

Finding a Central Value

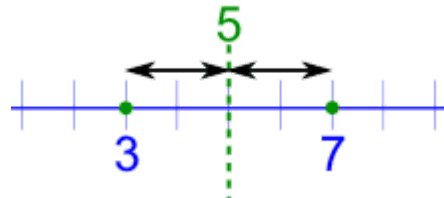
When you have two or more numbers it is nice to find a value for the "center".

2 Numbers

With just 2 numbers the answer is easy: go half-way between.

Example: what is the central value for 3 and 7?

Answer: Half-way between, which is 5.



You can calculate it by adding 3 and 7 and then dividing the result by 2:

$$(3+7) / 2 = 10/2 = 5$$

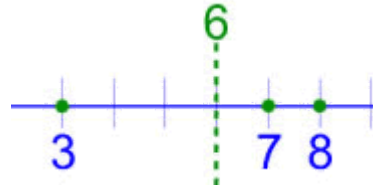
3 or More Numbers

You can use the same idea when you have 3 or more numbers:

Example: what is the central value of 3, 7 and 8?

Answer: You calculate it by adding 3, 7 and 8 and then dividing the results by 3 (because there are 3 numbers):

$$(3+7+8) / 3 = 18/3 = 6$$



Notice that we divide by 3 because we have 3 numbers ... very important!

The Mean

So far we have been calculating the Mean (or the Average):

Mean: Add up the numbers and divide by how many numbers.

But sometimes the Mean can let you down:

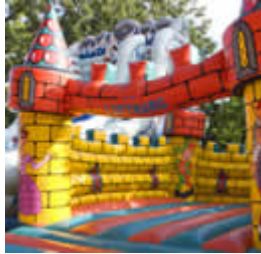
Example: Birthday Activities

Uncle Bob wants to know the average age at the party, to choose an activity.

There will be 6 kids aged 13, and also 5 babies aged 1.

Add up all the ages, and divide by 11 (because there are 11 numbers):

$$(13+13+13+13+13+13+1+1+1+1+1) / 11 = 7.5...$$



The mean age is about $7\frac{1}{2}$, so he gets a **Jumping Castle!**

The 13 year olds are embarrassed,
and the 1 year olds can't jump!

The Mean was **accurate**, but in this case it was **not useful**.

The Median

But you could also use the **Median**: simply list all numbers in order and choose the middle one:

Example: Birthday Activities (continued)

List the ages in order:

1, 1, 1, 1, 1, 13, 13, 13, 13, 13, 13

Choose the middle number:

1, 1, 1, 1, 1, **13**, 13, 13, 13, 13, 13

The Median age is **13** ... so let's have a **Disco!**

Sometimes there are **two** middle numbers. Just average them:

Example: What is the Median of 3, 4, 7, 9, 12, 15

There are two numbers in the middle:

3, 4, 7, 9, 12, 15

So we average them:

$$(7+9) / 2 = 16/2 = 8$$

The Median is **8**

The Mode

The Mode is the value that occurs most often:

Example: Birthday Activities (continued)

Group the numbers so we can count them:

1, 1, 1, 1, 1, 13, 13, 13, 13, 13, 13

"13" occurs 6 times, "1" occurs only 5 times, so the mode is **13**.

How to remember? Think "mode is most"

But Mode can be tricky, there can sometimes be more than one Mode.

Example: What is the Mode of 3, 4, 4, 5, 6, 6, 7

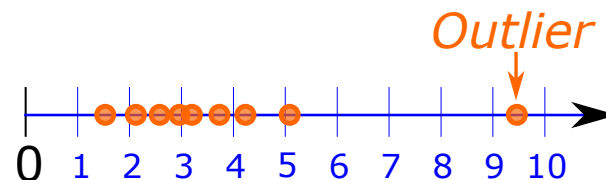
Well ... 4 occurs twice but 6 **also** occurs twice.

So **both 4 and 6** are modes.

When there are two modes it is called "bimodal", when there are three or more modes we call it "multimodal".

Outliers

Outliers are values that "**lie outside**" the other values.



They can change the mean a lot, so we can either not use them (and say so) or use the median or mode instead.

Example: 3, 4, 4, 5 and 104

Mean: Add them up, and divide by 5 (as there are 5 numbers):

$$(3+4+4+5+104) / 5 = \mathbf{24}$$

24 does not represent those numbers well at all!

Without the 104 the mean is:

$$(3+4+4+5) / 4 = \mathbf{4}$$

But please tell people you are not including the outlier.

Median: They are in order, so just choose the middle number, which is **4**:

3, 4, **4**, 5, 104

Mode: 4 occurs most often, so the Mode is **4**

3, **4, 4**, 5, 104

Conclusion

There are other ways of measuring central values, but **Mean, Median and Mode** are the most common.

Use the one that best suits your data. Or better still, use all three!

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