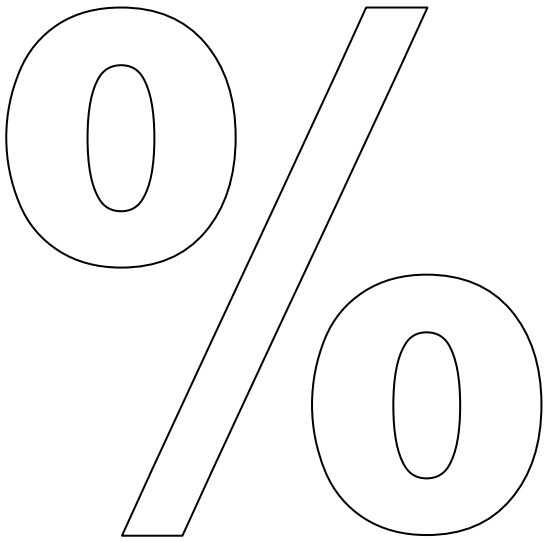
Percents



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To the student:
This packet is a supplement to your text.

Handout on Percents

Ratio and Proportion Method

Every percent problem has three possible unknowns, or variables: the percent, the part, or the base. In order to solve any percent problem, you must be able to identify these variables.

Look at the following examples. All three variables are known:

Example 1: 70% of 30 is 21
70 is the percent.
30 is the base.
21 is the part.

Example 2: 25% of 200 is 50
25 is the percent.
200 is the base.
50 is the part.

Example 3: 6 is 50% of 12
6 is the part.
50 is the percent.
12 is the base.

Each of these examples has a percent, part, and base. In *these types* of percent problems the percent will have a percent sign (%), the base always follows the word "of", and the part will be at the beginning of the sentence (in front of "is" or "=") or at the end of the sentence (after "is" or "=").

Exercise 1 (answers on page 16)

Directions: Identify the percent, part, and base in each of the following problems by writing "percent" over the percent, a "P" over the part, and a "B" over the base. (Answer key begins on page 8)

P percent B
Ex. 170 is 25% of 680

1) 8 is 40% of 20
2) 25% of 8 = 2
3) 15 = 50% of 30
4) 75% of 100 is 75
5) 5 is 1% of 500
6) 16% of 300 = 48
7) 20 is 50% of 40
8) ½ % of 250 = $1\frac{1}{4}$
9) $66\frac{2}{3}$% of 3 is 2
10) 1 is 33 $\frac{1}{3}$ % of 3

Exercise 2 (answers on page 16)

Directions: One of the three variables (P, B, or %) is the unknown in these percent problems. Identify the percent, part and base in each problem by writing "%" over the percent, a "P" over the part, and a "B" over the base
DO NOT SOLVE.

1) 7% of 78 is _____?
2) What is 87.5% of 8?
3) 43 is what percent of 483?
4) 1.6 is 8% of what?
5) 39.7% of what is 8.1?
6) 40 = _____% of 40?
7) _____ % of 803 is 1?
8) ½ % of 567.375 is what?
9) 48 = 16% of _____?
10) What percent of 30 is 20?

Percents using Ratios and Proportions

Percents are about ratios, or numbers compared to each other. In a percent problem the percent is compared to 100 and the part is compared to the base.

Ex.: 21 is 70% of 30

70% means the ratio $\frac{70}{100}$

21 is compared to 30 in the ratio $\frac{21}{30}$

Whenever one ratio is equal to another ratio, the equation is called a proportion. All percent problems can be set up as proportions.

Ex.: 70 % of 30 is 21

$\frac{70}{100} = \frac{21}{30}$ is a proportion

In proportions, since the two ratios are equal, you can cross-multiply and get the same answer.

