

Ratio and Proportion for Health Science

Ratio A ratio consists of two numbers that have a significant relationship to each other.

*For example, if the records at the Humane Society indicate that, historically, they have 10 dogs for every 9 cats. The ratio of dogs to cats is 10 to 9. The ratio can be written one of two ways: 10:9 or $\frac{10}{9}$. The ratio is read, 10 to 9.

This is a relation of dogs to cats, so the number of dogs is written first and then the number of cats. In the fraction form, the first number (dogs) is written on top, or as the numerator and the second number (cats) is written below, or as the denominator.

*Like fractions, ratios can be reduced to their lowest terms. $\frac{12}{3}$ reduces to $\frac{4}{1}$

1. Write and reduce these ratios: 6 to 8, 27 to 9, 1 to 4, and 18 to 9.
2. What is the ratio of 3 eggs to 1 chicken?

Proportion - A proportion shows the relationship between two ratios.

*The fraction $\frac{2}{3}$ is equal to $\frac{4}{6}$. The relationship of 2 to 3 is the same as the relationship of 4 to 6.

*Write this proportion as one ratio ($\frac{2}{3}$) followed by an = sign, and then the second ratio ($\frac{4}{6}$).

$$\frac{2}{3} = \frac{4}{6} \quad \text{This is read: 2 is to 3 as 4 is to 6.}$$

*Prove this is a true ratio/proportion by cross-multiplying. Multiply 2×6 and 3×4 . Both equal 12.

When the cross products of a proportion are equal, it is true or correct.

$$\begin{array}{c} \searrow 2 = 4 \swarrow \\ 3 \quad 6 \nearrow \end{array} \quad 2 \times 6 = 12 \quad 3 \times 4 = 12$$

3. Are $\frac{5}{16}$ and $\frac{3}{7}$ proportionate or true?

*Find a missing term in a ratio/proportion.

The unknown can be any one of the 4 numbers. There can only be one unknown number.

Substitute X for the missing number and write the proportion. 12 is to 5 as 8 is to ___? $\frac{12}{5} = \frac{8}{X}$

What is the ratio of 24 apples to 2 trees? $\frac{24 \text{ apples}}{2 \text{ trees}}$

Write the ratio/proportion for finding the number of apples per tree. $\frac{24 \text{ apples}}{2 \text{ trees}} = \frac{X \text{ apples}}{1 \text{ tree}}$ *

***Note:** It is **very** important to keep the relationship of the terms the same in each ratio; in this example: apples to trees, apples to trees.

*Solve for a missing term.

- a. Cross multiply

$$\frac{10}{3} = \frac{7}{X} \quad \rightarrow \quad 10X = 21$$

- b. Divide both sides of the equation by the coefficient of X which is 10

$$\frac{10}{10} X = \frac{21}{10}$$

- c. $X = 2.1$

Practice problems. Find the missing term for each proportion:

4. $\frac{4}{9} = \frac{X}{18}$

5. $\frac{5}{3} = \frac{30}{X}$

6. $\frac{9}{X} = \frac{12}{15}$

7. $\frac{X}{12} = \frac{30}{40}$

Solve these problems using ratio/proportion:

8. If 3 candy bars cost \$1.20, how much will a dozen cost?
9. If 3 apples cost \$1.00, how many can I buy for \$5.00?
10. If oranges cost 2 for \$.29, what will 8 cost?
11. What will 5 pencils cost, if they are 10 for \$.80?
12. You need 20 yards of concrete. How many trips will the cement truck have to make, if it can haul 3yards/trip?

Answers:

1. $\frac{6}{8} \rightarrow \frac{3}{4}$ $\frac{27}{9} \rightarrow \frac{3}{1}$ $\frac{1}{4}$ $\frac{18}{9} \rightarrow \frac{2}{1}$

Note: 3/1 and 2/1 remain fractions,
do not change to integers

2. 3 eggs
1 chicken
3. No
4. 8
5. 18
6. 11.25
7. 9
8. \$4.80
9. 15
10. \$1.16
11. \$.40
12. 7 trips