Definition of a Rate

A rate is a type of ratio used to compare different types of quantities, for example...

\[
\frac{283 \text{ miles}}{13 \text{ gallons}} \quad \text{OR} \quad \frac{9.55}{1 \text{ hour}}
\]

You can use key words to imply rates.

<table>
<thead>
<tr>
<th>Key Word</th>
<th>Example</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per</td>
<td>117 miles per 2 hours</td>
<td>(\frac{117 \text{ miles}}{2 \text{ hours}})</td>
</tr>
<tr>
<td>For</td>
<td>$18 for 5 lb</td>
<td>(\frac{18}{5 \text{ lbs}})</td>
</tr>
<tr>
<td>In</td>
<td>400 meters in 43.5 seconds</td>
<td>(\frac{400 \text{ meters}}{43.5 \text{ seconds}})</td>
</tr>
<tr>
<td>On</td>
<td>270 miles on 12 gallons of gas</td>
<td>(\frac{270 \text{ miles}}{10 \text{ gallons}})</td>
</tr>
</tbody>
</table>
A rate having a denominator of 1 unit is called a **unit rate**.

Which are units rates?

\[
\frac{250 \text{ mi}}{5 \text{ hr}} \quad \text{or} \quad \frac{100 \text{ m}}{1 \text{ sec}} \quad \text{or} \quad \frac{$2.43}{3 \text{ cans}} \quad \text{or} \quad \frac{250 \text{ pg}}{\text{min}}
\]
To avoid mistakes when finding a unit rate, you can use a ratio.

For example:

- At Hoffman's Bike Rentals, it costs $35 to rent a bike for 7 hours.

  How many dollars does it cost per hour of bike use?

- Notice our quantities are $$ and hours

- The problem asks for cost “per hour”, or “1” hour.

  …and since the “Unit Rate” should have a denominator of 1, we’ll set up our ratio to put the hours in the denominator

\[
\frac{35}{7} = 5.00
\]
Finding Unit Rates

- Maya runs 9 miles in 69 minutes.

  How many miles does she run per minute?

- Notice our quantities are miles and minutes

- The problem asks for miles “per minute”, or “1” minute.

  …and since the “Unit Rate” should have a denominator of 1, we’ll put the minutes in the denominator

\[
\frac{9}{69} = 0.13 \text{ minutes}
\]
Finding Unit Rates

- It takes 96 pounds of seed to completely plant an 11-acre field. How many acres can be planted per pound of seed?
  - Notice our quantities are pounds and acres
  - The problem asks for acres “per pound”, or “1” pound.
    - ...and since the “Unit Rate” should have a denominator of 1, we’ll put the pounds in the denominator
      \[
      \frac{11}{96} = 0.11 \text{ acres}
      \]