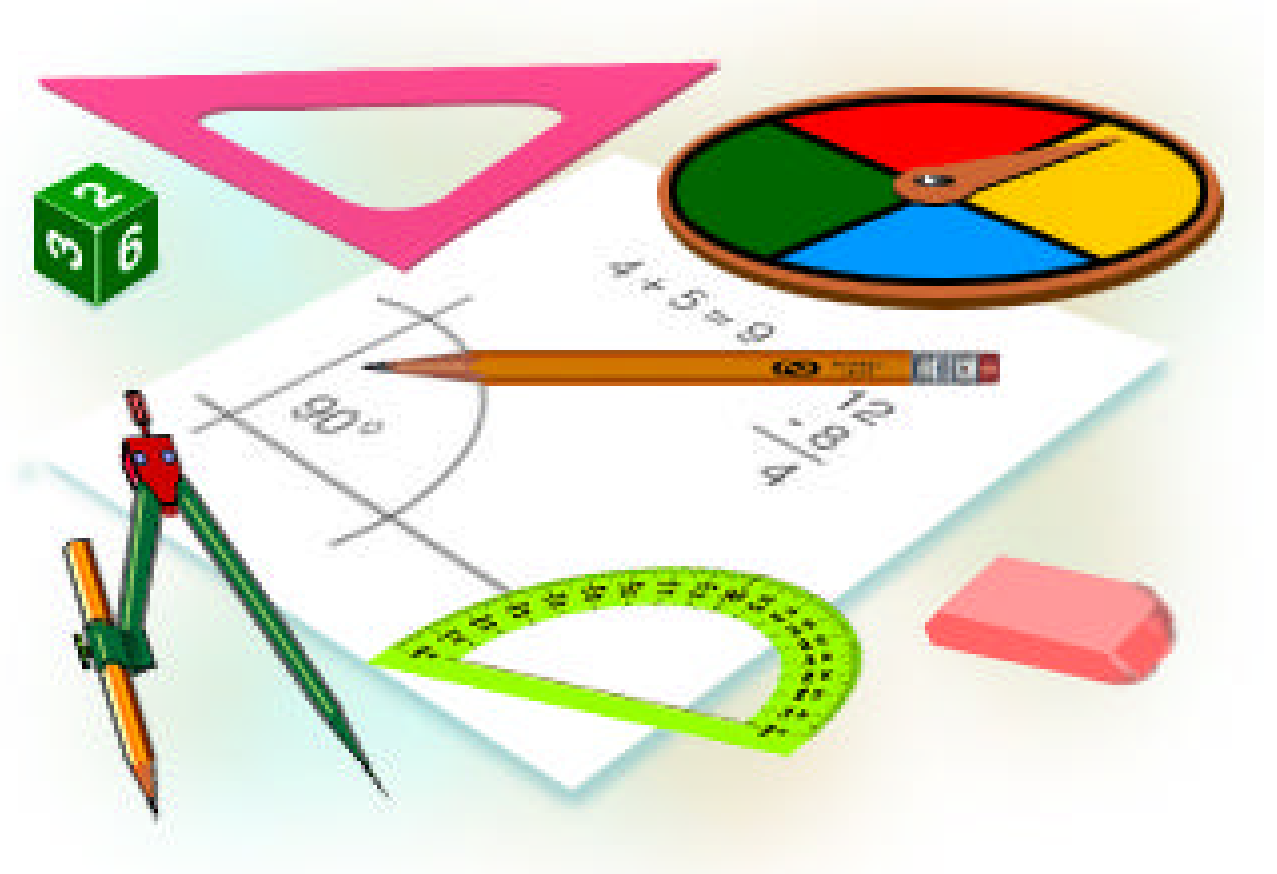


The Next Step

Mathematics Applications for Adults



Book 14017 – Percent and Ratio

OUTLINE

Mathematics - Book 14017

Percent and Ratio
<u>Introduction To Ratio 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.
<u>Problem Solving With Percent And Ratio</u>
solve multi-step problems requiring the performance of any combination of mathematical operations involving ratio and percent, with or without a calculator.

THE NEXT STEP

Book 14017

Ratio and Percent

Introduction to Ratio 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*?

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

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

Nine is 25% of what number?

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

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

$$25 \times ? = 900$$

$$? = 900 \div 25$$

$$? = 36$$

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.

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

Step 4 Divide and solve.

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

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

Practice Exercise

1. 20 is what % of 40?
2. Find 20.4% of 9.
3. 22 is what % of 44?
4. Find 86% of 100
5. 43 is what percent of 86?
6. $16\frac{1}{2}$ % of 258 is what number?

