

3.08 Ratio and Proportion

Basic Algebra: One Step at a Time. Page 297 - 300: #6, 3 Extra with follow up

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At first glance, you may think, “Word Problems!!” However, let me assure you that these are NOT word problems! They are just “problems with words!” They are very easy problems that need almost NO explanation. They are useful to everyday life, and this is NOT a difficult page. Just set up a proportion $\frac{a}{b} = \frac{c}{d}$, making sure that the numerators and denominators have the same units. Make sure that the denominators can NEVER be zero. And then solve the proportion as in the previous section by “cross-multiplying” $a \bullet d = b \bullet c$.

In summary, remember that $\frac{a}{b} = \frac{c}{d}$ means that $a \bullet d = b \bullet c$.

P. 299. # 6.

If on the interstate it takes 3 hours to travel 200 miles, how long will it take to travel 750 miles at this rate?

Solution: Set up a proportion of either hours over miles, or miles over hours. It doesn't matter which way you set it up, as long as you do both ratios the same. In either method, begin by letting x = number of hours.

First Method:
$$\frac{\text{hours}}{\text{miles}} = \frac{\text{hours}}{\text{miles}}$$

$$\frac{3 \text{ hours}}{200 \text{ miles}} = \frac{x \text{ hours}}{750 \text{ miles}}$$

Cross multiply: $200 x = 3 \bullet 750$

$$200 x = 2250$$

$$x = \frac{2250}{200}$$

$$x = 11.25 \text{ hours}$$

Second Method:
$$\frac{\text{miles}}{\text{hours}} = \frac{\text{miles}}{\text{hours}}$$

$$\frac{200 \text{ miles}}{3 \text{ hours}} = \frac{750 \text{ miles}}{x \text{ hours}}$$

Cross multiply: $200 x = 3 \bullet 750$

$$200 x = 2250$$

$$x = \frac{2250}{200}$$

$$x = 11.25 \text{ hours}$$

Application #1, from a rancher in real life!!

A rancher has a 25 gal weed sprayer. In mixing some weed killer, she needs to mix 6.5 oz of Roundup per gallon of water. How many cups of Roundup should be mixed with 25 gallons of water?

Note: The first solution given here will be the algebraic solution. The second solution is a common sense approach.

Solution:

First Method: Set up a ratio of :

$$\frac{\text{Roundup}}{\text{water}} = \frac{\text{Roundup}}{\text{water}}$$
$$\frac{6.5 \text{ ounces Roundup}}{1 \text{ gallon water}} = \frac{x \text{ ounces Roundup}}{25 \text{ gallons water}}$$

Cross multiply:

$$1x = 6.5 \cdot 25$$
$$x = 162.5 \text{ ounces}$$

How many cups is this?? A cup contains 8 ounces, so divide by 8. If you want to change cups to quarts, divide by 4. If you want to change quarts to gallons, divide by 4 again. This is what you get:

$$x = 162.5 \text{ ounces}$$
$$x = \frac{162.5}{8} = 20.315 \text{ cups}$$
$$x = \frac{20.315}{4} = 5.078 \text{ quarts}$$
$$x = \frac{5.078}{4} = 1.27 \text{ gallons}$$

Second method (common sense!):

The recommended mixture is 6.5 ounces per GALLON. You have 25 gallons, so you need 25 times as much. Multiply $6.5 \cdot 25 = 162.5 \text{ ounces}$ of Roundup. If you know that there are 32 ounces in a quart, then divide by 32 :

$$\frac{162.5}{32} = 5.078 \text{ quarts}$$

If you want to know how many gallons that is, divide this answer by 4, since

there are 4 quarts in a gallon, and it will be about $\frac{5}{4} = 1 \frac{1}{4} \text{ gallons}$.

Application #2, Diathane, from real life!!

Roses have to be sprayed with a fungicide every week to control black spot. If the instructions on a 12 pound bag of Diathane is to mix **1 or 2 pounds** with **100 gallons** of water, **how much** of the Diathane should be mixed to fill a **2 gallon** sprayer?

SOLUTION: $\frac{1 \text{ or } 2 \text{ pounds}}{100 \text{ gallons}} = \frac{x \text{ pounds}}{2 \text{ gallons}}$ (Let's call it about **1.5 pounds!**)

$$\frac{1.5 \text{ pounds}}{100 \text{ gallons}} = \frac{x \text{ pounds}}{2 \text{ gallons}}$$

Cross multiply: $100x = 2 \cdot (1.5)$
 $100x = 3$
 $x = \frac{3}{100}$ or 0.03 pounds

To convert to a more convenient unit, use the following conversions:

1 pound = 16 ounces
1 ounce = 2 tablespoons
1 tablespoon = 3 teaspoons

$$x = \frac{3}{100} \text{ or } 0.03 \text{ pounds}$$

$$x = \frac{3}{100} \text{ or } 0.03 \text{ (16 ounces)}$$

$$x = 0.48 \text{ ounces or about a half ounce!!}$$

Diathane Follow up Questions

1. If a half ounce of Diathane is mixed in the 2 gallon spayer, how many applications are can be made from the 12 pound bag?

SOLUTION:

Since there are 16 ounces per pound, there a total of $16 \times 12 = 192$ ounces in the bag. Since there are essentially 2 applications per week, there are about $2 \times 192 = 384$ applications per bag.

2. If 2 gallons of the Diathane spray in the previous exercise are used every other week how long will the 12 pound bag last?

SOLUTION:

If applications are made every other week, this is 26 applications per year, and the bag will last about $384 / 26 = 14.8$ years.

3. If the 12 pound bag cost \$56, then what was the cost of the Diathane for each application of the 2 gallon sprayer?

SOLUTION:

Since the bag cost \$56, the cost per application is $56 / 384$, which is about \$0.15 per application.

Application #3, Crabgrass Control, from real life!!

Problem: A crabgrass control application comes in a 35 pound bag. On the bag, are the rather strange directions, "Apply at the rate of 120 pounds per acre." How many square feet will this bag cover?

HINT: 1 Acre = 43,560 square feet

SOLUTION: Let x = number of square feet covered by one 35 pound bag, where 120 pounds covers 1 acre, which is actually 43560 square feet.

$$\frac{\text{pounds}}{\text{square feet}} = \frac{\text{pounds}}{\text{square feet}}$$

$$\frac{120 \text{ pounds}}{43560 \text{ sq ft}} = \frac{35 \text{ pounds}}{x \text{ sq ft}}$$

Cross multiply: $120 x = 43560 \cdot 35$

$$120 x = 1524600$$

$$x = \frac{1524600}{120}$$

$$x = 12705 \text{ square feet}$$

Follow up Questions:

1. If your yard is about 30 yards by 40 yards, will this be enough for your yard?

SOLUTION: 30 yards by 40 yards = 90 feet by 120 feet = 10800 square feet.
It covers!

2. How does an acre compare to a football field, goal to goal?

SOLUTION: The football field is 100 yards or 300 feet long and 160 feet wide.
The area is $300 \times 160 = 48000$ square feet. The football field is slightly more than an acre. An acre is slightly less than a football field.