

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

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)

$\begin{matrix} P & \text{percent} & B \\ \text{Ex. } 170 \text{ is } 25\% \text{ of } 680 \end{matrix}$

1) 8 is 40% of 20

6) 16% of 300 = 48

2) 25% of 8 = 2

7) 20 is 50% of 40

3) 15 = 50% of 30

8) $\frac{1}{2}$ % of 250 = $1\frac{1}{4}$

4) 75% of 100 is 75

9) $66\frac{2}{3}$ % of 3 is 2

5) 5 is 1% of 500

10) 1 is $33\frac{1}{3}$ % of 3

Exercise 2

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 _____ ?

6) 40 = _____ % of 40?

2) What is 87.5% of 8?

7) _____ % of 803 is 1?

3) 43 is what percent of 483?

8) $\frac{1}{2}$ % of 567.375 is what?

4) 1.6 is 8% of what?

9) 48 = 16% of _____ ?

5) 39.7% of what is 8.1?

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	100
$\times 30$	$\times 21$
2100	2100

Same

Ex.: 6 is 50% of 12

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

$$6 \times 20 = 120$$

2) Divide by the remaining number

$$100 \overline{)120.0} \quad \begin{array}{r} 1.2 \\ \end{array}$$

1.2 is the answer (the part)

Ex.: What % of 50 = 7? $\frac{\quad}{100} = \frac{7}{50}$

1) Multiply the opposites

$$7 \times 100 = 700$$

2) Divide by the remaining number

$$50 \overline{)700} \quad \begin{array}{r} 14 \\ \end{array}$$

14% is the answer (the percent)

Ex.: 4 is 25% of what? $\frac{25}{100} = \frac{4}{\quad}$

1) Multiply the opposites

$$100 \times 4 = 400$$

2) Divide by the remaining number

$$25 \overline{)400} \quad \begin{array}{r} 16 \\ \end{array}$$

16 is the answer (the base)

Exercise 3

Directions: solve each problem for the unknown

1) 3 is 50% of what?

6) What percent of 156 is 78?

2) 5 is 20% of what?

7) What is 80% of 40?

3) 67 is 100% of what?

8) What is 75% of 80?

4) What % of 60 is 12?

9) What is 10% of 50?

5) What % of 20 is 40?

10) What is 100% of 38?

Exercise 4

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

1) 94 is 80% of what?

6) What percent of 42 is 3.57?

2) 57 is 30% of what?

7) What is 25.5% of 12?

3) 5 is 31.25% of what?

8) What is 30% of 72?

4) What percent of 109 is 23?

9) What is .5% of 45?

5) What % of 76 is 11.4?

10) What is 6.5% of 28.6?

Exercise 5

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?

6) 66.3 is _____ % of 156?

2) $20.5 = 13\%$ of what?

7) 16 is _____ % of 38.1?

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

8) 172 is 35.83% of what?

4) What percent of 16.7 = 4.3?

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

5) $34\frac{5}{8}\%$ of 64 is _____ ?

10) 25 is $12\frac{1}{2}\%$ of what?

Answer Key

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) 480.05 (rounded)
4) 25.75%	9) .11
5) 22.16 or $22 \frac{4}{25}$	10) 200