Linear Scaling of Numerical Measures

Linear Scaling is used to calculate the mean and variance or standard deviation with less error.

It also allows us to manipulate the mean and standard deviation after they have been calculated such as for conversion equations.

The Mean

The mean is a measure of 'central tendency' or 'location'

It tells us the position of the data values on the number line

This means that if we 'scale' the data in any way we need to 'scale' the mean in the same way

Hence ...

- if we add a constant to each data value, we add the same constant to the mean
- if we subtract a constant from each data value, we subtract the same constant from the mean
- if we multiply each data value by a constant, we multiply the mean by the same constant
- if we divide each data value by a constant, we divide the mean by the same constant

As the mean tells us the position of the data on the number scale, this moves up or down in the same ratio as the data values

The Standard Deviation

The standard deviation is a measure of 'dispersion' or 'spread'

It tells us how spread out the data is around the mean point

This means that no matter how far up or down the number line we move the data, if they are still the same distance from each number, the spread of the data (and hence the standard deviation) will not change

Hence ...

- if we add a constant to each data value, we DO NOT CHANGE the standard deviation
- if we subtract a constant from each data value, we DO NOT CHANGE the standard deviation

As the standard deviation tells us the spread of the data, this does not change if all the data values move up or down the scale the same amount

However;

When we multiply or divide values in a data set by a constant, the distance between the value changes and therefore the spread of these data values changes

Hence ...

- if we multiply each data value by a constant, we multiply the **VARIANCE** by the constant^2
- if we divide each data value by a constant, we divide the **VARIANCE** by the constant^2

It is important to remember that when scaling numerical measures in this way we can only manipulate the **VARIANCE** and so to manipulate the standard deviation we must first convert it into the variance, manipulate and then convert back to the standard deviation