Ex.: $\frac{70}{100} = \frac{21}{30}$

$70 \times 30 = 2100$ $\quad$ $100 \times 21 = 2100$

Same

Ex.: 6 is 50% of 12 $\quad \frac{50}{100} = \frac{6}{12}$

$50 \times 12 = 600$ $\quad$ $100 \times 6 = 600$

Solving percent problems for the unknown

You will be able to use cross multiplication to solve all percent problems where one of the three numbers is missing.

Memorize this formula: $\frac{\%}{100} = \frac{P}{B}$

Set up percent problems by placing the numbers in ratios; but leave the unknown blank. The unknown can be found by 1) multiplying the numbers in opposite corners and 2) dividing by the remaining number.

Ex.: 6% of 20 is what? $\frac{6}{100} = \frac{\quad}{20}$ 1) Multiply the opposite corners

6 x 20 = 120

2) Divide by the remaining number

$$100\overline{)120.0} \quad 1.2$$

1.2 is the answer (the part)

Ex.: What % of 50 = 7? $\frac{\quad}{100} = \frac{7}{50}$ 1) Multiply the opposites

7 x 100 = 700

2) Divide by the remaining number

$$50\overline{)700} \quad 14$$

14% is the answer (the percent)

Ex.: 4 is 25% of what? $\frac{25}{100} = \frac{4}{\quad}$ 1) Multiply the opposites

100 x 4 = 400

2) Divide by the remaining number

$$25\overline{)400} \quad 16$$

Exercise 3 **(answers on page 16)**

Directions: solve each problem for the unknown

1) 3 is 50% of what?

2) 5 is 20% of what?

3) 67 is 100% of what?

4) What % of 60 is 12?

5) What % of 20 is 40?

6) What percent of 156 is 78?

7) What is 80% of 40?

8) What is 75% of 80?

9) What is 10% of 50?

10) What is 100% of 38?

Exercise 4 (answers on page 16)

Directions: Solve each problem for the unknown. Round answers to the hundredths place, *if necessary.*

1) 94 is 80% of what?

2) 57 is 30% of what?

3) 5 is 31.25% of what?

4) What percent of 109 is 23?

5) What % of 76 is 11.4?

6) What percent of 42 is 3.57?

7) What is 25.5% of 12?

8) What is 30% of 72?

9) What is .5% of 45?

10) What is 6.5% of 28.6?

Exercise 5 (answers on page 16)

Directions: Solve each problem for the unknown. Round decimal answers to the nearest hundredth, *if necessary*. Reduce fraction answers to lowest terms.

1) 5 is $33\frac{1}{3}$% of what?

2) 20.5 = 13% of what?

3) $66\frac{2}{3}$% of 300 is what?

4) What percent of 16.7 = 4.3?

5) $34\frac{5}{8}$ % of 103 is what?

6) 66.3 is what% of 156?

7) 16 is what% of 38.1?

8) 172 is 35.83% of what?

9) $\frac{1}{4}$% of 44 is what?

10) 25 is $8\frac{1}{2}$ % of what?

Percent Word Problems

Ratio and proportion method

Here are several aids that will help you solve word problems:
Make sure you understand the question that is asked.
Sort out the information to make a basic percent problem, such as "30% of what is 17?"
Sometimes, you will have to subtract or add some of the numbers.
The base will always be the original number, price, or total.

Some examples of percent word problems.
A baseball pitcher won 80% of the games he pitched. If he pitched 35 ballgames, how many games did he win?

80% of 35 is what?

$$\frac{80}{100} = \frac{\quad}{35}$$

1. Multiply the opposites
80 x 35 = 2800
2. Divide by the remaining number

$$100\overline{)2800}\quad 28$$

28 games

Jerry, an electrician, worked 7 months out of the year. What percent of the year did he work? (round answer to the nearest hundredth)
What percent of 12 is 7? 12 months = 1 year

$$\frac{\quad}{100} = \frac{7}{12}$$

1. Multiply the opposites
7 x 100 = 700
2. Divide by the remaining number

$$12\overline{)700.00}\quad 58.33$$

58.33% (rounded to hundredth)

Sometimes the information needed to solve a percent word problem is not stated directly. You will need to sort out the numbers given in the problem. Organizing all the information into a box format will help you see what numbers you have and what you need.

