# Build your skills: Working out the mean (average) – Part 1

This task has **three** parts to it.

**Part 1**

In this part, you will find information and activities to help you work out the *mean* ('average') of a set of data more confidently, and to work out the *range* of a set of values. The task covers how to work both of these out and also to understand what they can tell you.

Activities 1 and 2 focus on working out the mean, while Activity 3 looks at working out the range.

Activity 4 then helps you to think about both the mean and the range and what they each tell you.

Finally, in Activity 5 you will look briefly at some of the different ways that data might be presented to you when you are asked to find a mean or range.

**Part 2**

In Part 2 you can find suggestions of other free resources you can use to practise your skills.

**Part 3**

In Part 3 you can try out your skills on some practical activities and check your progress on some typical questions from the Level 1 National Test. Part 3 also contains the answers to all the activities in Parts 1–3.

HD1/L1.3
L1.4

**tutor notes**

## Thinking about 'averages'

We use the word 'average' when we want to give an impression of what is typical for a particular set of items. For example, we might talk about the 'average wage of workers in the health sector' or the 'average age of staff in the residential care team'.

The word 'average' doesn't really have a meaning in maths. Instead, there are several different types of mathematical 'average' – the most commonly used of which is the *'mean'*.

## Activity 1

When we collect information about a particular item in which we are interested, we call the information collected a set of '*data*' (numbers). Each of the numbers in the set of data is sometimes called a '***value'.***

Example:

You might want to know about the ages of members of a staff team. (You might want this information for a wide variety of reasons. For example, if you were a manager, you might want to use the information to help you think about how many staff are likely to be leaving over the next few years, so you can plan ahead about the sorts of numbers of new staff you will need to recruit and train.)

If you go around the team to collect the information and ask each person their age, you might get a ***set of data*** that looks like this:

25 37 56 52 43 54 23 40 20 60
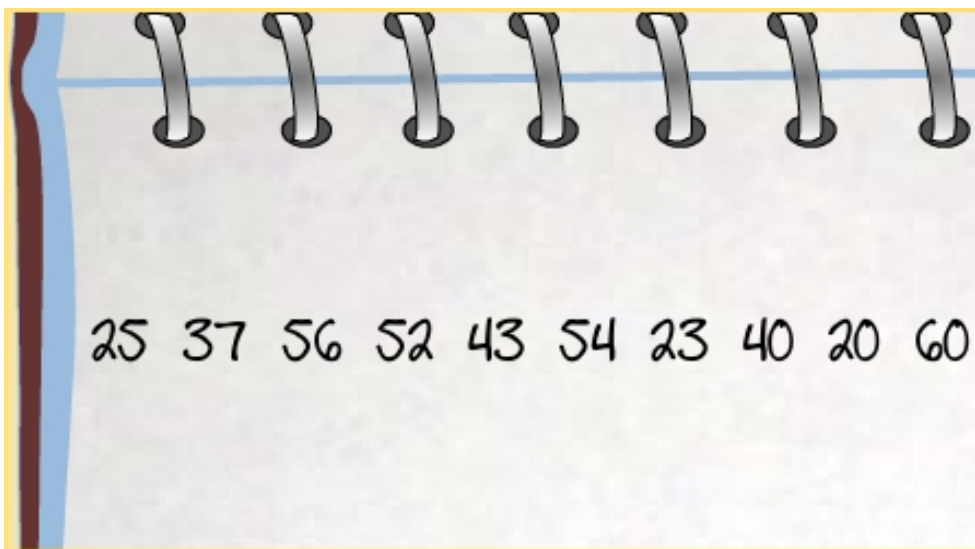
**Working out the mean of a set of data**

To work out the mean of a set of data, there are two steps:

I     add up all the *values* (i.e. all the numbers in the list)

II     divide this number by the number of values in the data set.

