

# S1-2 Data Summary

- mean, median, mode and range

[Summary](#) [Learn](#) [Solve](#) [Revise](#) [Answers](#)

---

---

## Summary

---

---

A statistic is a number which in some way summarises a set of data. In this module you will learn about four statistics: the mean, median, mode and range.

The mean is the sum of the numbers divided by the number of numbers.

The median is the middle number if the numbers are arranged in ascending order, or the mean of the two middle numbers if there are an even number of numbers.

The mode is the number which occurs most often.

The range is the difference between the highest and lowest numbers.

---

---

## Learn

---

---

Suppose we collected data on the amount of pocket money per month received by 11-year olds and got the following (in dollars):

28, 20, 15, 20, 16, 30, 15, 24, 18, 16, 30, 40, 10, 15



We can look at that and make a judgment about what is a typical amount. It would be something like \$20. The data are clustered around 20 with about as many below it as above. We certainly wouldn't say that \$40 was a typical amount, nor \$5.

Mathematicians use three different ways to calculate what is a typical value from a collection of data. The results of these calculations are called **statistics**.

## Mean

The most commonly used statistic is the **mean**. The mean is often called the average. The mean is what each would get if all the 11-year-olds in the sample put their pocket money together and shared it equally. We can calculate the mean by adding up all the numbers, then dividing by how many people in the sample.

Add them up:

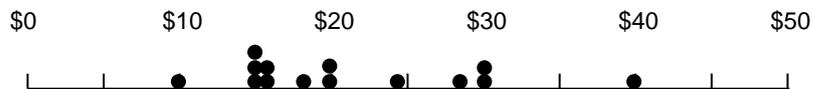
$$28 + 20 + 15 + 20 + 16 + 30 + 15 + 24 + 18 + 16 + 30 + 40 + 10 + 15 = 297$$

There are 14 numbers altogether, so we divide by 14.

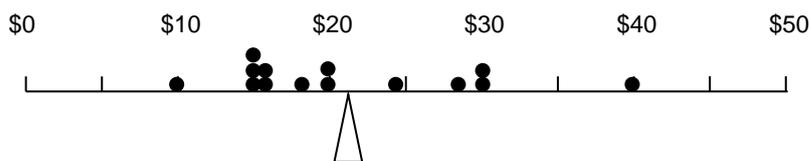
$$297 \div 14 = 21.21$$

So the mean pocket money is \$21.21.

Another way of thinking about the mean is to imagine putting all the numbers on a number line like this:



Then imagine that they are all people of equal weight on a see-saw. The place where it would balance is the mean.



## Median

The next-most-commonly used statistic is the **median**. To find the median we put all the data in numerical order and find the one in the middle. The value of that one is the median.

So, for example to find the median of 6, 4, 7, we put the numbers in numerical order, giving 4, 6, 7. 6 is in the middle so 6 is the median.

$$\begin{array}{ccc} 6 & 4 & 7 \\ 4 & 6 & 7 \\ & \uparrow & \\ & \text{median} = 6 & \end{array}$$

If there are an even number of data, there won't be a middle one. For instance, suppose the data is 7, 6, 4, 11. When we put these in numerical order we get: 4, 6, 7, 11. We see there are two middle numbers: 6 and 7.

7 6 4 11  
4 6 7 11  
↑  
**median = 6.5**

The median is the mean of these two numbers or the number half way between them. In this case the median is 6.5. If the two middle numbers are the same, as in 4, 7, 8, 8, 12, 14, then the median is the same as the middle two numbers. In this case it is 8.

If we look at the pocket-money numbers on the see-saw above, we see that the middle two numbers are 18 and 20. So the median is 19.

## Mode

The third statistic is the **mode**. The mode is the value which occurs most often. On the pocket-money see-saw we can see that \$15 is the most common amount of pocket money (3 people got that). Therefore \$15 is the mode.

If our data set looked like this: 4, 5, 5, 5, 6, 6, 7, 8, 8, 8, 9, 9, 10, 11, then we would see that 5 and 8 both occur three times. Then we would say that there are two modes and that the data set is bi-modal.

If more than two numbers tie for most common, we don't generally say that there are 3 or 4 modes; we say that there is no mode. If all numbers occur the same number of times, we would certainly say that there is no mode.

You have to remember which is which of mean, median and mode. One way to remember is like this.

The **MO**de is the number that occurs the **MO**st often

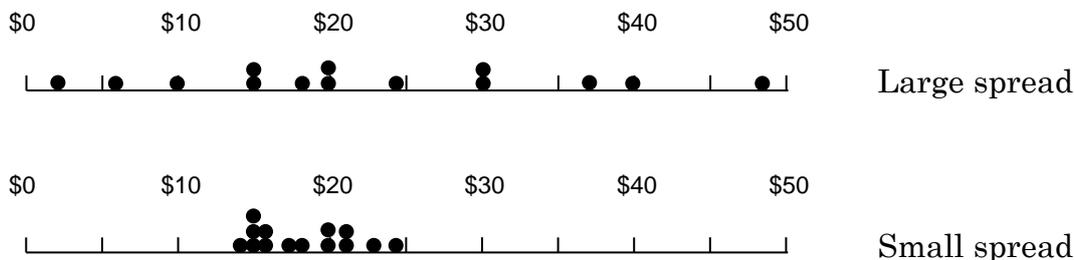
The **MEE**dian is the number in the **MEE**dle

The Mean is the other one

The mean, median and mode are sometimes called **measures of central tendency**. This is because they are measures of where the centre of the data tends to be if placed along a number line. The last statistic, range, is not a measure of central tendency. It is rather a measure of spread – of how spread out the data are along the number line.

