Standard Deviation

The standard deviation is a number that tells us how closely grouped a list of numbers is.

If the standard deviation is small, the numbers are close together.

If the standard deviation is large, the numbers are not close together.

There are several formulae for the standard deviation, but they are all different versions of the same formula. They are

$s=\sqrt{\frac{\sum (x-m)^2}{n}}$ or $s=\sqrt{\frac{\sum x^2}{n}-m^2}$ or

$$s=\sqrt{\frac{\sum x^2}{n}-(\frac{\sum x^2}{n})^2}$$

.

In the formulae above m is the mean and n is the number of numbers in the list.

To find the standard deviation of the list 2, 4, 7, 1, 3

Suppose we use the second formula above.

$$m=\frac{2+4+7+1+3}{5}=3.4$$

$$\sum x^2=2^2+4^2+7^2+1^2+3^3=79$$

Then $s=\sqrt{\frac{79}{5}-3.4^2}=\sqrt{4.24}=2.059$ to 3 decimal places.

It is important to realise that the standard deviation is only a measure of how spread out a list of numbers is. The list does not become any more spread out if every number in the list is increased by the same amount. Suppose that 3 is added to every number in the list used above. We have the new list 5, 7, 10, 4, 7

$$m=\frac{5+7+10+4+6}{5}=6.4$$

$$\sum x^2=5^2+7^2+10^2+4^2+6^2=226$$

Then $s=\sqrt{\frac{226}{5}-6.4^2}=\sqrt{4.24}=2.059$ to 3 dp as before.