In this example:

a     *Adding up all the values will give us:*
      *25 + 37 + 56 + 52 + 43 + 54 + 23 + 40 + 20 + 60 = **410***

b     *The number of values is 10. (There are ten numbers in our list.)*
      *So, dividing 410 (the total from step 1) by the number of values will give us:*

$$\frac{410}{10} = 41$$

Often the two steps are written in the form shown below:

*Step1:*
***Add up all the values in the set of data.***
(i.e. all the numbers in our list of ages)

$$\frac{25 + 37 + 56 + 52 + 43 + 54 + 23 + 40 + 20 + 60}{10}$$

*Remember:*
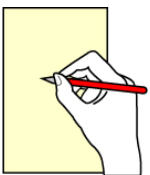The line shows us that we need to divide the number above the line by the number underneath.

*Step 2:*
***Divide by the number of values.***
(There were 10 numbers in our list, i.e. we asked ten members of the team.)

*Working this example through using the second way of writing it, we get:*

$$\frac{25 + 37 + 56 + 52 + 43 + 54 + 23 + 40 + 20 + 60}{10} = \frac{410}{10} = 41$$

*So, the mean age of the team is **41 years old**.*

**Work out the mean for each of these sets of data.**

1      The ages of the team members of a different team are:

       **35     37     43     24     19     34**

       What is the mean age of this team?


2      The distance that staff travel to work is:

       **12     3     5     23     9     2**

What is the mean distance that staff in this team travel to work?

**3**  In one morning, each member of the team visits the following numbers of clients:

*12    8    6    7    9    6*

What is the mean number of clients that the team visit in this morning?

**4**  Over a week, one member of the team visits the following numbers of clients on each day:

| Monday | Tuesday | Wednesday | Thursday | Friday |
|--------|---------|-----------|----------|--------|
| *8* | *6* | *7* | *9* | *5* |

What is the mean number of clients she visits per day in this week?

## Activity 2

**Tips to help you calculate the mean more efficiently**

When you are working out the mean of a set of data, there are several tips that can help you work more efficiently and check your calculation.

Firstly, when you add up the list of data values, it might help to try to match up numbers that add up to convenient amounts to make the adding easier.

Example:

The ages of a staff team are:

*35    26    19    44    51*

What is the mean age?

*Tip 1: You may already have a method for adding values that you are confident with. If not, when adding up the total of all the values, you could try the following approach (if you are adding without a calculator). This will make adding up the numbers easier:*

- *First, **find pairs or groups of digits in the list that add up to 10**.*

- *Cross these digits through on your list as you use them.*

- *Keep track of how many tens you have collected as you go.*

- *Then add any digits left over.*

Data to add up:
Ages

35
2̶6̶
1̶9̶
4̶4̶
5̶1̶
25

**Adding up the units:**

6 + 4        = 10
9 + 1        = 10
Left over        5 +
            **25**

Try a similar thing with **adding up the tens column** of the ages:
30 + 20        = 50
10 + 40        = 50
            50 +
    **150**

Data to add up:
Ages

35
26
19
44
5̶1̶
25
**150** +
175

*So the total of this set of data is 25 + 150 = 175.*

The mean age for this team of staff therefore will be:    $\dfrac{175}{5}$   =   25 years old.

Secondly: it can be easy to lose track of some of the values in the data by mistake (especially if there are a lot of numbers in the data set). So, I might add up the total of the values, but have missed out one of the numbers.

*Tip 2: To check that you have added up all the values:*

- *Count how many numbers there are in the data set.*

- *Check that you have this same number in your sum for working out the mean.*

So, in the above example: There are five ages in the list.

When adding up the total of the values, I can make sure I have five numbers in my sum:

$$\frac{35 + 26 + 19 + 44 + 51}{5} = \frac{175}{5}$$

**Use these two tips to help you work out the means for these situations**

**1**   The ages of residents in a care home are:

*74      83      72      94      97      88      81      79      92      80*

What is the mean age of the residents?

