GCSE Maths – Statistics

Measures of Central Tendency

Worksheet

WORKED SOLUTIONS

This worksheet will show you how to work out questions relating to measures of central tendency. Each section contains a worked example, a question with hints and then questions for you to work through on your own.

Section A

Worked Example

You are given the following data set showing the weight in kilograms of 7 guinea pigs:

$$\{3,\ 2,\ 3,\ 4,\ 2,\ 3,\ 5\}$$

What is the mode of the data set?

Step 1: Order the data set from lowest value to highest value. This will allow you to easily count how many values are the same.

$$\{3,\ 2,\ 3,\ 4,\ 2,\ 3,\ 5\} = \{2,\ 2,\ 3,\ 3,\ 3,\ 4,\ 5\}$$

Step 2: The mode is the value which occurs most often. Count how many of each value there are in the data set.

In the data set $\{2, 2, 3, 3, 3, 4, 5\}$ *There are three 3s, two 2s, one 4 and one 5. We see 3 occurs the most often so 3 is the mode.*

Answer: $Mode = 3$

Guided Example

A class of 8 people take an exam. Their scores are given in the set

$$\{35,\ 22,\ 22,\ 45,\ 34,\ 35,\ 32,\ 22\}$$

What is the mode of their scores?

Step 1: Order the data set from lowest value to highest value.

$\{22, 22, 22, 32, 34, 35, 35, 45\}$

Step 2: The mode is the value which occurs most often. Count how many of each value there are in the data set.

There are three 22s, one 32, one 34, two 35s and one 45. 22s is the most frequent, hence, 22 is the mode.

Answer: 22

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

1. Find the mode for the following set of numbers:

78 34 12 42 11 78 30 71 42 42

{ 11, 12, 30, 34, 42, 42, 42, 71, 78, 78 }

frequency in the set of numbers

11 = 1
12 = 1
30 = 1
34 = 1
42 = 3
71 = 1
78 = 2

42 is the mode since it is the most frequent.

2. Below is a list of how much a group of friends earn per hour (£):

£7.00
£8.50
£6.55
£7.00
£5.65
£6.55
£9.75
£6.55

What is the mode amount of money that is earned per hour?

{ 5.65, 6.55, 6.55, 6.55, 7.00, 7.00, 8.50, 9.75 }

5.65 = 1
6.55 = 3
7.00 = 2
8.50 = 1
9.75 = 1

£6.55 is the mode amount of money.

Section B

Worked Example

The number of pets owned by a group of children is recorded in a frequency table below:

Number of pets owned	Frequency
0	2
1	5
2	1
3	2

Find the median number of pets owned.

Step 1: Find the total number of children by adding up all the numbers in the frequency column. This will give us the total number of values in the data set.

$$2 + 5 + 1 + 2 = 10$$

There are 10 values in the data set (10 children).

Step 2: Write a list of the 10 values in the data set in order from lowest to highest. Use the table to work out how many of the values 0, 1, 2 and 3 you need to list.

The table shows that two children own 0 pets, so we start the list with 0, 0. Then five children own 1 pet, so we add five copies of 1 to the data set. Continuing, only one child has 2 pets, so we add a single 2 to the set and finally two children own 3 pets, so we add two copies of 3 to the data set.

Data set in order from lowest to highest value:

$$\{0,\ 0,\ 1,\ 1,\ 1,\ 1,\ 1,\ 2,\ 3,\ 3\}$$

Step 3: Using the ordered data set, calculate the median.

The median is the middle value. Since there are an even number of values in the data set (10 children), the median value is the average of the 5^{th} and 6^{th} values.

$$5^{th}\ value: 1$$
$$6^{th}\ value: 1$$

$$Median = \frac{1+1}{2} = 1$$

Answer: $Median = 1$

Guided Example

Below is a list of recorded reaction times in seconds. Find the median of the reaction times.

$$\{3,\ 4,\ 2,\ 1,\ 3,\ 5,\ 7,\ 2,\ 4,\ 6,\ 9,\ 3\}$$

Step 1: Order the set of values from lowest to highest.

$\{1, 2, 2, 3, 3, 3, 4, 4, 5, 6, 7, 9\}$

Step 2: Count how many data values there are and use this work out where the median lies in the data set.

there are 12 data values, $n = 12$

$\text{median} = \frac{(n+1)}{2} = \frac{(12+1)}{2} = \frac{13}{2} = 6.5$

↳ This means the median lies between the 6th and 7th term

Step 3: Find the median by counting up from the lowest value on the list.

