

*Data and Statistics - Lesson 1***Standard Deviation**LI

- Work out the Standard Deviation of a list of numbers.
- Know what the SD represents.
- Compare data sets qualitatively.

SC

- Standard Deviation formula.

The **Standard Deviation** represents how **spread out** data is. Big standard deviation means numbers are more spread out.

Standard Deviation Formula :

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

s = standard deviation

x = a data point

n = number of data points \bar{x} = average of all data points

\sum means sum (i.e. add)

Example 1

Calculate the standard deviation to (2 d.p.) of :

1, 3, 3, 4, 5, 5, 6, 7, 7, 7

$$n = 10$$

$$\bar{x} = \frac{48}{10} = 4.8$$

x	$x - \bar{x}$	$(x - \bar{x})^2$
1	-3.8	14.44
3	-1.8	3.24
3	-1.8	3.24
4	-0.8	0.64
5	0.2	0.04
5	0.2	0.04
6	1.2	1.44
7	2.2	4.84
7	2.2	4.84
7	2.2	4.84
		37.6

$$\sum (x - \bar{x})^2$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

$$s = \sqrt{\frac{37.6}{(10 - 1)}}$$

$$s = \sqrt{4.17 \dots}$$

$$s = 2.04$$

Standard deviation is often used to compare data sets

Example 2

Maximum daytime temperatures were recorded in Forres on seven consecutive days in April as :

7, 9, 12, 10, 14, 12, 6

Calculate the mean and standard deviation of these temperatures (2 d. p. each).

$$\bar{x} = \frac{70}{7}$$

$$\bar{x} = 10^{\circ}\text{C}$$

x	$x - \bar{x}$	$(x - \bar{x})^2$
7	-3	9
9	-1	1
12	2	4
10	0	0
14	4	16
12	2	4
6	-4	16
		50

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

$$s = \sqrt{\frac{50}{(7 - 1)}}$$

$$s = \sqrt{8.33 \dots}$$

$$s = 2.89^{\circ}\text{C}$$

The maximum daytime temperature was recorded in Mahon on the same seven consecutive days. The mean of these temperatures was 17°C and the standard deviation was 1.68.

Make two valid comparisons between the maximum daily temperatures in Forres and Mahon on these days.

$$\bar{x}_F = 10^{\circ}\text{C} \quad \bar{x}_M = 17^{\circ}\text{C}$$

On average, the temperatures in Mahon were higher, as $\bar{x}_M > \bar{x}_F$.

$$s_F = 2.89^{\circ}\text{C} \quad s_M = 1.68^{\circ}\text{C}$$

The Mahon temperatures were less spread out (more consistent) than the Forres temperatures, as $s_M < s_F$.

Questions

- 1** Find the mean and standard deviation of:
- a** 4 6 6 9 10 **b** 12 17 20 21 25 31
- 2** The figures below show the wingspan, in cm, of a sample of five buzzards captured in Norfolk:
- 121 152 134 142 131
- Calculate the mean and standard deviation for these measurements, giving your answers correct to 1 decimal place.

- 3 The fat content (per 100 g) of different soups in a supermarket were recorded as shown in the table.

Soup	Tomato	Leek	Cream of Chicken	Chicken Broth	Crab	Oxtail
Fat per 100 g	2.6g	1.7g	2.5g	1.1g	1.5g	2.6g

Calculate the mean and standard deviation of the fat content in soup based on this sample.

- 4 a During the monsoon season in Mumbai (India) the average rainfall (in mm) is as shown in the table.

Month	June	July	August	September
Rainfall in mm	495	531	737	349

Calculate the mean and standard deviation for the rainfall, giving your answers correct to 1 decimal place.

- b** During the same monsoon season in New Delhi (also in India) the average rainfall (in mm) is as follows.

Month	June	July	August	September
Rainfall in mm	97	201	190	136

Calculate the mean and standard deviation for the rainfall giving your answers correct to 1 decimal place.

- c Using your answers to **a** and **b** above, compare the average rainfall of the two cities and make two valid comparisons.
- 6 A company claims that there are 60 matches in each box of matches.
- a Find the mean and standard deviation of this sample of boxes correct to 1 decimal place:
- 61 62 59 59 58 60 61
- b For the company's claim to be valid, the Advertising Standards Agency specifies that the mean of a sample must be between 59 and 61, and the standard deviation of a sample should be less than 2. Based on this sample, is the company's claim valid?

Answers

- 1 a mean = 7, sd = 2.45
 b mean = 21, sd = 6.54
- 2 mean = 136, sd = 11.7
- 3 mean = 2, sd = 0.65
- 4 a mean = 528, sd = 160.0
 b mean = 156, sd = 48.5
 c Less rainfall and less variance in
 rainfall in New Delhi than Mumbai
- 6 a mean = 60, sd = $\sqrt{2}$
 b Their claim is valid