**2**   Find the mean number of agency staff per week of those working over a ten-week period.

*3      5      6      4      7      8      4      3      5      5*

**3**   Find the mean weight of five babies born in a maternity unit.

*3.6 kg          3.2 kg          4.0 kg          3.4 kg          3.8 kg*

**4**   The heights of children attending a clinic are:

*1.25 m          1.15 m          1.19 m          1.21 m          1.17 m          1.23 m*

What is the mean height over this session?

**5**   The time taken by staff to complete visits to each service user were:

*32 mins      28 mins      28 mins      30 mins      27 mins      25 mins*
*36 mins      27 mins      31 mins      33 mins      30 mins      21 mins*

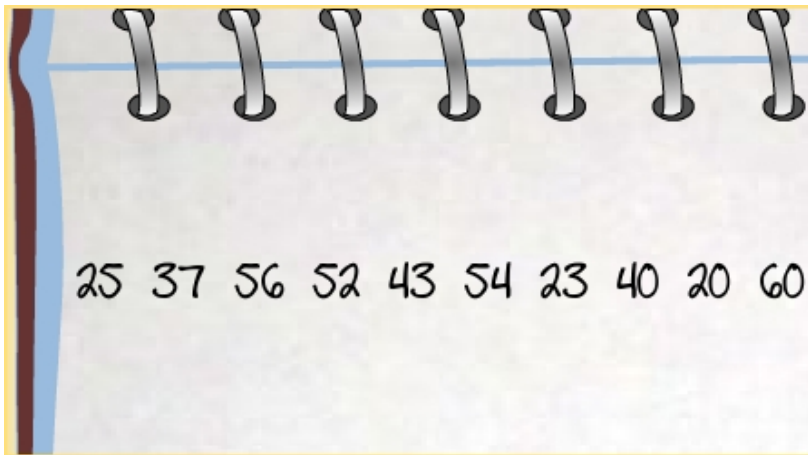What is the mean time taken per service user?

## Activity 3

**Working out the range of a set of data**

The range of a set of data is the difference between the highest and lowest value.

Example:

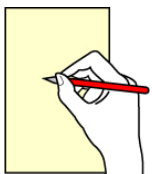Think again about the *set of data* we used in the example in Activity 1, showing the ages of a staff team:



The highest of these values is          60

The lowest of the values is          20

The range for the set of data is:    highest value – lowest value.

In this example:                              60 – 20 = 40

(i.e. There is 40 years difference between the oldest and youngest members of the team.)

**Look again at the data in each question in Activity 1.**

**Work out the range for each of these data sets.**

## Activity 4

It is useful to think about what the mean and range tell us about the data we have.
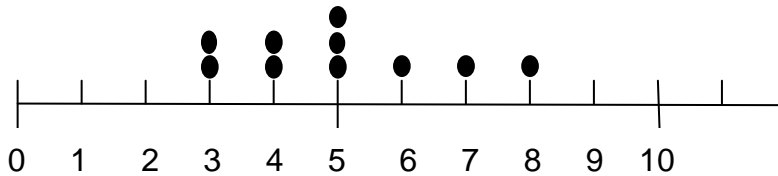
Example:

Let's think again about the data from Activity 2, question 2:

***Number of agency staff per week working in a care home over a ten-week period***:

**3    5    6    4    7    8    4    3    5    5**

We could represent this data on a diagram like this:



Each dot on the line represents one value of the data set.

The number '3' appears twice in the list of data values, so it has two dots above the point on the line marking 3.

Similarly, the number '5' appears three times in the list of data values, so it has three dots above the point on the line marking 5.

**Thinking about the mean:**



Mean of the values
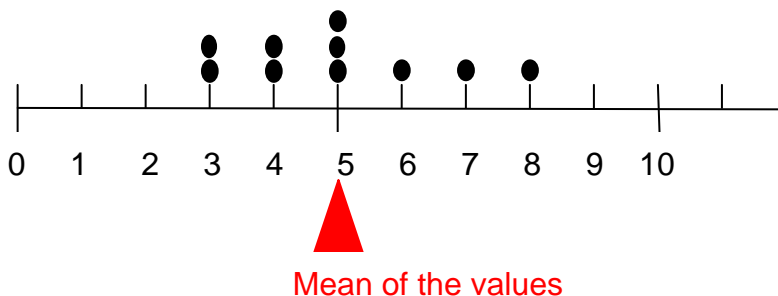
The mean of the data is like the 'balancing point'.

