Learning Enhancement Team

University of East Anglia

STUDENT SUPPORT SERVICE

Steps into Numeracy

Percentages

This study guide is designed to help you understand what percentages are and how to convert between percentages, fractions and decimals.

Introduction: What is a percentage?

The term **percentage** is frequently used in everyday and academic language and is given the symbol %. A clue to the meaning of a percentage lies in the word itself:

> *per* meaning 'divide by'
>
> *cent* meaning '100'

In other words the symbol % represents the mathematical operation of **dividing by 100**. Importantly **a percentage only has a meaning when applied to a given quantity**. For example it is common to see retail sales expressed as *20% off* [a given price] or restaurant bills with a 10% service charge [of the total bill]. Many newspaper reports discussing taxes, unemployment figures and the economy use percentage as a simplified means of conveying size, scale or value *with respect to a given figure*. Percentages are useful for representing increases and decreases in a given figure or quantity.

There are some specific percentages which have a special meaning: 100% represents the whole of something and 0% represents none of it. When statements which include percentages are used in complicated contexts your intuition may not be reliable and you should take care when drawing conclusions from such statements. For example when percentages are discussed you may hear figures which are over 100%: whether this is appropriate or not depends on the context. For example it is perfectly acceptable for a business person to state that profits have increased by 110%, however people who talk of giving 110% effort are showing a fundamental misunderstanding of percentages.

It is also worth remembering that, large percentages of very small numbers are still very small numbers and small percentages of very large numbers can still be large numbers.

Expressing percentages in different ways

A percentage can be thought of as so many parts out of 100 individual parts. You can think of taking a whole and dividing it into 100 equally sized pieces - each piece representing one percent of that whole. Recognising that the symbol % represents a short-hand for the mathematics "$\div 100$", allows you to express a percentage in different ways, either as a fraction or as a decimal number (see later in this guide for examples). It is useful if you are comfortable converting between the three representations: percentage, decimal and fraction. Practising these conversions will make working and calculating with percentages easier and more natural (see study guide: *Using Percentages*).

The use of percentages in statistics is common and you will often see data expressed as a percentage and/or a decimal number and/or a fraction which are used interchangeably as a matter of course. The main reason for this is that different representations of percentages suit different situations. Take an event which occurs 34% of the time, it has a probability of happening of 0.34 and can also be thought of as happening 34 times out of 100 on average - the best way of communicating this statistic is dependent on the context in which it appears and the perceived audience.

Percentages expressed as fractions

A common way of expressing a percentage is as a fraction, if you are unfamiliar with the language of fractions you should read the study guide: *Types of Fractions* before carrying on. **The conversion from percentage to fraction is achieved by replacing the % sign with $\div 100$ and rewriting this mathematics as the corresponding fraction.** It may also be beneficial to express the resulting fraction in its simplest form (see study guide: *Cancelling Down Fractions*).

Example: What is 19% expressed as a fraction?

To find the answer, replace the percentage sign in 19% with $\div 100$ to get $19 \div 100$ and write the corresponding fraction:

$$19\% = 19 \div 100 = \frac{19}{100}$$

This fraction cannot be cancelled down any further. You should notice that the percentage sign % is not present at the end of the calculation as it has been replaced with $\div 100$, so it would be incorrect to include it. It is important to realise that the equals signs, =, tell you that 19%, $19 \div 100$ and $\frac{19}{100}$ are exactly equal to each other.

Example: Express 20% as a fraction in its simplest form.

To find the answer, replace the percentage sign with $\div 100$ and write the corresponding fraction:

$$20\% = 20 \div 100 = \frac{20}{100} = \frac{1}{5}$$

Here the fraction has been cancelled down by recognising that the numerator and denominator have a common factor of 20. This more simple form should help you see that 20% is the same as 1 out of 5.

Percentages expressed as decimal numbers

Another common way of expressing a percentage is as a decimal number. You will often see percentages expressed as decimal numbers in the description of probabilities in statistics. For example, **a certain event is mathematically described as 100% likely or of having a probability of 1** similarly **an impossible event is mathematically described as 0% likely or of having a probability of 0**.

It is also common for the decimal form of a percentage to be used in calculations. As with the conversion to a fraction, the conversion of a percentage to decimal number also involves replacing the % sign with $\div 100$. You can perform the division by 100 by either moving the decimal place two places to the left or by moving the number two places to the right.

Example: Express 15% as a decimal number.

To do this, first replace the % sign with $\div 100$ to get $15 \div 100$ and then perform the division. Mathematically this is written as:

$$15\% = 15 \div 100 = 0.15$$

Example: Express 20% as a decimal number.

Again replace % sign with $\div 100$ to get $20 \div 100$ and then perform the division to get:

$$20\% = 20 \div 100 = 0.2$$

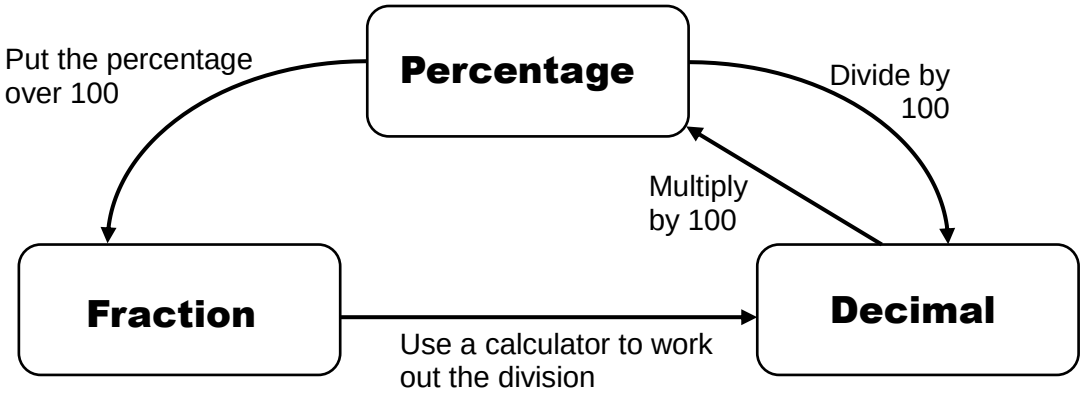
You now have three representations for 20%: 20% itself, $1/5$ and 0.2 all of which mean the same thing and can be used interchangeably to suit the context.

You may already know fractional and decimal representations of common percentages such as 50% (half) and 75% (three-quarters). The table below gives some common

percentages which you may find useful to learn.

Percentage	100%	75%	50%	25%	20%	10%	1%
Fraction	$\frac{1}{1}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{10}$	$\frac{1}{100}$
Decimal	1	0.75	0.5	0.25	0.2	0.1	0.01

You may also find the following diagram useful to help you move between the different representations of percentages.



Want to know more?

If you have any further questions about this topic you can make an appointment to see a **Learning Enhancement Tutor** in the **Student Support Service**, as well as speaking to your lecturer or adviser.

✆ Call: 01603 592761
💻 Ask: ask.let@uea.ac.uk
🖱 Click: https://portal.uea.ac.uk/student-support-service/learning-enhancement

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