There are 28 students in a class. Sixteen of those students are men. What percent of the class are women? (Round to the nearest tenth)

Men	%	16
Women	%	12
Total	100%	28

28 total students
-16 men
12 women

12 is what % of 28?

$$\frac{\quad}{100} = \frac{12}{28}$$

Multiple the opposites
100 x 12 = 1200
Divide by the remaining number

$$28\overline{)1200.00}\quad 42.85$$

42.9%

Donovan took a math test and got 35 correct and 10 incorrect answers. What was the percentage of correct answers? (Round to the nearest hundredth)

Correct answers	%	35
Incorrect answers	%	10
Total answers	100%	45

35 correct answers
+10 incorrect answers
45 total answers

35 is what % of 45?

$$\frac{\quad}{100} = \frac{35}{45}$$

Multiple the opposites
100 x 35 = 3500
2. Divide by the remaining number

$$45\overline{)3500.000}\quad 77.777$$

77.78% (rounded to hundredth)

Percent Word Problems (answers on page 17)

Directions: Set up a basic percent problem. Sometimes you will have to do extra steps to solve the problem. Follow rounding directions.

1. A student earned a grade of 80% on a math test that had 20 problems. How many problems on this test did the student answer correctly? (round to the nearest whole number)

2. There are 36 carpenters in a crew. On a certain day, 29 were present. What percent showed up for work? (round to the nearest tenth)

3. A metal bar weighs 8.15 ounces. 93% of the bar is silver. How many ounces of silver are in the bar? (round to the nearest thousandth)

4. A woman put $580 into a savings account for one year. The rate of interest on the account was $6\frac{1}{2}\%$. How much was the interest for the year in dollars and cents? (Round to the nearest cent)

5. A student answered 86 problems on a test correctly and received a grade 98%. How many problems were on the test, if all the problems were worth the same number of points? (Round to the nearest whole number)

6. Manuel found a wrecked Trans-Am that he could fix. He bought the car for 65% of the original price of $7200. What did he pay for the car? (Round to nearest dollar)

7. Pamela bought an electric drill at 85% of the regular price. She paid $32.89 for the drill. What was the regular price? (Round to the nearest cent)

(answers on pages 18-19)

8. A crew is made up of 8 men; the rest are women. $66\frac{2}{3}$ % of the crew are men. How many people are in the crew?

9. Ben earns $12,800 a year. About 15% is taken out for taxes. How much is taken out for taxes?

10. At a sale, shirts were sold for $15 each. This price was 80% of their original price. What was the original price?

11. There are 32 students in a class. Nine of those students are women. What percent are men? (round to the nearest tenth)

12. The Royals softball team played 75 games and won 55 of them. What percent of the games did they lose? (round to the nearest tenth)

Fraction/Decimal/Percent Conversions

Note: please talk to your instructor for other conversions

Changing fractions to decimals: divide the bottom number into the top number

$\frac{1}{2} = 2\overline{)1} = .5$ $\qquad$ $8\frac{1}{5} \Rightarrow 5\overline{)1} = 8.2$

Changing decimals to fractions: place a one under the point and a zero under the number(s)

$.7 = \frac{.7}{10} = \frac{7}{10}$ $\qquad$ $3.73 = 3\frac{.73}{100} = 3\frac{73}{100}$ $\qquad$ $2.6 = 2\frac{.6}{10} = 2\frac{6}{10} = 2\frac{3}{5}$

Changing Decimals to Percents: move decimal point two places to right (add zeros)

.27 = 27.% $\qquad$ 1.4 = 140.% $\qquad$ 7 = 700.% $\qquad$ .005 = .5%

Note: place a decimal point even if you don't see one

Changing Percents to Decimals: move the decimal point two places to the left (add zeros)