If the line above was a set of balancing scales and the dots represented weights (each of the same weight) placed at the points shown on the scale, the triangle shows the point at
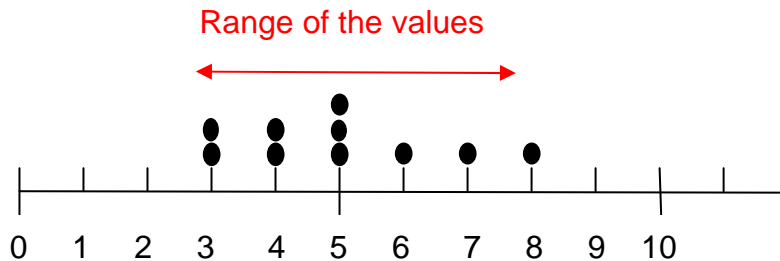
which the weights on either side of the triangle would balance, and the scales would become level.

**Thinking about the range**

You could indicate the range for this set of data on the diagram like this:



***You would not be asked to draw a diagram like this in the National Test***, but thinking about the mean and range visually like this may help you to think about what the mean and range tell you about data.

Looking at visual representations like these might also help you to think about how you can check that a mean you have worked out seems reasonable, given the data you started with.

Example:

If I work out the mean for the data set shown in the example above, and get an answer of 7, I might think that this doesn't really seem right.

The values in the data set are mostly just above and below 5, so why would the mean be as high as 7?

*Note: You actually don't need to draw a diagram to check like this. Your 'common sense' maths knowledge will tell you if the answer seems reasonable, if you remember to think about it.*

***Tip****: If you think that the answer you've got doesn't seem right, it is worth working out the mean again to check the answer you got.*

***When you work out the mean again as a check, add up the numbers in a different order*** *to the one you used last time (e.g. start from the end of the list of numbers and work backwards). This may save you making the same error twice if you've made a simple mistake in your arithmetic!*

**Try using the type of diagram shown above to represent the data from other questions in Activity 2.**

For each question:

- Draw dots on the line shown to represent the data (as in the example above).

- Mark in the mean, using a triangle below the number line (as above).

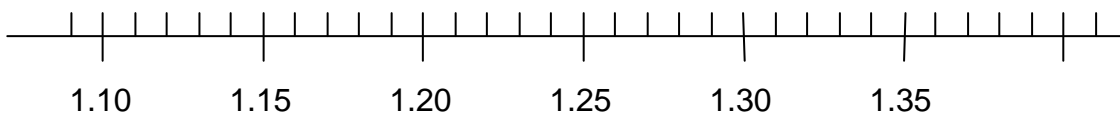- Mark in the range, using a double-headed arrow above the number line (as in the example).

**1**  The weights of 5 babies born in a maternity unit were:

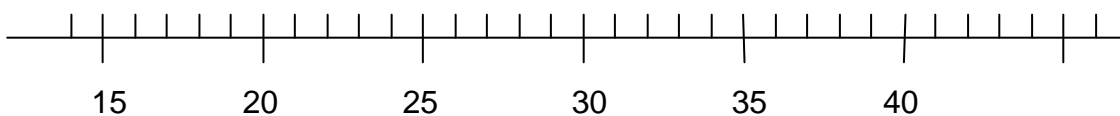 **3.6 kg**      **3.2 kg**      **4.0 kg**      **3.4 kg**      **3.8 kg**

| | | | | |
|---|---|---|---|---|
| 2.5 | 3 | 3.5 | 4 | 4.5 | 5 |
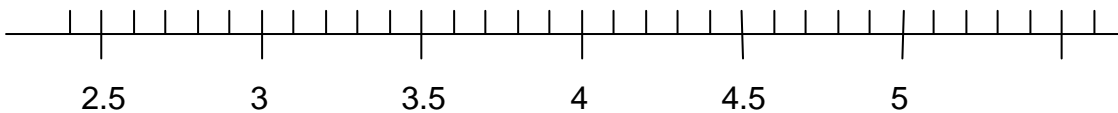
**2**  The heights of children attending a clinic are:

