

Unit Rates

Date: 12-17-12

Objective: Today we will define rates, ratios, and proportions in order to calculate unit rate.

Notes:

Rate: a ratio that compares quantities in different units

For example: Emily completes 30 problems in 20 minutes.

$$\frac{30 \text{ problems}}{20 \text{ minutes}} \quad 30:20$$

Unit Rate: a rate with a denominator of one

For example: The car gets 23 miles per gallon.

What is the difference between rate and unit rate?

Some unit rates can be calculated by simplifying the ratio.

Example: 20 miles : 5 hours

$$\frac{20 \text{ miles} \div 5}{5 \text{ hours} \div 5} = \frac{4 \text{ miles}}{1 \text{ hour}}$$

Example: 42 gallons : 7 minutes

$$\frac{42 \text{ gal} \div 7}{7 \text{ min} \div 7} = \frac{6 \text{ gal}}{1 \text{ min}}$$

Others require some calculation, so we write a proportion.

Proportion: equation that sets two ratios equal to each other

For example:

Units match across \rightarrow $\frac{20 \text{ miles}}{5 \text{ hours}} = \frac{4 \text{ miles}}{1 \text{ hour}}$

If the unit rate cannot be found by simplifying, we use a proportion.

For example:

$$\frac{12 \text{ problems}}{5 \text{ minutes}} = \frac{x}{1 \text{ minute}}$$

We must apply the cross product to solve.

Cross Product Property (criss-cross property)

$$\frac{a}{b} \times \frac{c}{d}$$

can be rewritten as

$$a \cdot d = c \cdot b$$

Example: $\frac{20 \text{ miles}}{5 \text{ hours}} \times \frac{4 \text{ miles}}{1 \text{ hour}}$

$$20 \cdot 1 = 4 \cdot 5$$
$$20 = 20 \checkmark$$

Example: $\frac{12 \text{ problems}}{5 \text{ minutes}}$ $\frac{x}{1 \text{ minute}}$

$$12 \cdot 1 = 5 \cdot x$$

$$\frac{12}{5} = \frac{5x}{5}$$

$$\frac{2.4 \text{ prob} = x}{1 \text{ min}}$$

Example: $\frac{215 \text{ miles}}{40 \text{ gallons}}$ $\frac{x}{1 \text{ gallon}}$

$$215 \cdot 1 = 40 \cdot x$$

$$\frac{215}{40} = \frac{40x}{40}$$

$$x = \frac{5.375 \text{ mil}}{1 \text{ gal}}$$

Exit Ticket

Calculate the unit rate.

800 miles: 15 hours