## Range

The **range** is a measure of spread – i.e. of how varied the data are or how spread out they are along the number line.



The range is simply the difference between the highest value and the lowest value. To calculate the range, simply find the highest value, then subtract the lowest value from it.

The range in the top example above is  $48 - 2 = 46$ .

The range in the bottom example is  $24 - 14 = 10$ .

$$\text{Range} = \text{Highest} - \text{Lowest}$$

## Practice

Q1 These are the masses (in kg) of the cats staying at the Sourpuss Cats' Home: 2.4, 4.0, 3.3, 3.8, 2.6, 3.2, 3.2, 6.7, 3.5, 2.9

- Find:
- (a) the mean mass
  - (b) the median mass
  - (c) the mode of the masses
  - (d) the range of the masses

Q2 These are the numbers of legs on three spiders found behind the toilet door: 8, 5, 8

- Find:
- (a) the mean number
  - (b) the median number
  - (c) the mode of the numbers

(d) the range of the numbers

- Q3 The following are 6 students' scores on a maths test: 5, 8, 5, 7, 11, 0  
Find: (a) the mean score  
(b) the median score  
(c) the mode of the scores  
(d) the range of the scores
- Q4 The following are 6 students' scores on an English test: 2, 4, 2, 7, 7, 5  
Find: (a) the mean score  
(b) the median score  
(c) the modal score  
(d) the range of the scores
- Q5 The following are 7 students' scores on a pencil sharpening test:  
21, 30, 34, 27, 3, 31, 22  
Find: (a) the mean score  
(b) the median score  
(c) the modal score  
(d) the range of the scores
- Q6 The mean of five numbers is 18. What is the sum of the five numbers?
- Q7 The ages of Lisa and Gary's children add up to 91 and their mean is 13. How many children do they have?
- Q8 Lisa's six dogs have an average mass of 9 kg. The masses of five of them are: 12 kg, 5 kg, 8 kg, 10 kg and 5 kg. What is the mass of the sixth dog?

## Finding Statistics with a Calculator

Most scientific and graphics calculators will calculate statistics including the mean, median and mode. The median is often called Q2 (second quartile) (you will see why in Module S4-1). Most don't give the range directly, but will give the lowest and highest values (often called MIN and MAX) and the difference between these gives the range.

The method for entering data into the calculator and producing the statistics varies from calculator to calculator, so cannot be detailed here. Use of a bit of guess and check or the manual will usually lead to working it out. Failing that, you can Google it or ask someone who might know, like your teacher.

If you would like some practice using a calculator to find statistics, redo some of the practice questions above.



---

---

## Solve

---

---

- Q51 There are 3 boys and 3 girls in a volleyball team. The average height of the team is 176 cm. If the average height of the boys is 180 cm, what is the average height of the girls?
- Q52 The mean of three numbers is 8, the median is 10 and the range is 8. What are the three numbers?
- Q53 The 7 girls in a netball team have a mean height of 173 cm. One girl who is 169 cm tall is replaced by a new player who is 183 cm tall. What is the new mean height of the team?
- Q54 Five numbers have a median of 7, a mode of 8, a mean of 6 and a range of 5. What are the numbers?
- Q55 Three dragons have a mean weight of 132 kg and a median weight of 12 kg. What is the greatest possible weight for the heaviest one?
- Q56 Vera moved from Queensland to New South Wales and in doing so, increased the mean IQ of both states. How could this happen?

---

---

## Revise

---

---

### Revision Set 1

- Q61 These are the IQs of the eight members of the Theodore Thugs Netball Team:  
87, 59, 72, 94, 60, 59, 113, 89
- Find: (a) the mean IQ  
(b) the median IQ  
(c) the modal IQ  
(d) the range of the IQs

### Revision Set 2

- Q71 These are the temperatures on the first 10 days in February:  
28, 29, 32, 35, 36, 26, 30, 29, 30, 25
- Find: (a) the mean temperature  
(b) the median temperature  
(c) the modal temperature  
(d) the range of the temperatures

## Revision Set 3

Q81 These are the numbers of flies caught by seven venus fly traps:  
2, 6, 0, 3, 1, 11, 4

- Find: (a) the mean  
(b) the median  
(c) the mode  
(d) the range

---

---

### Answers

---

---

- |     |  |               |               |                   |            |
|-----|--|---------------|---------------|-------------------|------------|
| Q1  | (a) 3.56 kg  | (b) 3.25 kg   | (c) 3.2 kg    | (d) 4.1 kg        |            |
| Q2  | (a) 7  | (b) 8         | (c) 8         | (d) 3             |            |
| Q3  | (a) 6  | (b) 6         | (c) 5         | (d) 11            |            |
| Q4  | (a) 4.5  | (b) 4.5       | (c) 2 and 7   | (d) 5             |            |
| Q5  | (a) 24   | (b) 27        | (c) no mode   | (d) 31            |            |
| Q6  | 90   | Q7 7          | Q8 5 kg       |                   |            |
| Q51 | 172 cm   | Q52 3, 10, 11 | Q53 175 cm    | Q54 3, 4, 7, 8, 8 | Q55 384 kg |
| Q56 | Vera's IQ was below the Queensland mean, but above the NSW mean. |               |               |                   |            |
| Q61 | (a) 79.125   | (b) 79.5      | (c) 59        | (d) 74            |            |
| Q71 | (a) 30   | (b) 29.5      | (c) 29 and 30 | (d) 11            |            |
| Q81 | (a) 3.86   | (b) 3         | (c) no mode   | (d) 11            |            |