30% = .30 $\qquad$ .57% =.0057 $\qquad$ $8\frac{1}{5}\% \Rightarrow 5\overline{)1} = 8.2\% = .082$

Practice (Read and follow all directions) Directions: Fill in the blanks in the following table. Reduce fractions to lowest terms. ***Round decimals to hundredths***. **Round percents to hundredths**. **(answers on page 20)**

Mixed number or fraction	Decimal Number	Percent
$\frac{1}{2}$		
	.336	
		72%
$\frac{3}{5}$		
		$\frac{1}{2}\%$
	1.23	
$\frac{7}{8}$		
		$3\frac{1}{4}\%$
	426.2	
$8\frac{2}{3}$		
	.01	
$5\frac{7}{8}$		

Simple Interest Problems

Interest is money paid for the use of money. If you borrow from the bank to buy a car, the bank will charge you interest for its use. If you open a savings account at the bank, the bank will pay you interest for as long as the account is open.

Note: Banks usually charge compound interest not simple interest. See your local accounting teacher for more information.

The interest (I) is the dollar amount earned or owed.
The interest rate (R) is per year (T) unless otherwise noted.
Note: If the time is in months, T can be found using the ratio $\frac{\text{number of months}}{12}$.
The principal (P) is the amount borrowed or deposited.

This is the formula to express simple interest:
I(nterest) = P(rincipal) x R(ate) x T(ime)
I = P x R x T or I = PRT

Solve each of these interest problems:

1) You get a student loan from the New Mexico Educational Assistance Foundation to pay for your educational expenses this year.
Find the interest on the loan if you borrowed $2,000 at 8% for 1 year.
(You may wish to use the percent key on your calculator or change 8% to .08)

2) You are starting your own small business in Albuquerque. You borrow $10,000 from the bank at a 9% rate for 5 years.
Find the interest you will pay on this loan.

3) You are tired at the end of the term and decide to borrow $500 to go on a trip to Whatever Land. You go to the bank and borrow the money at 11% for 2 years.
a) Find the interest you will pay on the loan.

b) How much will you have to pay the bank at the end of the two years?

4. a) Find the interest on a loan of $2500 that is borrowed at 9% for 7 **months**.

b) How much would it cost to repay the loan from 4a) above?

5. Do you understand what interest means? Circle one YES! NO!

6. Have you ever borrowed money from a bank or loan office to buy a car, house, or whatever? Circle one YES! NO!

Answers

1. $160
2. $4500
3. a) $110
   b) $610
4. a) $131.25
   b) $2631.25
5. Yes = good job
   No = ask your teacher or IT for help
6. Yes = you know it all
   No = go out and buy something big today!

Answers to Handout on Percents

Exercise 1	Exercise 2
1) P percent B	1) % B P
2) percent B P	2) P % B
3) P percent B	3) P % B
4) percent B P	4) P % B
5) P percent B	5) % B P
6) percent B P	6) P % B
7) P percent B	7) % B P
8) percent B P	8) % B P
9) percent B P	9) P % B
10) P percent B	10) % B P
Exercise 3	Exercise 4
1) 6	1) 117.5
2) 25	2) 190
3) 67	3) 16
4) 20%	4) 21.10% (rounded)
5) 200%	5) 15%
6) 50%	6) 8.5%
7) 32	7) 3.06
8) 60	8) 21.6
9) 5	9) .23
10) 38	10) 1.86
Exercise 5	
1) 15	6) 42.5%
2) 157.69	7) 41.99% (rounded)
3) 200	8) 480.04 (rounded)
4) 25.75%	9) .11
5) 35.66 rounded or $35\frac{33}{50}$	10) 294.12 (rounded) or $294\frac{3}{25}$

