio of adults to girls?
adults to girls = 2 : 9 = \( \frac{2}{9} \) = 2 : 9

c. What fractions of all Brownie are adults? What fraction are girls?
The fraction of adults of all Brownie is: \( \frac{2}{11} \)
The fraction of girls of all Brownie is: \( \frac{9}{11} \)

d. If there are 45 girls who want to be Brownies, how many adults are needed.
keep the ratio \( \Rightarrow \) keep the ratio

\[ \frac{\text{girls}}{\text{adults}} = \frac{9}{2} = \frac{9 \cdot \frac{5}{2}}{2 \cdot \frac{5}{2}} = \frac{45}{10} \]
10 adults are needed.

e. If 12 adults are willing to be Brownie leaders, how many girls can be Brownies?

\[ \frac{\text{girls}}{\text{adults}} = \frac{9}{2} = \frac{9 \cdot \frac{6}{2}}{2 \cdot \frac{6}{2}} = \frac{54}{12} \]
54 girls can be Brownies.

#8. Emmet spends $720 a month for housing and $500 a month for food. What is the ratio of his food expenses to his housing expenses?
Solution:

\[
\frac{500}{720} = \frac{\$500}{\$720} = \frac{25}{36}
\]

The ratio of his food expenses to his housing expenses is 25 to 36.

#14. Village Miller distributed 12,000 boxes of Oat Toasties last month, and 15 of the boxes contain a certificate for breakfast in Paris.

a. What is the ratio of certificates to the total number of boxes?

\[
15 : 12000 = \frac{15}{12000} = \frac{3}{2400} = \frac{1}{800}
\]

The ratio of certificates to the total number of boxes is 1 to 800.

b. What is the ratio of plain boxes to prize boxes?

\[
(12000 - 15) : 15 = \frac{12000 - 15}{15} = \frac{11985}{15} = \frac{799}{1}
\]

The ratio of plain boxes to prize boxes is 799 to 1.

c. What percent of the boxes contain certificates?

\[
\frac{15}{12000} \times 100\% = \frac{15}{120} \times \frac{1}{8} \times 100\% = \frac{5}{40} \times 100\% = 0.125\%
\]