



Percentages Review

The use of percentage is another way of expressing numbers (usually fractions) in such a way as to make comparisons between them more obvious. For instance, if you get 28 out of 40 in test A and 37 out of 50 in Test B, it may not be clear whether you have improved or not. The use of percentage will allow this comparison, because a percent is part of 100. (i.e. a percent is a fraction with a denominator of 100).

A. CHANGING % TO FRACTIONS / DECIMALS

A percent means a part of 100. For example, if you get 95% on a test, your mark was 95 out of 100. A percent can be changed to a fraction or decimal by simply dividing the percentage number by 100.

1. Changing % to Fractions

Divide by 100.

(i.e. put the % number over 100 and reduce if necessary)

$$93\% = \frac{93}{100}$$

$$50\% = \frac{50}{100} = \frac{1}{2}$$

$$24\% = \frac{24}{100} = \frac{6}{25}$$

If a decimal appears in the fraction, multiply the fraction by 10, 100, 1000 etc. to produce an equivalent fraction without decimals.

$$\begin{aligned} 26.3\% &= \frac{26.3}{100} \times \frac{10}{10} \\ &= \frac{263}{1000} \end{aligned}$$

$$\begin{aligned} 5.55\% &= \frac{5.55}{100} \times \frac{100}{100} \\ &= \frac{555}{10000} = \frac{111}{2000} \end{aligned}$$

2. Changing % to Decimals

Simply divide by 100. (i.e. move the decimal point 2 places to the left)

$$50\% = .50 \quad \text{or} \quad .5$$

$$9.23\% = .0923$$

$$4\% = .04$$

$$148\% = 1.48$$

B. CHANGING FRACTIONS / DECIMALS TO PERCENTS

1. Changing Fractions to Percent

If you get 17 out of 20 on a test, it is convenient to change this mark to a percentage.

This means changing $\frac{17}{20}$ to an equivalent fraction with 100 as denominator (i.e. $\frac{17}{20} = \frac{?}{100}$).

To change fractions to %, simply multiply the fraction by 100%.

$$\frac{17}{20} = \frac{17}{20} \times 100\% = \frac{1700}{20} = 85\%$$

$$\frac{1}{2} = \frac{1}{2} \times 100\% = 50\%$$

$$\frac{2}{3} = \frac{2}{3} \times 100\% = 66.\dot{6}\%$$

$$\frac{19}{40} = \frac{19}{40} \times 100\% = 47\frac{1}{2}\% \text{ or } 47.5\%$$

Note: The mathematical wording for changing a fraction ($\frac{17}{20}$) to a percent would normally be:

17 is what % (out) of 20?
or
What % is 17 (out) of 20?

The word “out” is usually not included.

e.g. 19 is what % of 75?

$$\frac{19}{75} = \frac{19}{75} \times 100\% = 25\frac{1}{3}\%$$

What % is 7 of 5?

$$\frac{7}{5} = \frac{7}{5} \times 100\% = 140\%$$

2. Changing Decimals to Percents

To change decimals to percents, simply multiply by 100% (i.e. move the decimal point 2 places to the right.)

$$\begin{array}{rclclcl} .29 & = & .29 & \times & 100\% & = & 29\% \\ .156 & = & .156 & \times & 100\% & = & 15.6\% \\ 1.3 & = & 1.3 & \times & 100\% & = & 130\% \end{array}$$

C. USING PERCENTS

When percents are used in calculations, they are first converted to either fractions or decimals. Usually it is more convenient to change % to decimals.

1. Multiplying With Percents

If a test mark was 50% and it was out of 40 total marks, what was the test score?

$$\begin{aligned}
 50\% &= \frac{\text{test score?}}{40 \text{ (total marks)}} \\
 50\% \times 40 &= .5 \times 40 = 20 \\
 \text{So } 50\% &= \frac{20 \text{ marks}}{40}
 \end{aligned}$$

50% (out) of 40 is what number?
What number is 50% (out) of 40?

