5.2 Unit Rates

A RATE compares two measurements with different units.

Speeds such as miles per hour or feet per second are familiar examples of rates.

These are also examples of a unit rate. A unit rate is a rate with a denominator of 1.

To change a rate to a unit rate, divide both numerator and denominator by the denominator.

Example: Express each ratio as a unit rate.

a.) 100 miles in 4 hours b.) $120 for 5 days of work

$$\frac{100 \text{ miles} \div 4}{4 \text{ hrs} \div 4}$$

$$\frac{25 \text{ miles}}{1 \text{ hr}}$$

$$5\overline{)120}$$

$$\begin{array}{r} 24 \\ 5\overline{)120} \\ -10\downarrow \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

$$\frac{\$120 \div 5}{5 \text{ days} \div 5}$$

$$\frac{\$24}{1 \text{ day}}$$

Example: Express each ratio as a unit rate.

c.) 24 pounds lost in 8 weeks

$$\frac{24 \text{ lbs} \div 8}{8 \text{ wks} \div 8} \qquad \boxed{\frac{3 \text{ lbs}}{1 \text{ wk}}}$$

d.) 180 feet in 19 seconds

$$\frac{180 \text{ ft} \div 19}{19 \text{ sec} \div 19}$$

$180.00000 \div 19 = 9.4736$ (-171, 90, -76, 140, -133, 70, -57, 130, -114, 16)

$$\boxed{\frac{9.47 \text{ ft}}{1 \text{ sec}}}$$

Example: Express each ratio as a unit rate.

e.) 12 inches of rain in 5 hours

$$\frac{12 \text{ inch} \div 5}{5 \text{ hrs} \div 5} = \boxed{\frac{2.4 \text{ inch}}{1 \text{ hr}}}$$

$12.0 \div 5 = 2.4$ (-10, 20, -20, 0)

f.) 187 miles in 7 days

$$\frac{187 \text{ miles} \div 7}{7 \text{ days} \div 7}$$

$187.000 \div 7 = 26.714$ (-14, 47, -42, 50, -49, 10, -7, 30, -28, 2)

$$\boxed{\frac{26.71 \text{ miles}}{1 \text{ day}}}$$

Example: A typical bottlenose dolphin will take about 34 breaths in 4 hours. How many breaths will a bottlenose dolphin take in 7 hours?

$$\frac{34 \text{ breaths}}{4 \text{ hrs}} \begin{matrix}\div 4 \\ \div 4\end{matrix} = \frac{8.5 \text{ breaths}}{1 \text{ hrs}} \times 7$$

$$8.5 \times 7 = 59.5$$

$$\frac{59.5 \text{ breaths}}{7 \text{ hrs}}$$

$$4\overline{)34.0} \quad -32 \quad 20 \quad -20 \quad 0$$

Example: A snail moved 5 feet in 2 hours. At this rate, how many feet will the snail move in 5 hours?

$$\frac{5 \text{ ft}}{2 \text{ hrs}} \begin{matrix}\div 2 \\ \div 2\end{matrix} = \frac{2.5 \text{ ft}}{1 \text{ hrs}} \times 5$$

$$2.5 \times 5 = 12.5$$

$$\frac{12.5 \text{ ft}}{5 \text{ hrs}}$$

$$2\overline{)5.0} \quad -4 \quad 10 \quad -10 \quad 0$$