

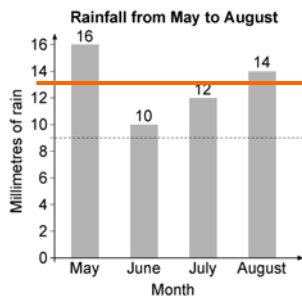
# Can I explain range, mode, median and mean and use them to describe data in order to make decisions?

## Teaching guidance

### Key vocabulary

frequency, mode, maximum value, minimum value, range, mean, average, median, statistics, data

### Models and images and resources

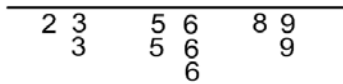


### Graphs and charts

The mean rainfall from May to August is 13 mm per month in this period  
 $(16 + 10 + 12 + 14) \div 4 = 52 \div 4$   
 $= 13$

Showing the mean on the chart as here (the orange line) helps to give a visual image of the concept of the mean.

### Diagrams



Use a number line to demonstrate the concept of range, and relative positions of mean, mode and median for a variety of sets of data.

### Spinners and 20 Cards ITPs



Use the Spinners and 20 Cards ITPs to create data then find the range, mode and median.

## Teaching tips

- Provide opportunities to identify the median where there is an even number of data points. The median is then the number halfway between the two centre numbers. For example, the median of the following data is 6.5 (the mean average of the two centre numbers,  $(6 + 7) \div 2$ ):

2, 3, 3, 3, 6, 7, 8, 8, 10, 12

- Give children the opportunity to investigate averages (for example, the average age of children visiting a museum) using frequency tables. Children often make errors such as finding the total of the first column to find the mean and not looking at the frequency column.

Age	f		$fx$
9	3	$9 \times 3 =$	27
10	6	$10 \times 6 =$	60
11	5	$11 \times 5 =$	55
12	3	$12 \times 3 =$	36
13	1	$13 \times 1 =$	13
	18		191

- For example, with the data shown here, children might make the error of adding the ages and dividing by five to find the mean, rather than multiplying the ages by the frequency with which they occur and dividing by the total number of children. Children might find it useful to list the data: 9, 9, 9, 10, 10, 10, 10, 10, 10, 10, 11, 11, 11, 11, 11, 12, 12, 12, 13

- Sometimes the choice of average to represent a set of data is made to present the data in a particular way.

For example, the amounts won by 18 successive competitors in a television quiz show are:

£16 000, £8000, £1000, £8000,  
£8000, £4000, £4000, £32 000,  
£4000, £8000, £125 000, £1000,  
£8000, £16 000, £8000, £32 000,  
£4000, £8000

Ask children to consider which average they would advertise to encourage people to take part in the quiz, explaining their choice.

- Explore other examples of data where different impressions can be conveyed through the use of a different choice of average. For example:
  - Comparing how many people live in houses in different parts of the world
  - Money donated to charity over a period of time by six different companies.
- When carrying out scientific experiments producing numerical data, find the mean for all the trials of the experiments carried out. Support the children in reflecting on the purpose of the mean used in this way, in comparison with using single trials. Ask them what conclusions they can draw from the mean of their results, and how knowing the range also supports understanding of the data.
- Set the children challenges that will help develop understanding of mean, mode and median. For example:

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#### Overcoming barriers level 4–5

- Can you write down five numbers whose mean, median and mode are all six and whose range is eight? (An example is 2, 6, 6, 6, 10.) Ask the children to explain their strategies. Are there other possibilities?
- The essential idea of finding the mean is ‘smoothing numbers out’ in order to get an overall view of the size of the numbers in a given set of data.
  - You might introduce the idea by giving each child a different number of blocks or cards, and asking how many each of them has. Write those numbers down, and discuss how they vary. Then work together to find a way to share them equally in order to estimate the mean. Eventually they should all have about the same number of objects, and you can discuss with them how they could have decided beforehand how many each of them should have. The answer, of course, is to find the total number of objects and divide by the number of children. The resulting number – the number that each has if they share equally – is called the mean average.
  - An alternative demonstration is to make piles of blocks of different heights, for example:

```
      H
     H H
    H H   H
   H H H   H
  H H H H H
 H H H H H
```

Then move blocks from the higher piles to the lower ones to make all the piles equal:

```
 H H H H H
 H H H H H
 H H H H H
 H H H H H
```

You have just found the mean: the mean number of blocks per pile was four.

- Choose other examples which do not give an integer (whole number) mean, so that children have the experience of trying to share the number of cubes equally between them but end up with leftover cubes; they can imagine these as being cut to be shared out.