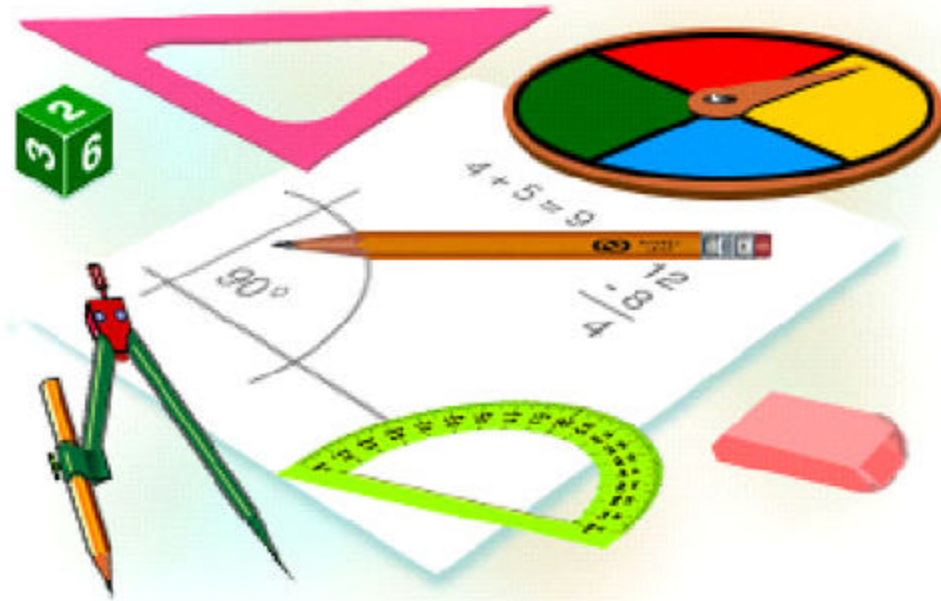


The Next Step

Mathematics Applications for Adults



Book 14018 – Ratio, Proportion and Percent

OUTLINE

Mathematics - Book 14018

Ratio, Proportion and Percent
<u>Introduction To Ratio, Proportion, and Percent</u>
find the percentage that one number is of another number.
find the number when a percentage is given.
percent of a given number.
use the formula $r/100 = P/W$ and cross-multiplication.
determine which ratio in a given list is equal to given ratio.
determine which of a given list of compared ratios are proportions and which are false statements.
<u>Problem Solving With Ratio, Proportion and Percent</u>
solve multi-step problems requiring the performance of any combination of mathematical operations involving ratio, proportion, and percent, with or without a calculator.

THE NEXT STEP

Book 14018

Ratio, Proportion, and Percent

Introduction to Ratio, Proportion and Percent

To find a percentage of a number, multiply the number by the percentage written in its decimal fraction form. Find 25% of 12.

$$.25 \times 12 = 3$$

To find what percentage one number is of another, write the numbers as a fraction. Divide the fraction into its decimal form. Then change the decimal into its percentage form. *12* is what percent of *48*?

$$\frac{12}{48} \text{ or } \frac{.25}{48} = 25\% \quad \sqrt{12.00}$$

To find a number when a percentage of it is known, try this:

Nine is 25% of what number?

$$\frac{25}{100} = \frac{9}{?}$$

$$\begin{aligned}25 \times ? &= 100 \times 9 \\25 \times ? &= 900 \\? &= 900 \div 25 \\? &= 36\end{aligned}$$

Nine is **25%** of 36.

Some people like to use a formula to find the percent of a number, what percent one number is of another, or a number when a percent is given. The formula looks like this:

$$\frac{r}{100} = \frac{P}{W}$$

r = percent rate

P = part of the number

W = the whole (entire) number

So, to solve the problem, nine is **25%** of what number, we would follow these steps.

Step 1 Write down the formula.

$$\frac{r}{100} = \frac{P}{W}$$

Step 2 Insert the necessary information in the correct places.

$$\frac{25}{100} = \frac{9}{?}$$

Step 3 Cross multiply.

$$25 \times ? = 9 \times 100$$
$$25 \times ? = 900$$

Step 4 Divide and solve.

$$? = 900 \div 25$$
$$? = 36$$

Therefore, nine is **25%** of 36.

Practice Exercise

1. 195 is 39% of what number?
2. What % of 37000 is 44.4?
3. What is 0.64% of 38000?
4. What is 12 ½% of 95?
5. What % of 2200 is 1100?
6. What is 4% of 58?
7. 313.5 is 0.95% of what number?
8. What is 8% of 3000?
9. What % of 27000 is 102.6?
10. What is 18 ½% of 43?