To find the test score, or the part, we multiply the % by the total.

e.g. 85% of 25 is what number? $85\% \times 25 = .85 \times 25 = 21.25$

What number is 30% of 45.37? $30\% \times 45.37 = .3 \times 45.37 = 13.611$

2. Dividing with Percents

If a test mark was 50% and you received a score of 20 marks, what was the test out of?

$$\begin{aligned}
 50\% &= \frac{20 \text{ marks}}{\text{total?}} \\
 20 \div 50\% &= 20 \div .5 = 40 \\
 \text{or } 20 \div \frac{1}{2} &= 20 \times \frac{2}{1} = 40 \\
 \text{So, } 50\% &= \frac{20}{40} \text{ total marks}
 \end{aligned}$$

50% (out) of what number is 20?
20 is 50% (out) of what number?

To find the total marks, we divide by the %.

e.g. 40% of what number is 25? $25 \div 40\% = 25 \div .40 = 62.5$

18 is 75% of what number? $18 \div 75\% = 18 \div .75 = 24$

D. SUMMARY AND EXERCISE

1. Three types of Percent Problems

In summary, there are three things that we can do with percent. We will use the example on the right side of the page to summarize.

$$50\% = \frac{20 \text{ (part)}}{40 \text{ total}}$$

1. Finding % or what % of 40 is 20?

$$\frac{20}{40} = \frac{20}{40} \times 100\% = 50\%$$

2. Finding the Part or 50% of 40 is what number?

$$50\% \times 40 = .5 \times 40 = 20$$

3. Finding the total or 50% of what number is 20?

$$20 \div 50\% = 20 \div .5 = 40$$

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2. EXERCISE: PERCENT PROBLEMS

1. Change to Fractions

- | | | | |
|----------|--------|---------------------|----------|
| a) 97% | b) 82% | c) 150% | d) 45.3% |
| e) 9.25% | f) 40% | g) $5\frac{1}{2}\%$ | |

2. Change to Decimals

- | | | | |
|----------|----------|-------|-----------|
| a) 42% | b) 9.37% | c) 2% | d) 243.9% |
| e) 0.95% | | | |

3. Change to %

- | | | | |
|--------------------|--------------------|--------------------|-------------------|
| a) $\frac{19}{20}$ | b) $\frac{2}{3}$ | c) $\frac{18}{75}$ | d) $\frac{1}{12}$ |
| e) $\frac{5}{9}$ | f) $\frac{38}{40}$ | g) 0.865 | h) 2.37 |
| i) .0092 | j) $\frac{7}{4}$ | | |

4. Finding %

- a) What % of 72 is 18?
- b) 16 is what % of 80?
- c) What % of 30 is 18.5?

5. Finding the Part

- a) 40% of 18 is what number?
- b) What number is 16.5% of 30.2?
- c) 65% of 15 is what?

6. Finding the Total

- a) 40% of what number is 12?
- b) 18 is 55% of what number?
- c) 120 is 150% of what number?

7. Percent Problems Combined

- a) What % of 25 is 5?
- b) 70% of 15 is what number?
- c) 85 is 20% of what number?
- d) 90 is what % of 55?
- e) 30% of what number is 80?
- f) What number is 42% of 50?

ANSWERS

1. a) $\frac{97}{100}$ b) $\frac{41}{50}$ c) $1\frac{1}{2}$ d) $\frac{453}{1000}$ e) $\frac{37}{400}$ f) $\frac{2}{5}$ g) $\frac{11}{200}$
2. a) .42 b) .0937 c) .02 d) 2.439 e) .0095
3. a) 95% b) $66.\dot{6}\%$ or $66\frac{2}{3}\%$ c) 24% d) $8.\dot{3}\%$ e) $55.\dot{5}\%$ f) 95%
- g) 86.5% h) 237% i) .92% j) 175%
4. a) 25% b) 20% c) $61.\dot{6}\%$
5. a) 7.2 b) 4.983 c) 9.75
6. a) 30 b) $32.\overline{72}$ c) 80
7. a) 20% b) 10.5 c) 425 d) $163.\overline{63}\%$ e) $266.\dot{6}$ f) 21