- | |
|--|
| 7. Find $62\frac{1}{2}$ % of 35 |
| 8. 65.7% of 179 is what number? |
| 9. 35% of 240 is what number? |
| 10. What number is $15\frac{1}{2}$ % of 84 ? |
| 11. 20 is what percent of 40? |
| 12. 94% of 298.7 is what number? |
| 13. 6 is what percent of 60? |
| 14. Find 10.4% of 87. |
| 15. Find 60% of 65. |
| 16. 41 is what percent of 82? |

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

Practice Exercise

Write each ratio and simplify

1. The ratio of 23 to 46 1:2 or 1 to 2	2. The ratio of 16 to 12 _____
3. The ratio of 15 to 45 _____	4. The ratio of 6 to 36 _____
5. The ratio of 14 to 35 _____	6. The ratio of 9 mins to 36 mins _____
7. The ratio of 25 quarters to 10 quarters _____	8. The ratio of 24 secs to 36 secs _____
9. The ratio of 12 hours to 9 hours _____	10. The ratio of 85 nickels to 100 nickels _____
11. The ratio of 18 mins to 54 mins _____	12. The ratio of 18 lb to 6 lb _____
13. The ratio of 35 mins to 7 mins _____	14. The ratio of 80 quarters to 100 quarters _____

15. The ratio of 14 oz to 50 oz _____	16. The ratio of 26 days to 50 days _____
17. The ratio of 45 secs to 9 secs _____	18. The ratio of 12 dimes to 5 dimes _____
19. The ratio of 12 yr to 60 yr _____	20. The ratio of 3 hours to 1 hour _____

Mark True or False for Each of the Following

- | | | |
|--------------------|---|---|
| 1. $2:3 = 10:15$ | T | F |
| 2. $14:6 = 28:12$ | T | F |
| 3. $9:20 = 3:10$ | T | F |
| 4. $7:18 = 3.5:9$ | T | F |
| 5. $4.2:3 = 14:10$ | T | F |

Problem Solving with Percent and Ratio

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 above, 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.

Percent word problems can be set up 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) If you want to enlarge a 5 inch wide by 6 inch long photo to be 30 inches wide, how long will the length be?
- (2) Jane worked 10.24 hours and received \$107.52. What will Jane receive for working 7 hours?
- (3) A six-pack of pop costs \$12. What should it cost for 25 cans?
- (4) On a map it is 5 inches from Campbellton to Edmundston. It is 9 inches from Edmundston to Saint John. According to the map it is 125 miles from Campbellton to Edmundston. How many miles is it from Edmundston to Saint John?
- (5) At the local market 20 bananas are \$2.45. How much will 4 cost?
- (6) If 3 books are purchased for \$33, how much will it cost for 9 books?
- (7) Paul sells houses and recently made \$1216.05 by selling a house for \$11,055. How much must Paul's next property be worth to make \$2190.10?
- (8) If the average defective rate for a new computer is 35 per 100 or 35%, how many should be expected to be defective in a batch of 2160 computers?

- (9) At the local market 21 oranges are \$8.19. How much will 9 cost?
- (10) Brad is a lawyer who earned \$75,000 last year and paid \$29,250 in taxes. If Brad had a good year and earned \$200,000, how much will Brad pay in taxes? (Assume the same tax rate)
- (11) 3 friends own a pizza shop. One of the 3 friends receives 50% of the profit, while the other friend receives 18%. How much does the 3rd friend receive?
- (12) If 23% of available tickets were not sold, what percent was sold?
- (13) 13% is the interest rate a bank pays. If you invest \$8,500 for one year, how much interest will you earn?
- (14) Al earns \$1,344 per month. If 2.5% of his earnings goes to income tax, how much does he pay per month in income tax?
- (15) 10 students out of 20 scored an A. 2 students scored a B. What percentage of students had a score other than A or B?
- (16) 360 out of 1000 people voted in an election. What % of people voted?
- (17) The final exam your teacher is giving has 75 questions. If you need 68% to pass, how many questions must you get correct?

- (18) Cindy's insurance paid 90% of the cost of getting her car fixed. If the repair bill was \$625, how much did the insurance pay?
- (19) On a test, a student got 80% of the items correct. If the student got 56 items correct, how many items were on the test?
- (20) The Huskies won 18 games out of 45. What percent of their games did the Huskies win?

Answer Key

Book 14017 – Ratio, Proportion and Percent

Page 5

1. 50% 2. 18.36 3. 50% 4. 86
5. 50% 6. 42.57 7. 21.875 8. 117.603
9. 84 10. 13.02 11. 50% 12. 280.778
13. 10% 14. 9.048 15. 39 16. 50%

Page 10

2. 4:3 or 4 to 3 3. 1:3 or 1 to 3
4. 1:6 or 1 to 6 5. 2:5 or 2 to 5
6. 1:4 or 1 to 4 7. 5:2 or 5 to 2
8. 2:3 or 2 to 3 9. 4:3 or 4 to 3
10. 17:20 or 17 to 20 11. 1:3 or 1 to 3
12. 3:1 or 3 to 1 13. 5:1 or 5 to 1
14. 4:5 or 4 to 5 15. 7:25 or 7 to 25
16. 13:25 or 13 to 25 17. 5:1 or 5 to 1
18. 12:5 or 12 to 5 19. 1:5 or 1 to 5
20. 3:1 or 3 to 1

Page 11

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

Page 14

1. 36 inches 2. \$73.50 3. \$50
4. 225 miles 5. 49 cents 6. \$99
7. \$19910 8. 756 computers 9. \$3.51
10. \$78000 11. 32% 12. 77%
13. \$1105 14. \$33.60 15. 40%
16. 36% 17. 51 questions 18. \$562.50
19. 70 items 20. 40%