Math 101, Littlefield
Key for Ratio-Proportion Homeworks

100 Percent of Daily Allowance of Iron

A common foodstuff is found to contain .00125% iron. The serving size is 87.0 grams. If the recommended daily allowance is 18mg of iron, how many servings would a person have to eat to get 100% of the daily allowance of iron?

$$\frac{1.0\ daily\ allowance}{1} \times \frac{18\ mg\ iron}{daily\ allowance} \times \frac{100\ gm\ foodstuff}{0.00125\ gm\ iron} \times \frac{1\ gm}{1000\ mg} \times \frac{1\ serving}{87\ gm\ foodstuff} = 16.6\ servings$$

Administering Insulin

If a doctor prescribes 30 units of insulin in 500 ml to be administered over 2 hours, how many drops per minute should be administered if the set is calibrated to deliver 20 drops per ml?

$$\frac{500\ ml}{2\ hours} \times \frac{1\ hour}{60\ minutes} \times \frac{20\ drops}{ml} = \frac{83.33\ drops}{minute}$$

Time, Speed, Distance, and Unit Conversion

If a car moves at 44 mph for 50 minutes, how many kilometers does it travel?

$$\frac{44\ miles}{hour} \times \frac{50\ minutes}{1} \times \frac{1\ hour}{60\ minutes} \times \frac{1.61\ kilometer}{mile} = 59.0\ kilometers$$

Analyzing a Prescription for the Correct Dose

A 46 lb child is prescribed 1 Tsp of medicinal syrup three times a day. There are 2 mg of medicine per 5 ml of syrup, and a safe dose is 0.1 mg per kg of body weight. Is the prescribed dose safe?

The definition of "safe dose" here is ambiguous because no time period is specified. To be conservative, let's assume that it means "per day", which is how safe doses are often described. Then the safe dose is:

$$\frac{46\ lb\ body}{1} \times \frac{0.454\ kg}{1\ lb} \times \frac{0.1\ mg\ med}{1\ kg\ body} \times \frac{1}{day} = \frac{2.0884\ mg}{day}$$

The abbreviation Tsp is ambiguous. Standard abbreviations are "tsp" (lower case t!) for teaspoon and "T" or "tbsp" for tablespoon. A frequent cook, reading quickly, could easily misread "Tsp" as "Tablespoon". To be conservative, let's assume that it will be interpreted as "tablespoon", which is 3 times larger than a teaspoon. Then the actual dose is:

$$\frac{1\ tablespoon}{1\ occasion} \times \frac{3\ occasions}{1\ day} \times \frac{14.79\ ml}{1\ tablespoon} \times \frac{2\ mg}{5\ ml} = \frac{17.75\ mg}{day}$$

This is decidedly unsafe!

In contrast, the solution given at http://mathforum.org/library/drmath/view/67058.html concludes that the dosage is safe. Why the difference? Partly it's because they're answering a slightly longer problem statement that actually does specify safe dose as 0.1 mg/kg three times a day. And partly it's because they didn't notice that the capitalized "Tsp" is a non-standard abbreviation that could easily be misinterpreted by the target user: a stressed-out homemaker in a hurry.

Be sure you know what those symbols mean! If you aren't sure, ask!

The Difference between Calculating Markup and Profit Margin

If we have fixed costs of $50,000 on a product and want to have a profit margin of 25%, how much should we charge the customer to buy it?

The biggest problem here may be figuring out what the words mean. Searching for common usage, it seems that "profit margin" means "selling price minus costs", and if it's expressed as a percentage, the denominator is selling price. Hence:

$$\frac{SellingPrice - 50000}{SellingPrice} = 25\% = 0.25$$

Solving this gives *SellingPrice* = 66,666.67.

Ratio and Proportion: Beaches and Hawks

On a map, the scale states that 3 inches represent 125 miles. Two beaches are 5.2 inches apart. How far apart are they in miles?

This can be set up as a proportion:

$$\frac{3\ inches}{125\ miles} = \frac{5.2\ inches}{?\ miles}$$

Solving that proportion gives the answer: 217 miles. (There's no sense expressing the answer to more than 3 significant digits, since that's already more precise than the "5.2".)

Alternately, using the factor-label method with nice long labels to avoid confusion:

$$\frac{5.2\ inches\ on\ the\ map}{1} \times \frac{125\ miles\ in\ real\ life}{3\ inches\ on\ the\ map} = 217\ miles\ in\ real\ life$$

Ratio Set-Up Problem

Concrete can be made by mixing cement, sand, and gravel in the ratio 3:6:8. How much gravel is needed to make 850 m^3 of concrete?

To solve this problem from what is stated, we need to imagine that 3:6:8 parts of cement et.al. mix together to make 3+6+8 = 17 parts of concrete. This gives a proportion:

$$\frac{17\ parts\ concrete}{8\ parts\ gravel} = \frac{850\ m^3\ concrete}{?\ m^3\ gravel}$$

Solving this proportion gives an answer of $\boxed{400\ m^3\ gravel}$.

That answer won't actually work, by the way. What happens physically is that the sand largely fits into spaces between the gravel, and the cement largely fits into the spaces that are left. If you actually mix together 150 m^3 of cement, 300 m^3 of sand, and 400 m^3 of gravel as indicated by the math, you'll end up with a lot less than the 850 m^3 of concrete that you intended to get. Various sources give slightly different numbers for how much less, but in general they're around volume of concrete = $^2/_3$ * volume of ingredients. By mixing 150 m^3 of cement, 300 m^3 of sand, and 400 m^3 of gravel, you'll actually end up with something like $^2/_3$ * 850 = 567 m^3 of concrete.

In other words, 3+6+8 is significantly less than 17 if you try mixing concrete by volume!

This problem was written by somebody who didn't understand what they were writing about.

Source: These problems were selected from http://mathforum.org/library/drmath/sets/mid_ratio.html .