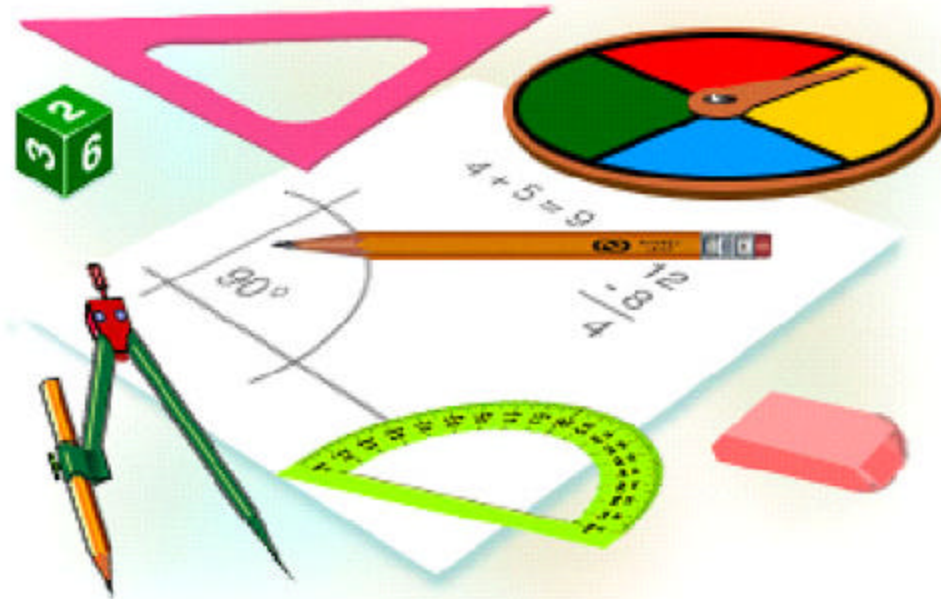


# The Next Step

## Mathematics Applications for Adults



**Book 14016 – Percents**

## OUTLINE

### Mathematics - Book 14016

<b>Percents</b>
<b><u>Understanding and Comparing Percents</u></b>
demonstrate an ability to visualize percent.
compare percents by ordering them from greatest to least and vice versa.
convert percent to decimals and fractions.
convert decimals and fractions to percent.
<b><u>Using Percents</u></b>
find percent of a number by converting it to either a decimal or a fraction.
find the percentage that one number is of another number.
find the number when a percentage is given.
use the formula $r/100 = P/W$ and cross multiplication.
<b><u>Simple Interest</u></b>
calculate simple interest.
<b><u>Word Problems with Percent</u></b>
solve one/two step word problems involving percent and simple interest.

## THE NEXT STEP

### Book 14016

#### Percents

#### Understanding and Comparing Percents

The term *percent* means *parts per hundred*. Any fraction with a denominator of **100** can be written as a percentage, using a percent sign, **%**. So, if you ate  $\frac{1}{2}$  of a pie, you ate **50/100** or **.50** or **50%** of the pie.



If you ate  $\frac{1}{8}$  of the pie, you ate **12.5%**

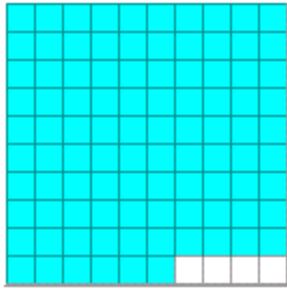
If you ate  $\frac{3}{4}$  of the pie, you ate **75%**

If you ate  $\frac{1}{5}$  of the pie, you ate **20%**

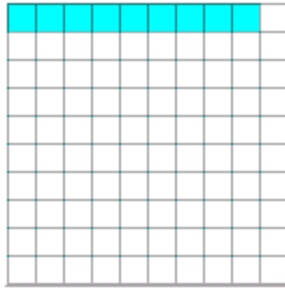
**P** If you ate **1 whole pie**, you ate **1.00** or **100%** of the pie. **You ate the whole thing!!!**

What fraction of each grid is shaded?