11. What is 7% of 50?
12. What % of 2400 is 1608?
13. 3139 is 73% of what number?
14. What is 72% of 2900?
15. 52.9 is 0.23% of what number?
16. What is 0.43% of 8000?
17. What is $3\frac{1}{2}\%$ of 35?
18. What % of 41000 is 28.7?
19. What is $21\frac{1}{2}\%$ of 61?
20. What is 0.71% of 16000?
21. What % of 820 is 123?
22. 2162 is 46% of what number?
23. 158.4 is 0.66% of what number?
24. What is 4% of 4600?
25. 273 is 0.65% of what number?
26. What % of 27000 is 59.4?
27. What is 47% of 4400?
28. What is 0.84% of 23000?

Ratios describe the size of things in comparison to each other. Ratios are sometimes written in the form of fractions. More often, the symbol $:$ is used to separate the numerator and the denominator.

For example, if you ate **2** parts of a pie that had been cut into **5** parts, the ratio of pieces of pie you ate to the uneaten pieces of pie is **2 to 3**. The ratio may be written as **2:3** or $\frac{2}{3}$.



Writing the ratio in words will help you keep the numbers in the correct order. The words will also help you remember the meaning of the numbers. Including labels in your final ratio is also helpful.

Example If Barbara earns \$180 in 15 hours, how much does she earn per hour?

Write the ratio of earnings to hours. Then divide to simplify.

$$\frac{\text{dollars earned}}{\text{hours}} = \frac{\$180}{15} = \frac{180}{15} \div \frac{15}{15} = \frac{\$12}{1 \text{ hr}}$$

Barbara earns \$12 for every 1 hour she works. In other words, she earns **\$12 per hour**.

Reducing Ratios

Reducing a ratio means finding an equal, simplified version of the original. The ratio is reduced to lowest terms when there is no number other than 1 that will divide evenly into both of the numbers that make up the ratio.

To simplify a ratio, divide both of the numbers that make up the ratio by the same number, and write the new ratio.

Example In one hour, 10 customers visited Stuart's newsstand. Of those, 4 bought a magazine. What is the ratio of those who bought a magazine to those that did not?

Write a ratio: bought magazines:didn't buy magazines
4:6

Simplify the ratio by dividing both of the numbers in the ratio by 2.

$$4:6 = 2:3$$

You may also represent the ratios as fractions when simplifying.

$$\frac{4}{6} = \frac{4 \div 2}{6 \div 2} = \frac{2}{3}$$

$$\frac{2}{3} = 2:3$$

Calculating Equal Ratios

If one cherry pie is baked for every 4 apple pies, the ratio is 1:4, or $\frac{1}{4}$.

If the number of apple pies is increased to 12, how many cherry pies are needed to keep the same ratio?

To find the solution, write the ratios as an equation.

$$\frac{1}{4} = \frac{?}{12}$$

To solve, multiply (or divide) each term of the first ratio by the same number to make a true statement.

$$\frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$$

1:4 and 3:12 are equal ratios.

You can also find the missing term by cross-multiplying and then dividing.

$$\begin{array}{l} \frac{1}{4} \times \frac{?}{12} \\ \frac{1}{4} \times 12 = 4 \times ? \\ \frac{12}{4} = \frac{4}{4} \times ? \\ 3 = ? \end{array}$$

When ratios are equal or equivalent, they are said to be **proportional** and can be referred to as **true proportions**.

When ratios are not equal, they are said to be non-equivalent or disproportionate.

The **terms** of a proportion are:

$$\begin{array}{l} \text{first} \rightarrow \underline{a} = \underline{c} \leftarrow \text{third} \\ \text{second} \rightarrow b \quad d \leftarrow \text{fourth} \end{array}$$

The **extremes** are the first and fourth terms of a proportion.

The **means** are the second and third terms of a proportion.

Proportions are often written using a fraction bar that stands for “is compared to”. For example, $\frac{2}{3} = \frac{6}{9}$ means 2 compared to 3 is the same as 6 compared to 9.

A **direct proportion** is indicated when two quantities are so related that an increase in one causes a corresponding increase in the other or when a decrease in one causes a corresponding decrease in the other.

The following is a list of directly proportional relationships.

- a. The faster the speed, the greater the distance covered.
- b. The more people working, the greater amount of work done.
- c. The slower the speed, the lower the number of revolutions.
- d. The shorter the object, the shorter the shadow.

Practice Exercise

Mark True or False for Each of the Following

- | | | |
|--------------------|---|---|
| 1. $4:6 = 20:30$ | T | F |
| 2. $7:3 = 14:6$ | T | F |
| 3. $18:40 = 6:20$ | T | F |
| 4. $14:36 = 7:18$ | T | F |
| 5. $8.4:6 = 28:20$ | T | F |

In each of the following proportions, solve for the unknown value.