 **1.25 m**      **1.15 m**      **1.19 m**      **1.21 m**      **1.17 m**      **1.23 m**

| | | | | |
|---|---|---|---|---|
| 1.10 | 1.15 | 1.20 | 1.25 | 1.30 | 1.35 |

**3**  The time taken by staff to complete visits to each service user were:

 **32 mins**      **28 mins**      **28 mins**      **30 mins**      **27 mins**      **25 mins**

 **36 mins**      **27 mins**      **31 mins**      **33 mins**      **30 mins**      **21 mins**

| | | | | |
|---|---|---|---|---|
| 15 | 20 | 25 | 30 | 35 | 40 |

This type of visual representation may also help you to understand how two very different sets of data could have the same mean.

Example 1:

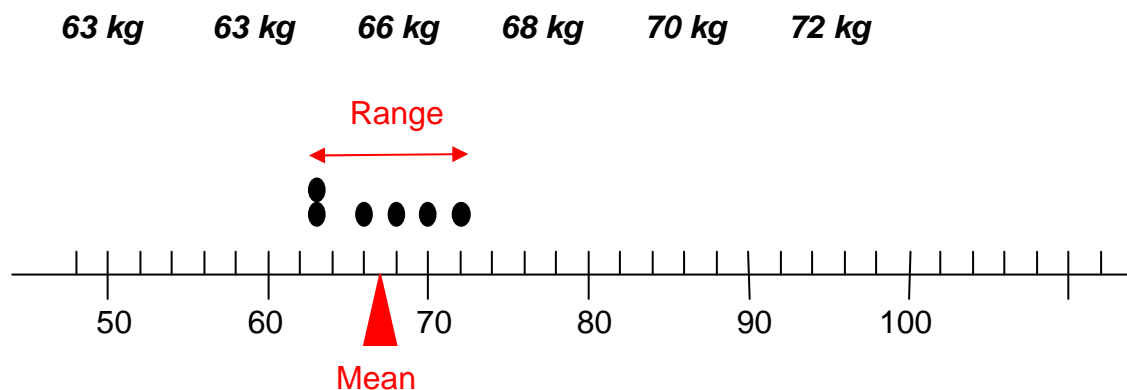The weights of a group of 6 people are:

**56 kg      60 kg      70 kg      96 kg      62 kg      58 kg**
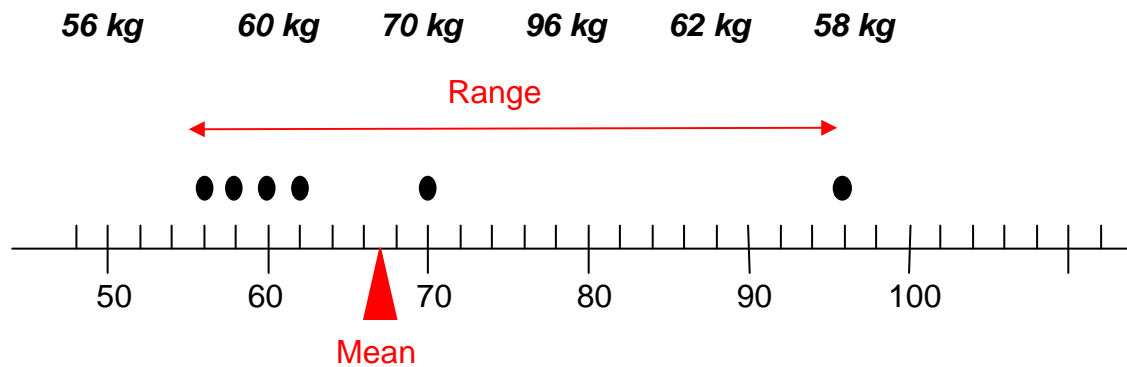


Example 2:

The weights of a different group of 6 people are:

**63 kg      63 kg      66 kg      68 kg      70 kg      72 kg**



For both groups of people, the mean weight is 67 kg. However:

- **The people in group 1 have a much greater variety of weights.**
  There are several people in group 1 who are lighter than those in group 2, but the person who weighs 96 kg in group 1 takes up the mean for the group as a whole.

- **In group 2, the people's weights are all more similar to one another.**
  No one is a lot heavier or lighter than the others in the group.

Although the two sets of data have the same mean, group 1 has a bigger range than group 2. This is why a range can often be useful – to give you more information about data, rather than just looking at the mean.

## Activity 5

One point to note: the data you are given might be presented in a variety of different forms.

Example:

a    The data set could be given to you **as a list of values** (as in the examples used in the activities above):
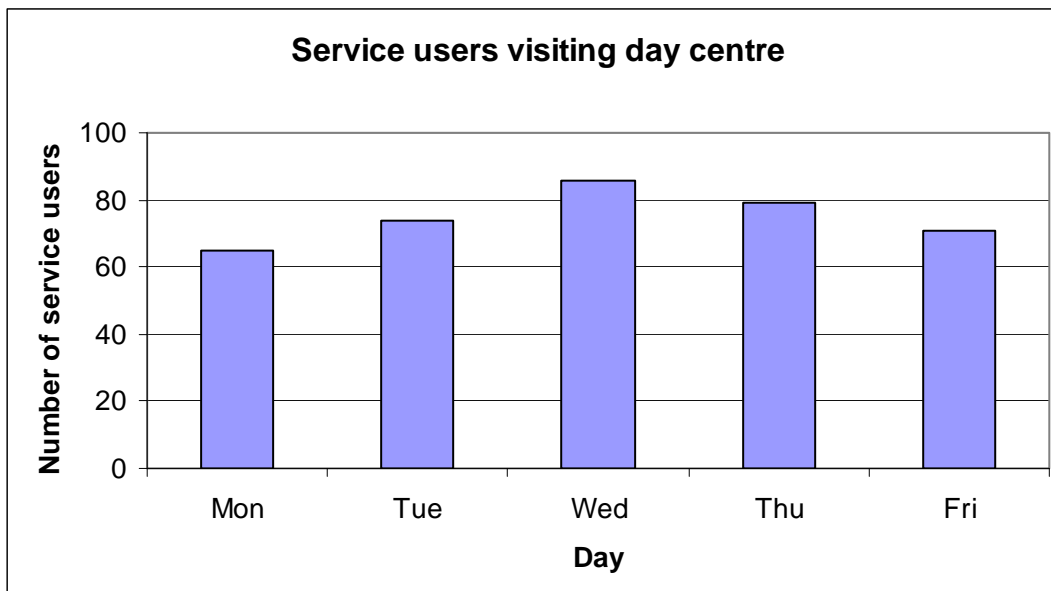
*Numbers of service users visiting a day centre over one week:*