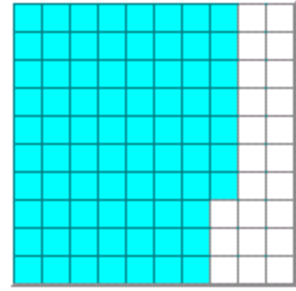
Grid 1



Grid 2



Grid 3



Each grid above has 100 boxes. For each grid, the **ratio** of the **number of shaded boxes** to the **total number of boxes** can be represented as a fraction.

Comparing Shaded Boxes to Total Boxes		
Grid	Ratio	Fraction
1	96 to 100	$\frac{96}{100}$
2	9 to 100	$\frac{9}{100}$
3	77 to 100	$\frac{77}{100}$

We can represent each of these fractions as a **percent** using the symbol %.

$$\frac{96}{100} = 96\% \quad \frac{9}{100} = 9\% \quad \frac{77}{100} = 77\%$$

Let's look at our comparison table again. This time the table includes percents.

Comparing Shaded Boxes to Total Boxes			
Grid	Ratio	Fraction	Percent
1	96 to 100	$\frac{96}{100}$	96%
2	9 to 100	$\frac{9}{100}$	9%
3	77 to 100	$\frac{77}{100}$	77%

It is easy to convert a fraction to a percent when its denominator is 100. If a fraction does not have a denominator of 100, you can convert it to an equivalent fraction with a denominator of 100, and then write the equivalent fraction as a percent.

Write each fraction as a percent:

**Example 1:**  $\frac{1}{2}$ ,  $\frac{18}{20}$ ,  $\frac{4}{5}$

Solution		
Fraction	Equivalent Fraction	Percent
$\frac{1}{2}$	$\frac{1 \times 50}{2 \times 50} = \frac{50}{100}$	50%
$\frac{18}{20}$	$\frac{18 \times 5}{20 \times 5} = \frac{90}{100}$	90%
$\frac{4}{5}$	$\frac{4 \times 20}{5 \times 20} = \frac{80}{100}$	80%

You may also change a fraction to a percentage by dividing the fraction.

$$\frac{2}{5} = \frac{.40}{2.00}$$

Then change the decimal to a fraction with **100** in the denominator.

$$.40 = \frac{40}{100} = 40\%$$

To change a percentage to a fraction, reverse the process. Be sure to write the fraction in its lowest possible terms.

$$4\% = \frac{4}{100} = \frac{1}{25} \qquad 13\% = \frac{13}{100}$$

## Writing Decimals as Percents

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**Problem:** What percent of a dollar is 76 cents?

$$76 \text{ cents} = .76$$

$$.76 = 76\%$$

**Solution:** 76 cents is 76% of a dollar.

\$  
%

The solution to the above problem should not be surprising, since both dollars and percents are based on the number 100. As a result, there is nothing complicated about converting a decimal to a percent. **To convert a decimal to a percent, move the decimal point two places to the right.** Look at the example below:

**Example 1** Write each decimal as a percent: .93, .08, .67, .41

Solution	
Decimal	Percent
.93	93%
.08	8%
.67	67%
.41	41%

Each of the decimals in Example 1 has two places to the right of the decimal point. However, a decimal can have any number of places to the right of the decimal point. Look at Example 2 and Example 3 below:

**Example 2** Write each decimal as a percent: .786, .002, .059, .8719

Solution	
Decimal	Percent
.786	78.6%
.002	.2%
0.59	5.9%
.8719	87.19%

**Example 3** Write each decimal as a percent: .1958, .007, .05623, .071362

Solution	
Decimal	Percent
.1958	19.58%
.007	.7%
.05623	5.623%
.071362	7.1362%



## Writing Percents as Decimals

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**Problem:** What is 35 percent of one dollar?

We know from the previous lesson that  $.35 = 35\%$ . The word "of" means multiply. So we get the following:

$$35\% \times \$1.00 = .35 \times \$1.00$$

$$.35 \times \$1.00 = .35 \times 1 = .35$$

**Solution:** 35% of one dollar is \$.35, or 35 cents.

The solution to the above problem should not be surprising, since percents, dollars and cents are all based on the number 100. **To convert a percent to a decimal, move the decimal point two places to the left.** Look at the example below:

**Example 1** Write each percent as a decimal:

18%, 7%, 82%, 55%

Solution	
Percent	Decimal
18%	.18
7%	.07
82%	.82
55%	.55

In Example 1, note that for 7%, we needed to add in a zero. **To write a percent as a decimal, follow these steps:**

- Drop the percent symbol.
- Move the decimal point two places to the left, adding in zeros as needed.

