Why do we have different types of average?

- You'll hear the phrase "on average" used a lot, from politicians talking about the economy to sports analysts to shops talking about their "average customer"
- However not all data is numerical (eg the party people voted for in the last election) and even when it is numerical, some of the data may lead to misleading results
- This is why we have **3 types of average**

What do I need to know?

1. Mean

- This is what is usually meant by "average" – it's like an ideal world where everybody has the same, everything is shared out equally
- It is the **TOTAL** of all the values **DIVIDED** by the **NUMBER OF VALUES**
  Find the mean of 4, 6, 7, 9

$4 + 6 + 7 + 9 = 26$

$26 \div 4 = 6.5$

Mean = 6.5

- Problems with the mean occur when there are one or two unusually high (or low) values in the data (**outliers**) which can make the mean too high (or too low) to reflect any patterns in the data

2. Median

- This is similar to the word medium, which can mean in the middle
- So the median is the middle value – but beware, the data has to be arranged into numerical order first
  Find the median of 20, 43, 56, 78, 92, 56, 48

In order: 20, 43, 48, 56, 56, 78, 92

To find the median cross out numbers from either end until you meet in the middle (cross them out lightly so you can still read them)
This may not be necessary with small lists but is more important when working with lots of data

~~20~~, 43, 48, 56, 56, 78, ~~92~~

~~20~~, ~~43~~, 48, 56, 56, ~~78~~, ~~92~~

~~20,~~ 43, 48, 56, ~~56,~~ ~~78,~~ ~~92~~

Median = 56

- We would use the median instead of the mean if we did not want extreme values (outliers) affecting our data
- If we have an even number of values we would get two values in the middle
- In these cases we take the half-way point between these two values. This is usually obvious but, if not, we **add the two middle values and divide by 2** (this is the same as finding the mean of the middle two values)
  20, 43, 46, 48, 56, 56, 78, 92 (as above with an extra 46 in there!)

When crossed out we get

~~20,~~ ~~43,~~ ~~46,~~ 48, 56, ~~56,~~ ~~78,~~ ~~92~~

So the two middle values are 48 and 56.

Halfway is 52 but if you can't spot that you can work it out …

48 + 56 = 104

104 ÷ 2 =52

Median = 52

3. Mode

- Not all data is numerical and that is where we use mode
- **MO**de means the **M**ost **O**ften
- So it is often used for things like "favourite …" or "… sold the most" or "… were the most popular"
- Mode is sometimes referred to as **modal** – so you may see phrases like "**modal value**" – but they still mean the mode
  12 people were asked about their favourite crisp flavour. The responses are below:

Salt and vinegar, Prawn cocktail, Ready salted,

Ready salted, Salt and vinegar, Salt and vinegar,

Smokey bacon, Ready salted, Salt and vinegar

Salt and vinegar, Cheese and onion, Ready salted

With only a few pieces of data it is quite quick and easy to see here that Salt and vinegar is chosen the most
With more data it may be wise to create a tally chart or similar to help count the number of each flavour
Mode is Salt and vinegar

- Be aware that the mode can apply to numerical data as well (from the data used in the example for the median the mode would have been 56)
- Sometimes if no value/data occurs more often than others we say there is no mode

- If two values occur the most we may say there are two modes (**bi-modal**) – whether it is appropriate to do this will depend on what the data is about

(a)

Mean:

12 + 10 + 15 + 14 + 17 + 11 + 12 + 13 + 9 + 21 + 14 + 20 + 19 + 16 + 23 = 226

> 1 - You could do the adding up in bits by adding the rows (or columns) as above in brackets

226 ÷ 15 = 15.066...

> Do the mean in two stages to avoid confusion around using brackets on your calculator and to show all stages of working

Mean = 15.1 (to one decimal place)

> Round final answer to something sensible if not asked to

Median:

~~9~~ ~~10~~ ~~11~~ ~~12~~ ~~12~~ ~~13~~ ~~14~~ 14 ~~15~~ ~~16~~ ~~17~~ ~~19~~ ~~20~~ ~~21~~ ~~23~~

Median = 14

> 2 - Make sure you write them in order and do not miss any out, it's a good idea to lightly cross them off the original list

(b)

Two values occur more than any others, 12 and 14

> 3 - Notice how this is easy to see once the data is in order from finding the median in part (a)

So we can say there are two modes – 12 and 14, or, we could say that there is no mode

1. Mean

The following table gives the daily income of ten workers in a factory. Find the arithmetic mean.

Workers	A	B	C	D	E	F	G	H	I	J
Daily Income (in ₹)	120	150	180	200	250	300	220	350	370	260

Answer:

Workers	Daily Income (in ₹) (X)
A	120
B	150
C	180
D	200
E	250
F	300
G	220
H	350
I	370
J	260
Total	ΣX=2400

N = 10

$$X = \Sigma\frac{X}{n} = \frac{2400}{10} = 240$$

Arithmetic Mean = ₹ 240