Lesson 13: Rates and Unit Rates

A **rate** is a ratio that compares two different units. Some examples of rates are 72 miles per 3 gallons, $6 for 3 pounds, and 130 heartbeats in 2 minutes.

A **unit rate** is a rate that compares two different units, where one of the measurements is 1. Some unit rates are 24 miles per gallon, $2 per pound, and 65 heartbeats per minute. Notice that these unit rates could also be stated as 24 miles per 1 gallon, $2.00 per 1 pound, and 65 heartbeats per 1 minute.

**Example**

Mr. Easton bought 12 gallons of gas for $36. What is Mr. Easton’s unit rate for the cost of 1 gallon of gas?

Use the ratio of dollars to gallons of gas to find the unit rate.

\[
\frac{\text{dollars}}{\text{gallons of gas}} = \frac{36}{12} = \frac{3}{1} = 3
\]

Mr. Easton paid $3 for every gallon of gas.

**Example**

Julia traveled 432 miles in 8 hours. What is the unit rate for the average number of miles she traveled per 1 hour?

Use the ratio of miles to hours to find the unit rate.

\[
\frac{\text{miles}}{\text{hours}} = \frac{432}{8} = \frac{54}{1} = 54
\]

Julia traveled an average of 54 miles per 1 hour.
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CCSS: 6.RP.2, 6.RP.3.b

A tape diagram can help solve a rate problem. You can use it to find the unit rate. Then you can multiply the unit rate by the number of items.

Example

The cost of 4 curtains is $48. What is the cost of 6 curtains?

The following tape diagram shows $48 split into 4 equal parts. The value of each part represents the cost of 1 curtain.

\[
\begin{align*}
\text{\$48} & \quad \text{\$48} & \quad \text{\$48} & \quad \text{\$48} \\
\frac{\text{\$48}}{4} & \quad \frac{\text{\$48}}{4} & \quad \frac{\text{\$48}}{4} & \quad \frac{\text{\$48}}{4}
\end{align*}
\]

\[ \$48 \div 4 = \$12 \]

The unit rate is $12 for 1 curtain, so the cost of 6 curtains will be equal to the unit rate times 6.

\[ \$12 \times 6 = \$72 \]

The cost of 6 curtains is $72.

Example

The cost of 5 toy cars is $35. What is the cost of 9 toy cars?

The following tape diagram shows $35 split into 5 equal parts. The value of each part represents the cost of 1 toy car.

\[
\begin{align*}
\text{\$35} & \quad \text{\$35} & \quad \text{\$35} & \quad \text{\$35} & \quad \text{\$35} \\
\frac{\text{\$35}}{5} & \quad \frac{\text{\$35}}{5} & \quad \frac{\text{\$35}}{5} & \quad \frac{\text{\$35}}{5} & \quad \frac{\text{\$35}}{5}
\end{align*}
\]

\[ \$35 \div 5 = \$7 \]

The unit rate is $7 for 1 toy car, so the cost of 9 toy cars will be equal to the unit rate times 9.

\[ \$7 \times 9 = \$63 \]

The cost of 9 toy cars is $63.