**Why do we move the decimal point 2 places to the left?** Remember that percent means parts per hundred, so 18% equals  $\frac{18}{100}$ . From your knowledge of decimal place value, you know that  $\frac{18}{100}$  equals eighteen hundredths (.18) . So 18% must also equal eighteen hundredths (.18). In Example 2 below, we take another look at Example 1, this time including the fractional equivalents.

**Example 2** Write each percent as a decimal:

18%, 7%, 82%, 55%

Solution		
Percent	Fraction	Decimal
18%	$\frac{18}{100}$	.18
7%	$\frac{7}{100}$	.07
82%	$\frac{82}{100}$	.82
55%	$\frac{55}{100}$	.55

Let's look at some more examples of writing percents as decimals.

**Example 3** Write each percent as a decimal:

12.5%, 89.19%, 39.2%,  
71.935%

Solution	
Percent	Decimal
12.5%	.125
89.19%	.8919
39.2%	.392
71.935%	.71935

**P** To remember which way to move the decimal point when changing from a decimal to a percent or vice versa, think of your alphabet. Think of the decimal as “d” and the percent as “p”. To change from a decimal to a percent, move two places up your alphabet. Move two places down your alphabet to go from a percent to a decimal.

# Practice Exercise

Write each fraction as a percent.

1.  $\frac{8}{10} = 80\%$     2.  $\frac{44}{100} = \underline{\hspace{2cm}}$     3.  $\frac{7}{10} = \underline{\hspace{2cm}}$

4.  $\frac{1}{5} = \underline{\hspace{2cm}}$     5.  $\frac{3}{4} = \underline{\hspace{2cm}}$     6.  $\frac{33}{50} = \underline{\hspace{2cm}}$

7.  $\frac{294}{600} = \underline{\hspace{2cm}}$     8.  $\frac{6}{20} = \underline{\hspace{2cm}}$     9.  $\frac{27}{90} = \underline{\hspace{2cm}}$

10.  $\frac{2}{4} = \underline{\hspace{2cm}}$     11.  $\frac{9}{10} = \underline{\hspace{2cm}}$     12.  $\frac{27}{75} = \underline{\hspace{2cm}}$

13.  $\frac{56}{80} = \underline{\hspace{2cm}}$     14.  $\frac{45}{100} = \underline{\hspace{2cm}}$     15.  $\frac{17}{50} = \underline{\hspace{2cm}}$

16.  $\frac{7}{50} = \underline{\hspace{2cm}}$     17.  $\frac{21}{30} = \underline{\hspace{2cm}}$     18.  $\frac{3}{5} = \underline{\hspace{2cm}}$

19.  $\frac{24}{40} = \underline{\hspace{2cm}}$     20.  $\frac{4}{20} = \underline{\hspace{2cm}}$     21.  $\frac{6}{10} = \underline{\hspace{2cm}}$

Write each decimal as a percent.

1.  $0.76 = 76\%$     2.  $0.26 = \underline{\hspace{2cm}}$     3.  $0.31 = \underline{\hspace{2cm}}$

4.  $0.61 = \underline{\hspace{2cm}}$     5.  $0.63 = \underline{\hspace{2cm}}$     6.  $0.06 = \underline{\hspace{2cm}}$



## Using Percents

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?

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

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.