$$1. \frac{18}{15} = \frac{6}{?}$$

$$2. \frac{4}{12} = \frac{?}{24}$$

$$3. \frac{16}{10} = \frac{?}{5}$$

$$4. \frac{35}{?} = \frac{7}{9}$$

$$5. \frac{4}{?} = \frac{20}{45}$$

$$6. \frac{18}{36} = \frac{6}{?}$$

$$7. \frac{12}{21} = \frac{?}{49}$$

$$8. \frac{11}{?} = \frac{44}{8}$$

$$9. \frac{16}{?} = \frac{6}{9}$$

$$10. \frac{35}{?} = \frac{7}{12}$$

$$11. \frac{164}{?} = \frac{41}{18}$$

$$12. \frac{?}{72} = \frac{14}{16}$$

$$13. \frac{?}{84} = \frac{21}{98}$$

$$14. \frac{41}{19} = \frac{?}{38}$$

$$15. \frac{?}{28} = \frac{6}{14}$$

$$16. \frac{108.9}{47.7} = \frac{12.1}{?}$$

$$17. \frac{15}{20.9} = \frac{?}{125.4}$$

$$18. \frac{?}{21.7} = \frac{32.4}{130.2}$$

$$19. \frac{34}{33} = \frac{204}{?}$$

$$20. \frac{17}{10} = \frac{?}{20}$$

$$21. \frac{47}{46} = \frac{?}{230}$$

Problem Solving with Ratio, Proportion and Percent

Identifying the Parts of and Solving a Percent Word Problem

Read the statement below:

The 8-ounce glass is 50% full. It contains 4 ounces.

This statement contains three facts:

the whole: the 8-ounce glass

the part: 4 ounces

the percent: 50%

A percent word problem would be missing one of these facts. When you are solving a percent word problem, the first step is to identify what you are looking for. As shown on page 159, you have three possible choices: the part, the whole, or the percent.

It is usually easiest to figure out that you are being asked to find the percent. Word problems asking for the percent usually ask for it directly, with a question such as “What is the percent?” or “Find the percent” or “3 is what percent?” Occasionally, other percent-type words are used, such as “What is the *interest rate*?”

Example 114 city employees were absent yesterday. This was 4% of the city work force. How many people work for the city?

Step 1: *question:* How many people work for the city?

Step 2: *necessary information:* 114 city employees, 4%

Step 3: You are given the number of city employees who were absent (114) and the percent of the work force that this represents (4%). You are looking for the total number of people who work for the city, the whole.

Once you identify what you are looking for in a percent word problem, set up the problem and solve it.

Percents are ratios: 15% means 15 out of 100. Percent word problems can be set up as a proportion by writing two ratios that are equal in the following form:

$$\begin{aligned}\frac{P}{W} &= \frac{r}{100} \\ \frac{114}{?} &= \frac{4}{100} \\ 114 \times 100 &= 4 \times ? \\ 11400 &= 4 \times ? \\ 11400 \div 4 &= ? \\ 2850 &= ?\end{aligned}$$

2850 people work for the city.

Practice Exercise

- (1) Jill worked 8.24 hours and received \$70.04. What will Jill receive for working 9 hours?
- (2) A six-pack of pop costs \$11.40. What should it cost for 25 cans?
- (3) If you want to enlarge a 4 inch wide by 9 inch long photo to be 16 inches wide, how long will the length be?
- (4) At the local market 5 bananas are \$6. How much will 14 cost?
- (5) If your purchase comes to \$765.38, including tax for a \$710 purchase, how much will the tax be on a \$370 purchase?
- (6) If your purchase comes to \$140 + tax, how much do you owe?
Tax is 7% and the total should be rounded to the nearest penny.
- (7) Paul, a salesman, sold a house for \$112,000. Paul earns a 9% commission when selling a house. How much did Paul earn by selling this house?

- (8) $11\frac{1}{2}\%$ is the interest rate a bank pays. If you invest \$8,800 for one year, how much interest will you earn?
- (9) The final exam your teacher is giving has 150 questions. If you need 70% to pass, how many questions must you get correct?
- (10) How much must be sold to earn \$950.95, if the commission on sales is 13%?

Answer Key

Book 14018 – Ratio, Proportion and Percent

Page 5

1. 500
2. .12%
3. 243.2
4. 11.875
5. 50%
6. 2.32
7. 33000
8. 240
9. .38%
10. 7.955
11. 3.5
12. 67%
13. 4300
14. 2088
15. 23000
16. 34.4
17. 1.225
18. .07%
19. 13.115
20. 113.6
21. 15%
22. 4700
23. 24000
24. 184
25. 42000
26. .22%
27. 2068
28. 193.2

Page 10

1. True
2. True
3. False
4. True
5. True

Page 11

1. 5
2. 8
3. 8
4. 45
5. 9
6. 12
7. 28
8. 2
9. 24
10. 60
11. 72
12. 63
13. 18
14. 82
15. 12
16. 5.3
17. 90
18. 5.4
19. 198
20. 34
21. 235

Page 14

1. \$76.50
2. \$47.50
3. 36 inches
4. \$16.80
5. \$28.86
6. \$149.80
7. \$10080
8. \$1012
9. 105 questions
10. \$7315