Averages from lists

The Mean

A measure of average to find the central tendency… a typical value that represents the data

24, 8, 4, 11, 8,

Find the sum of the data (add the values)

55

Divide the overall total by how many pieces of data you have

55 ÷ 5

Mean = 11

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8,

This can still be easier if it the data is ordered first

Mode = 8

The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8,

Put the data in order 4, 8, 8, 11, 24

Find the value in the middle 4, 8, 8, 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

For Grouped Data

The modal group – which group has the highest frequency

The range

To find the range you subtract the smallest value from the largest

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency

Here are the number of runs scored last month by Lucy and James in cricket matches

Lucy: 45, 32, 37, 41, 48, 35

James: 60, 90, 41, 23, 14, 23

Lucy

Mean: 396 (1dp), **Median**: 38 **Mode**: no mode, **Range**: 16

James

Mean: 418 (1dp), **Median**: 32, **Mode**: 23, **Range**: 76

James has two extreme values that have a big impact on the range

"James is less consistent that Lucy because his scores have a greater range. Lucy performed better on average because her scores have a similar mean and a higher median"

Choosing the appropriate average

The average should be a representative of the data set – so it should be compared to the set as a whole - to check if it is an appropriate average

Here are the weekly wages of a small firm

£240	£240	£240	£240	£240
£260	£260	£300	£350	£700

Which average best represents the weekly wage?

The Mean = £307

The Median = £250

The Mode = £240

Put the data back into context

Mean/Median – too high (most of this company earn £240)

Mode is the best average that represents this wage

It is likely that the salaries above £240 are more senior staff members – their salary doesn't represent the average weekly wage of the majority of employers

Reverse Averages

Alison has a set of cards

3	9	3	5	5	7	6	1

Example 1

She needs to choose 4 cards from the list with a median of 4

The median is the middle number so the two middle cards must add together to give 8 because 8 ÷ 2 = 4, the middle numbers must be 3 and 5

	3	5	

The smallest number must be less than 3 because the set of numbers has no mode (if you chose 3 the mode would be 3) so the number must be 1. The biggest number must be a number bigger than 5 (if you chose 5 the mode would be 5) so you could chose 6, 7 or 9

Example 2

Alison has the following 4 cards. She needs to chose another card so the mean of the set is 6 and the median is 7

1	7	9	6

The middle number must be 7 because the median is 7.

		7		

The mean is found by adding the numbers together then dividing by the number of values. If we multiply the mean by the number of values we will get the total of all the values. 5 x 6 = 30. If we add the total of the other cards together and take this away from 30 we will find the number on the last card and the order of the other cards. 1 + 7 + 9 + 6 = 23, 30 – 23 = 7. The last card must be 7

1	6	7	7	9

Averages from a discrete (ungrouped) table

Mode

Number of cars	Frequency
0	4
1	5
2	3
3	1

The mode is the most common value so it is the number of cars with biggest frequency. The biggest frequency the 5 so the mode must be 1 car

Median

Number of cars	Frequency	Cumulative Frequency
0	4	4
1	5	4 + 5 = 9
2	3	9 + 3 = 12
3	1	12 + 1 = 13
	Total = 13	

$$\text{Median} = \frac{number\ of\ terms + 1}{2}$$

$$\text{Median} = \frac{13+1}{2} = 7^{th}\ \text{term}$$

The 7^{th} term is 1 car

Mean

Number of people	Frequency	Number × Frequency
1	5	1 × 5 = 5
2	6	2 × 6 = 12
3	3	3 × 3 = 9
4	2	4 × 2 = 8
	n = 16	Total = 34

$$\text{Mean} = \frac{total\ of\ values}{number\ of\ values} = \frac{34}{16} = 2.125$$

Averages from a grouped table

Mode and median

The mode and median of a grouped table are calculated in exactly the same way as a discrete table but the answers will be in a group (e.g. 0 – 9 or $30 < x \leq 35$) rather than a number

Estimate for the Mean

Marks scored	Frequency	Mid-point	Frequency × Mid-point
0 - 9	3	$\frac{0+9}{2} = 4.5$	3 × 4.5 = 13.5
10 - 19	5	$\frac{10+19}{2} = 14.5$	5 × 14.5 = 72.5
20 - 29	8	$\frac{20+29}{2} = 24.5$	8 × 24.5 = 196
30 - 39	4	$\frac{30+39}{2} = 34.5$	4 × 34.5 = 138
	n = 20		Total = 420

In a grouped table we do not know all of the values so we have to take an educated guess as to what they might be. The best way to do this is to take the middle value or mid-point of each group (found by adding the top and bottom value together and dividing by two, if the mid-point isn't easy to spot) and using this as our value. This is also why it is an estimate for the mean because we do not have specific values. Once we have you mid-point we can calculate the estimate for the mean in the same we as we did for the discrete table.

$$\text{Mean} = \frac{total\ of\ values}{number\ of\ values} = \frac{420}{20} = 21$$