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

**Step 4** Divide and solve.

$$? = 900 \cdot 25$$
$$? = 36$$

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

## Practice Exercise

1. 15 is what % of 60?
2. 27 is what % of 81?
3. 9 is what % of 90?
4. 12 is what % of 72?
5. 8 is what % of 16?
6. 40 is what % of 320?
7. 16 is what % of 20?
8. 14 is what % of 35?
9. 32 is what % of 48?
10. 75 is what % of 90?
11. 33 is what % of 44?
12. 56 is what % of 64?
13. 75% of 68
14. 65% of 80
15. 78% of 100
16. 50% of 90
17. 36% of 62
18. 6% of 68
19. 39% of 76
20. 58% of 41
21. 72% of 79



22. 40% of 50
23. 54% of 48
24. 13% of 85
25. 25% of what number is 8?
26. 50% of what number is 45?
27. 75% of what number is 48?
28. 60% of what number is 75?
29. 40% of what number is 60?
30. 15% of what number is 12?
31. 10% of what number is 6.3?
32. 35% of what number is 8.4?

## Simple Interest

Simple interest is the amount obtained by multiplying the principal by the rate by the time;  $I = prt$ .

The principal is the amount of money borrowed or saved.

*Example:*

Carol invested \$150 at a simple interest rate of 4%. Find the interest she will earn in 1 year.

$$I = prt$$

$$I = 150 \times 4\% \times 1 \quad p = \$150, r = 4\%, t = 1 \text{ year}$$

$$I = 150 \times 0.04 \times 1 \quad \text{Multiply.}$$

$$I = 6$$

So, the interest earned in 1 year is \$6.

**Watch Out!!!** We know that there are 365 days in a year but with interest you calculate with 360 days (a business year).

$$30 \text{ days} = \frac{30}{360} = \frac{1}{12}$$

$$120 \text{ days} = \frac{120}{360} = \frac{1}{3}$$

$$1 \text{ year} = 1 \quad 1 \frac{1}{2} \text{ years} = 1.5 \quad 2 \frac{3}{4} \text{ years} = 2.75$$

**Example** What would the interest be on a 90 day loan of \$500.00, if the rate was 15%?

$$15\% = .15$$
$$\frac{90}{360} = \frac{1}{4}$$

$$I = PRT$$
$$I = 500 \times .15 \times \frac{1}{4}$$
$$I = \$18.75$$

To find the rate, principal, or time, you may rewrite the interest formula as follows:

$$\text{Rate} = \frac{\text{interest}}{\text{principal} \times \text{time}}$$
$$\text{Principal} = \frac{\text{interest}}{\text{rate} \times \text{time}}$$

$$\text{Time} = \frac{\text{interest}}{\text{principal} \times \text{rate}}$$

To figure out the total amount owed or total payment due to the lender (bank, credit card company, etc.) add the accumulated interest to the original principal.

**Example** Mr. Jones borrowed \$1600.00 for a period of 2 years. He is paying a rate of 12% a year. How much interest will he have to pay? What is the total amount that he will owe to the lender?

$$12\% = .12$$

$$I = PRT$$

$$I = 1600 \times .12 \times 2$$

$$I = \$384.00$$

$$\text{Total Amount} = P + T$$

$$\text{Total Amount} = 1600 + 384$$

$$\text{Total Amount} = \$1984$$

**Mr. Jones will have to pay \$384 in interest. At the end of the lending period (2 years), he will owe the lender \$1984.**

# Practice Exercise

Complete the following.

	<b>Principal</b>	<b>rate</b>	<b>time</b>	<b>interest</b>
1)	\$400.00	7%	1 year	
2)	\$800.00		60 days	\$7.00
3)	\$1550.00	6%		\$232.50
4)	\$880.00		2 years	\$149.60
5)	\$525.00	5%	2 years	
6)	\$400.00	8%		\$16.00

Calculate the interest and total payment assuming this is a loan.

	<i>principal</i>	<i>rate</i>	<i>time</i>	<i>interest</i>	<i>total payments</i>
1.	\$200	11%	30 days	<b>\$1.83</b>	<b>\$201.83</b>
2.	\$300	5%	2 years	_____	_____
3.	\$200	7%	1 year	_____	_____
4.	\$710	5%	1 year	_____	_____
5.	\$570	8%	4 $\frac{3}{4}$ years	_____	_____
6.	\$390	12%	60 days	_____	_____

7.	\$380	7%	210 days	_____	_____
8.	\$730	9%	1 year	_____	_____
9.	\$1,880	9%	1 year	_____	_____
10.	\$680	16.2%	150 days	_____	_____
11.	\$2,040	9%	1 year	_____	_____
12.	\$1,675	7.4%	51 years	_____	_____
13.	\$1,920	11.34%	120 days	_____	_____
14.	\$14,410	13.11%	$1 \frac{3}{4}$ years	_____	_____
15.	\$17,020	5%	1 year	_____	_____

## Word Problems with 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 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:

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

**2850** people work for the city.

## Practice Exercise

Solve for each of the given problems.