Answers to Percents Word Problems

1. $\frac{80}{100} = \frac{\quad}{20}$

Multiply the opposites:
80 x 20 = 1600
Divide by the remaining number:

$$100\overline{)1600}\quad 16$$

16 problems

2. $\frac{\quad}{100} = \frac{29}{36}$

Multiply the opposites:
29 x 100 = 2900
Divide by the remaining number:

$$36\overline{)2900.00}\quad 80.55$$

80.6%

3. $\frac{93}{100} = \frac{\quad}{8.15}$

Multiply the opposites:
93 x 8.15 = 757.95
Divide by the remaining number:

$$100\overline{)757.9500}\quad 7.5795$$

7.580 ounces

4. $\frac{6\,1/2}{100} = \frac{\quad}{580}$

Multiply the opposites:
6 ½ x 580 = 3770
Divide by the remaining number:

$$100\overline{)3770.00}\quad 37.70$$

$37.70

5. $\frac{98}{100} = \frac{86}{\quad}$

Multiply the opposites:
100 x 86 = 8600
Divide by the remaining number:

$$98\overline{)8600.0}\quad 87.7$$

88 problems (rounded to nearest whole)

6. $\frac{65}{100} = \frac{\quad}{7200}$

Multiply the opposites:
65 x 7200 = 468,000
Divide by the remaining number:

$$100\overline{)468000}\quad 4680$$

$4680

7. $\frac{85}{100} = \frac{32.89}{\quad}$

Multiply the opposites:
100 x 32.89 = 3289
Divide by the remaining number:

$$85\overline{)3289.000}\quad 38.694$$

$38.69

8. $\frac{66\frac{2}{3}}{100} = \frac{8}{\quad}$

Multiply the opposites:
100 x 8 = 800
Divide by the remaining number:

$$800 \div 66\tfrac{2}{3} = \frac{800}{1} \div \frac{200}{3} = \frac{\cancel{800}^{4}}{1} \times \frac{3}{\cancel{200}_{1}} = \frac{12}{1}$$

12

9. $\frac{15}{100} = \frac{\quad}{12{,}800}$

Multiply the opposites:
15 x 12,800 = 192,000
Divide by the remaining number:

$$100\overline{)192000}\quad 1920$$

$1920

10. $\frac{80}{100} = \frac{15}{\quad}$

Multiply the opposites:
100 x 15 = 1500
Divide by the remaining number:

$$80\overline{)1500.00}\quad 18.75$$

$18.75

11.

Total	100%	32
Men		23
Women		9

$$\frac{\quad}{100} = \frac{23}{32}$$

$$\begin{array}{r} 32 \\ -\ 9 \\ \hline 23 \end{array}$$

Multiply the opposites:
100 x 23 = 2300
Divide by the remaining number:

$$32\overline{)2300.00}\quad 71.87$$

71.9%(rounded to nearest tenth)

12.

Total	100%	75
Won		55
Lost		20

$$\frac{\quad}{100} = \frac{20}{75}$$

$$\begin{array}{r} 75 \\ -\ 55 \\ \hline 20 \end{array}$$

Multiply the opposites:
100 x 20 = 2000
Divide by the remaining number:

$$75\overline{)2000.000}\quad 26.667$$

26.7% games lost (rounded to tenth)

Answers to Conversions Practice

Mixed number or fraction	Decimal Number	Percent
$\frac{1}{2}$	.50	50.00%
$\frac{42}{125}$	.336	33.60%
$\frac{18}{25}$	0.72	72.00%
$\frac{3}{5}$	0.60	60.00%
$\frac{1}{100}$	0.01	$\frac{1}{2}$%
$1\ \frac{23}{100}$	1.23	123.00%
$\frac{7}{8}$	0.88	88%
$\frac{3}{100}$	0.03	$3\ \frac{1}{4}$%
$426\ \frac{1}{5}$	426.2	42,620.00%
$8\ \frac{2}{3}$	8.67	867%
$\frac{1}{100}$	0.01	1%
$5\frac{7}{8}$	5.88	588%