  *65    74    86    79    71*

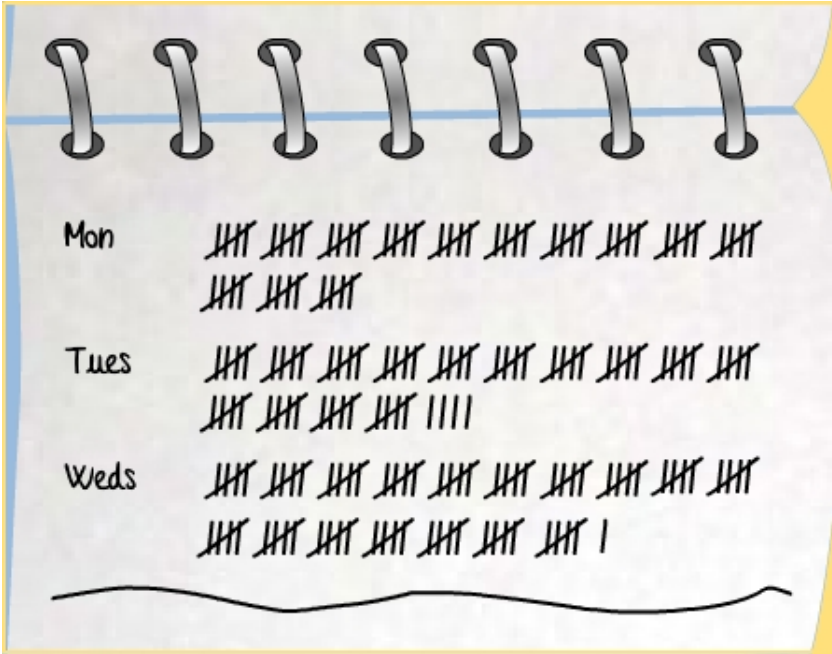b    However, the data could be presented **in a table**:

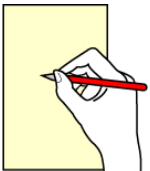| Mon | Tue | Wed | Thu | Fri |
|------|------|------|------|------|
| 65 | 74 | 86 | 79 | 71 |

c    Or in the form of a graph or chart:

d    Or as a tally chart:



In these cases, you will need to read off or interpret the values in the data set before you can work out the mean or range.

**Try these two examples.**

1    The table below shows the number of clients visited by members of a home help team on one particular day:

*Numbers of clients visited by team members on Monday 14 November:*

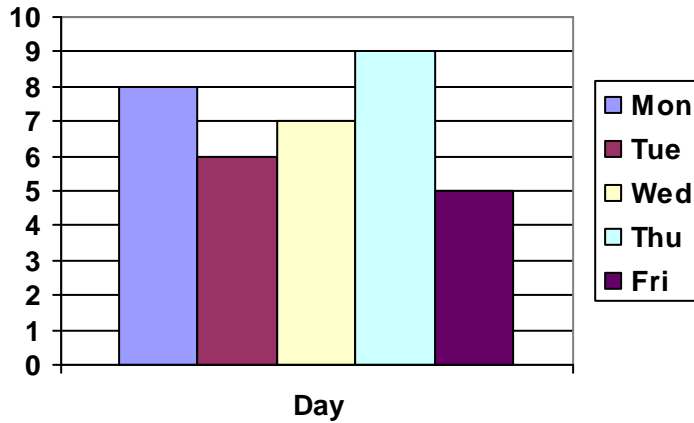|  | Sue | Cath | Tony | Pauline | Mav | Jon |
|---|---|---|---|---|---|---|
| Number of clients visited | *12* | *8* | *6* | *7* | *9* | *6* |

a    What is the mean number of clients per staff member visited by the team that day?

b    What is the range of the number of clients visited by the team?

**2**    The graph below shows the:

*Number of clients visited by a home help each day over one week:*



**a**   What is the mean number of clients she visited per day that week?

**b**   What is the range of the number of clients she visited?

*One point to note:*

Sometimes a table might tell you *how many* of a particular value there are in the data set.

You will then need to interpret the information in the table and think about what the data set will look like.

Example:

**Number of agency staff each week working in a care home over a ten-week period:**

| Number of agency staff | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|
| Number of weeks | 2 | 2 | 3 | 1 | 1 | 1 |

Total number of weeks is 10

*The table tells me there were **two** weeks when 3 agency staff were working at the home . . .*

*. . . and **two** weeks when 4 agency staff were working.*

The number of agency staff working over the ten weeks would look like this if it was presented as a list of values:

3      3      4      4      5      5      5      6      7      8

**Now print out Part 2 of this task to find suggestions of other free resources you might want to use to practise these skills.**