- |    |  |
|----|--|
| 1. | A survey of 1,760 people was done by a newspaper. 40% of people did not know the name of their representative in Parliament. How many of the 1,760 people knew the answer? |
| 2. | A class of thirty voted for class president. 30% voted for Brad and 70% voted for Amy. How many votes did the winner receive?  |

3.	Jane is in a class of 15 boys and 10 girls. 28% of the students in the class take the bus to school. How many students do not take the bus to school?
4	The movie theater has 250 seats. 150 seats were sold for the current showing. What percentage of seats are empty?
5.	3 out of 4 dentists recommend a fluoride toothpaste. What percent of all dentists recommend a fluoride toothpaste?
6.	112,492 voted for mayor in the city. This was 40% of the registered voters. How many registered voters are there in the city?
7.	Jane purchased a house for \$82,000. To pay for the house, Jane took out a 30 year mortgage and pays the bank a yearly interest fee of 8.9%. In eight years, how much in interest fees was paid to the bank?
8.	Brad deposited \$40,000 at a bank that pays 11% interest. Amy deposited \$32,000 at a bank that pays 14% interest. Who will receive more interest in a year, and by how much more?



## Answer Key

### Book 14016 - Percent

- Page 12
2. 44%    3. 70%    4. 20%    5. 75%  
6. 66%    7. 49%    8. 30%    9. 30%  
10. 50%    11. 90%    12. 36%    13. 70%  
14. 45%    15. 34%    16. 14%    17. 70%  
18. 60%    19. 60%    20. 20%    21. 60%

- Page 12
2. 26%    3. 31%    4. 61%    5. 63%  
6. 6%    7. 47%    8. 50%    9. 22%  
10. 90%    11. 73%    12. 55%    13. 77%  
14. 8%    15. 25%    16. 71%    17. 65%  
18. 17%    19. 1%    20. 9%    21. 72%  
22. 38%    23. 97%    24. 39%

- Page 13
1.  $1/20$     2.  $21/50$     3.  $3/20$     4.  $4/25$   
5.  $39/50$     6.  $2/25$

- Page 13 (fraction to decimal)    1. .13    2. .72  
3. .27    4. .85

- Page 16
1. 25%    2.  $33\frac{1}{3}\%$     3. 10%  
4.  $16\frac{2}{3}\%$     5. 50%    6. 12.5%    7. 80%  
8. 40%    9.  $66\frac{2}{3}\%$     10.  $83\frac{1}{3}\%$   
11. 75%    12. 87.5%    13. 51    14. 52  
15. 78    16. 45    17. 22.32    18. 4.08  
19. 29.64    20. 23.78    21. 56.88    22. 20  
23. 25.92    24. 11.05    25. 32    26. 90

27. 64    28. 125    29. 150    30. 80  
31. 63    32. 24

**Page 20**

1. \$28    2. 5.25%    3. 2.5 years    4. 8.5%  
5. \$52.50    6.  $\frac{1}{2}$  of a year

**Page 20**

2. \$36, \$336    3. \$14, \$214  
4. \$47.60, \$752.60    5. \$216.60, \$786.60  
6. \$7.80, \$397.80    7. \$15.52, \$395.52  
8. \$65.70, \$795.70    9. \$169.20, \$2049.20  
10. \$45.90, \$725.90    11. \$183.60, \$2223.60  
12. \$681.72, \$2356.73    13. \$72.58, \$1992.58  
14. \$2361.44, \$16771.44    15. \$851, \$17871

**Page 23**

1. 1056 people know the answer  
2. 21 votes    3. 18 students    4. 40%  
5. 75%    6. 281230 registered voters  
7. \$58384    8. Amy, \$80