



# The Mean, Variance and Standard Deviation of Scores

## Introduction:

The mean along with either the variance or standard deviation are very important measures of the centre of and the variation within a set of scores.

## This sheet will teach you to:

- Understand what the mean is measuring and calculate a mean
- Understand what a variance is measuring and calculate a variance
- Understand how to find a standard deviation from the variance

## 1. The mean

Consider a sample of ten scores:

$$X = 6 \ 3 \ 4 \ 2 \ 6 \ 5 \ 1 \ 2 \ 5 \ 6$$

The mean of the scores represents the arithmetic average of these scores found by adding the scores together and dividing by the number of scores.

$$M = \frac{\sum X}{n} = \frac{6+3+4+2+6+5+1+2+5+6}{10}$$

$$M = \frac{40}{10}$$

$$M = 40 \div 10 = 4$$

### Symbols

- M is used here to represent a sample mean
- n is used to represent the number of scores
- $\Sigma X$  instructs us to add together the X scores
- $s^2$  is used here to represent a sample variance
- s is used here to represent a sample standard deviation.

The mean is the balance point in the scores. If you think in terms of a set of scales, there is an equal weight of scores smaller than the mean as there is bigger than the mean



## 2. The variance

The variance of the scores is a measure of how widely spread the data is from the mean. The sum of squares ( $SS_x$ ) is used in this measure of the spread.

The Sum of Squares worksheet found  $SS_x$  of these scores to be 32

A reminder:

$$SS_x = \sum X^2 - \frac{(\sum X)^2}{n}$$

The variance is now found by dividing the sum of squares by the number of scores less 1 ( $n-1$ ).

$$s^2 = \frac{SS_x}{n-1} = \frac{32}{10-1} = \frac{32}{9} = 3.56$$

## 3. The standard deviation

The standard deviation is the square root of the variance

$$s = \sqrt{\text{variance}} = \sqrt{3.56} = 1.89$$

(this square root has been rounded to 2 decimal places)

When working by hand the variance is always found before the standard deviation. The statistics functions of a scientific calculator or a software program such as SPSS will however calculate the standard deviation alone if you choose. A mean and a standard deviation are always reported together in social research.

## 4. Exercises to try

Find the mean, variance and standard deviation for the scores

1. 10, 15, 16, 18, 20, 22
2. 102, 110, 132, 145

## 5. Solutions

The sum of squares for these two data sets were calculated in the Sum of Squares worksheet.

1.  $\Sigma X = 101$ ,  $SS_x = 88.83$ ,  $n = 6$  so  $n-1 = 5$

Mean =  $\Sigma X/n = 101 \div 6 = 16.83$

Variance =  $SS_x/n-1 = 88.83 \div 5 = 17.77$

Standard deviation =  $\sqrt{17.77} = 4.22$

2.  $\Sigma X = 489$ ,  $SS_x = 1172.75$ ,  $n = 4$  so  $n-1 = 3$

Mean =  $\Sigma X/n = 489 \div 4 = 122.25$

Variance =  $SS_x/n-1 = 1172.75 \div 3 = 390.92$

Standard deviation =  $\sqrt{390.92} = 19.77$

## 6. For more information

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