6th term = 3 7th term = 4

$\text{median} = \frac{3+4}{2} = \frac{7}{2} = 3.5$ → average of 6th and 7th value

Answer: median = 3.5

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

3. Find the median and mode for the following sets of numbers:

a) {30, 21, 59, 23, 12, 12, 21, 39, 14, 21, 21}

{ 12, 12, 14, 21, 21, 21, 21, 23, 30, 39, 59 }

mode = 21 (is the most frequent - repeated 4 times)

number of data values = 11

median = $\frac{(n+1)}{2} = \frac{(11+1)}{2} = \frac{12}{2} = 6$ → 6th term

The median is 21 as this is the 6th term.

b) {1.5, 2.4, 3.0, 2.4, 4.5, 1.6, 1.6, 2.4, 1.5}

{ 1.5, 1.5, 1.6, 1.6, 2.4, 2.4, 2.4, 3.0, 4.5 }

mode : 2.4

number of data sets : 9

median = $\frac{(n+1)}{2} = \frac{(9+1)}{2} = \frac{10}{2} = 5$ → 5th term

median is 2.4 as it is the 5th term.

frequency :

1.5 = 2
1.6 = 2
2.4 = 3
3.0 = 1
4.5 = 1

4. Eleanor has eight guinea pigs in her garden.

The weights (in kilograms) are listed in the set below.

{1.0, 2.5, 1.5, 1.6, 3.0, 2.5, 1.3, 2.2}

Find the median and mode weight of the rabbits.

{ 1.0, 1.3, 1.5, 1.6, 2.2, 2.5, 2.5, 3.0 }
(1.6: 4th term; 2.2: 5th term)

mode = 2.5

number of data sets : 8

median = $\frac{(n+1)}{2} = \frac{(8+1)}{2} = \frac{9}{2} = 4.5$ → 4th and 5th term

median = $\frac{1.6+2.2}{2} = \frac{3.8}{2} = 1.9$

The median is 1.9

frequency :

1.0 = 1
1.3 = 1
1.5 = 1
1.6 = 1
2.2 = 1
2.5 = 2
3.0 = 1

5. Taylor aims to bake 25 cakes each day. The number of cakes baked by their bakery each day is recorded in the following frequency table.

Number of cakes baked	Frequency
22	1
23	3
24	1
25	2
26	3
27	4
28	2

Calculate the median and mode for the number of cakes baked per day.

List down the number of cakes in a sequence based on the frequency :

{ 22, 23, 23, 23, 24, 25, 25, 26, 26, 26, 27, 27, 27, 27, 28, 28 }

Mode = find the number with the highest frequency :

27 is the mode

number of data sets : $1+3+1+2+3+4+2$ → add all the frequencies

$= 16$

median = $\frac{(n+1)}{2} = \frac{(16+1)}{2} = \frac{17}{2} = 8.5$ → 8th term and 9th term

8th term : 26 9th term = 26

median : $\frac{26+26}{2} = \frac{52}{2} = 26$

median is 26

Section C

Worked Example

The scores of 10 students were recorded for an exam. The scores are recorded in the data set below.

$$\{12,\ 24,\ 28,\ 23,\ 11,\ 23,\ 29,\ 15,\ 15,\ 20\}$$

Calculate the mean score.

Step 1: Add up of the numbers in the data set to find the sum of the values.

$$12 + 24 + 28 + 23 + 11 + 23 + 29 + 15 + 15 + 20 = 200$$

Step 2: Divide the total by how many values there are.

We are already told that there are 10 students, so we simply divide 200 by 10:

$$200 \div 10 = 20$$

Answer: $Mean = 20$

Guided Example

Below is a list of heights recorded in centimetres for a survey:

$$\{155,\ 165,\ 140,\ 180,\ 174,\ 155,\ 186,\ 175\}$$

Calculate the mean height of the data.

Step 1: Add up of the numbers in the data set to find the sum of the values.

$= 155 + 165 + 140 + 180 + 174 + 155 + 186 + 175$

$= 1330$

Step 2: Divide the total by how many values there are.

Number of data values : 8

Mean height $= \frac{1330}{8} = 166.25$

Answer: The mean height is 166.25

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

6. John is investigating how long it takes people to complete a Rubik's cube.

   Their times (in minutes) is recorded in the data set below:

   $$\{5,\ 6,\ 19,\ 9,\ 14,\ 23,\ 21,\ 8\}$$

   Calculate the mean time taken, giving your answer to one decimal place.

   Add all values together : $5+6+19+9+14+23+21+8$
   $= 105$

   Number of data values $= 8$

   Mean time taken $= \frac{105}{8} = 13.125 \approx 13.1$ minutes

7. Two schools are comparing the English exam scores of 5 of their best students. They gave their scores in the table below.

School A's exam scores	School B's exam scores
30	49
34	38
43	47
36	45
46	26

   Which school has a higher mean exam score? Show your working.

   Total exam scores for School A : $30+34+43+36+46$
   $= 189$

   Number of students : 5

   Mean exam score for school A : $\frac{189}{5} = 37.8$

   Total exam scores for school B : $49+38+47+45+26$
   $= 205$

   Number of students : 5

   Mean exam score for school B : $\frac{205}{5} = 41$

   School B has a higher mean exam score.