8.2 Solving Problems that Involve Rates

Learning targets:

1. Demonstrate understanding of new terminology pertaining to rates.
2. Convert quantities from one unit of measurement to a different unit of measurement.

3. Solving problems using proportions.

Terminology

Proportion: a mathematical equation involving two equal ratios.

Ex. $\frac{240\ words}{8\ min} = \frac{120\ words}{4\ min} = \frac{60\ w}{2\ min} = 30\ \frac{w}{min}$

Ex. $\frac{150\ km}{2\ hr} = \frac{450\ km}{6\ hr}$

Using proportions to solve problems:

When using equivalent ratios, set up the proportion so that the **units** in the **numerators** are the **same**, and the **units** in the **denominators** are the **same**.

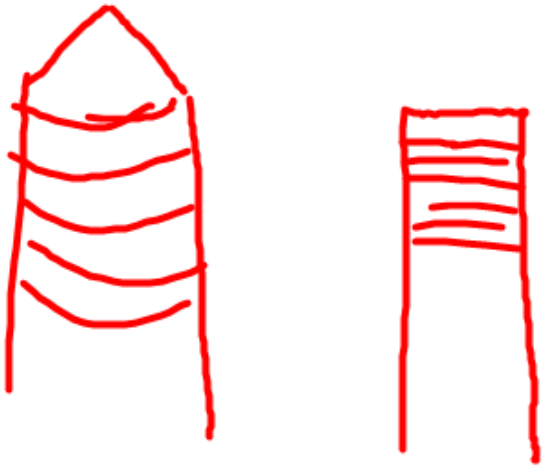
When setting up equivalent ratios to solve a problem, sometimes you have to convert quantities to other units, such as:

kg to pounds or pounds to kg
metres to centimetres or centimetres to metres
hours to minutes or minutes to hours
etc.

Example #1: Solving a rate problem

Method 1: with equivalent ratios

A screw has 64 turns over a distance of 50 mm of thread. Determine the number of turns in a screw with the same pattern over 40 mm of thread. Round your answer to the nearest turn.



$$\frac{64 \text{ turns}}{50 \text{ mm}} = \frac{x}{40 \text{ mm}}$$

$$\frac{x(50\text{mm})}{50\text{mm}} = \frac{(40\text{mm})(64 \text{ turns})}{50\text{mm}}$$

$$x = 51.2 \text{ turns}$$

Example #1: Solving a rate problem

Method 2 **using a unit rate**

A screw has 64 turns over a distance of 50 mm of thread. Determine the number of turns in a screw with the same pattern over 40 mm of thread. Round your answer to the nearest turn.

Create unit rate

$$\frac{64 \text{ turns}}{50 \text{ mm}} = 1.28 \text{ turns/mm}$$

$$1.28 \frac{t}{\cancel{mm}} \cdot 40\cancel{mm} = 51.2 \text{ turns}$$

Example #2: Solving a rate problem with equivalent ratios

The dosage of an antibiotic for a person with a mass of 85 kg is 15 mL. What dosage of antibiotic is needed for a person whose mass is 65 kg? State the dosage to the nearest tenth of a mL.

$$\frac{85\text{ kg}}{15\text{ ml}} = \frac{65\text{ kg}}{x}$$

$$\frac{x\,(85\text{ kg})}{(85\text{ kg})} = \frac{(65\text{ kg})(15\text{ ml})}{(85\text{ kg})} = 11.5\text{ ml}$$

You Try:

17 kg of Yukon Gold potatoes costs $26.80. Determine the cost of 5 kg of potatoes. Round your answer to the nearest cent.

Example #3:

Paula is asked to order snacks for an office meeting of 180 people. She decides to order dessert squares, which come in boxes of 24. She estimates that she will need 2.5 squares/person. How many boxes should she buy?

You Try:

Michael must order snacks for an office meeting of 170 people. He decides to order tarts, which come in boxes of 12. He estimates that he will need 1.5 tarts per person. How many boxes should Michael buy?

Example #4: Solving a rate problem requiring a unit conversion

Jenna wants to defrost a frozen turkey in her microwave. The turkey has a mass of 4.23 kg. A cookbook says it takes 21 minutes to defrost 3 lb. of meat. How long, to the nearest minute, should Jenna set the timer on defrost for?

$$(4.23\ \text{kg})\left(\frac{2.2\ \text{lbs}}{1\ \text{kg}}\right) = 9.306\ \text{lbs}$$

$$\frac{3\ \text{lbs}}{21\ \text{min}} = \frac{9.306\ \text{lbs}}{x}$$

$$\frac{(9.306\ \cancel{lbs})(2\ l/min)}{3\ \cancel{lbs}} = x$$

$$65.142\ min = x$$

You Try:

If 15 kg of beef costs $127.00, how much will it cost, to the nearest penny, for 25 lb. of beef?

Example #5:

Bob burns 620 Cal in a cardio-kick-box class lasting 2 h, and 120 Cal in a body-sculpt class lasting 30 min. If he does cardio-kick-box for 3 h, how much longer would he have to do body-sculpt to burn the same number of Calories?

$$\frac{\text{CKB}}{310\ \text{cal/h}}$$

$$\frac{\text{BS}}{240\ \text{cal/hr}}$$

$$\frac{\text{In 3hrs}}{310\ \text{cal/h} \cdot 3\text{h}} = 930\ \text{cal}.$$

$$\frac{930\ \text{cal}}{x} = \frac{240\ \text{cal}}{1\ \text{hr}}$$

$x = 3.875\,h$

$3.875\,h - 3.00\,h$

$0.875\,h = 525\,min$

Assignment

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