

Mean, Median, Mode and Range from Grouped Data

Starter

- (Review of Y7 material)** For the data values 2, 4, 7, 1, 9, 6, 5, 7, find:
 - the mean average
 - the mode
 - the median
 - the range.
- (Review of Y7 material)** Pete got a mean of 12 for his six experiments. The values were 12, 13, 10, 12, 10, x . What is the value of the missing mark?

Notes

From Y7:

Mean — add up the values and divide by the number of values

Median — the middle value

Mode — the most frequent value

Range — the difference between the highest and lowest values

Data in frequency tables

When we have a lot of values, it is easier to collate them into a table.

How do we work out the mean, mode and range for data in a table?

This frequency table shows the mass of eggs laid by hens on a free range farm.

Mass	44 g	48 g	52 g	56 g	60 g
Frequency, f	5	6	7	9	3

It means there are 5 eggs that have a mass of 44g and 6 eggs that have a mass of 48 g etc.

Mean from a frequency table

- Multiply the frequencies by the weight.

Mass	44 g	48 g	52 g	56 g	60 g
Frequency, f	5	6	7	9	3
Freq \times Weight	$44 \times 5 = 220$	$48 \times 6 = 288$	$52 \times 7 = 364$	$56 \times 9 = 504$	$60 \times 3 = 180$

- Add up all the values in the new row (or column) — this is the total weight of all the eggs.
 $220 + 288 + 364 + 504 + 180 = 1556$

- Find the total frequency (or column) — this is the total number of eggs.
 $5 + 6 + 7 + 9 + 3 = 30$

$$\begin{aligned}
 4. \quad \text{Mean} &= \frac{\text{Sum of (frequency} \times \text{value)}}{\text{Total frequency}} \\
 &= \frac{(5 \times 44) + (6 \times 48) + (7 \times 52) + (9 \times 56) + (3 \times 60)}{5 + 6 + 7 + 9 + 3} \\
 &= \frac{1556}{30} = 51.9 \text{ (3 s.f.)}
 \end{aligned}$$

Mode from a frequency table

The mode is most frequent value so in a table it is the one with the highest frequency. In the example above, the mode is 56 g as this appears nine times.

Range from a frequency table

Range = Highest value – Lowest value = 60 – 44 = 16 g

Median from a frequency table

The median value is the middle value. If there are n data values, the median is the $\frac{n + 1}{2}$ th value. To find the median from a table we calculate the cumulative frequency (sometimes called the “running total”).

There are 30 values so the median is the $\frac{30 + 1}{2} = 15.5$ th value.

Mass	44 g	48 g	52 g	56 g	60 g
Frequency, f	5	6	7	9	3
Cumulative frequency	5	5 + 6 = 11	11 + 7 = 18		

The 11th value is 48 g.

The 18th value is 52 g

So the 15.5th value is 52 g so the median is 52 g.

Alternatively, 18 is the first value in the cumulative frequency that is above 15.5, so 52 g is the median.

N.B. Make sure you include units with your answer.

E.g. 1 The frequency table shows the mass of pears sold in a shop.

Mass	70 g	80 g	90 g	100 g	110 g	120 g
Frequency, f	2	7	9	11	8	3

Find the mean, mode, median and range.

Working:

$$\begin{aligned} \text{Mean} &= \frac{\text{Sum of (frequency} \times \text{value)}}{\text{Total frequency}} \\ &= \frac{(2 \times 70) + (7 \times 80) + (9 \times 90) + (11 \times 100) + (8 \times 110) + (3 \times 120)}{2 + 7 + 9 + 11 + 8 + 3} \\ &= \frac{3850}{40} = 96.25 \text{ g (3 s.f.)} \end{aligned}$$

Mode = 100 g *highest frequency*

Range = 120 – 70 = 50 g *highest – lowest*

Median — these are 40 values so the median is the $\frac{40 + 1}{2} = 20.5$ th value.

Mass	70 g	80 g	90 g	100 g	110 g	120 g
Frequency, f	2	7	9	11	8	3
Cumulative frequency	2	2 + 7 = 9	9 + 9 = 18	18 + 11 = 29		

The 18th value is 90 g.
The 29th value is 100 g.
So the 20.5 is 100 g so the median is 100 g.

Alternatively, you could also see that 29 is the first cumulative frequency value bigger than 20.5 so 100 g is the median.

E.g. 2 The frequency table shows the price of a Mars bar in different shops.

Price	49p	50p	51p	52p	53p	54p
Frequency, f	3	4	7	10	6	5

Find the mean, mode, median and range.

Video: [Mean from a frequency table](#)
Video: [Median from a frequency table](#)
Video: [Mode](#)
Video: [Range](#)

[Solutions to Starter and E.g.s](#)

Exercise

p90 Ex 5.2 Qu 1-10

Summary

Mean — add up the values and divide by the number of values

Median — the middle value

Mode — the most frequent value

Range — the difference between the highest and lowest values

From frequency tables:

$$\text{Mean} = \frac{\text{Sum of (frequency} \times \text{value)}}{\text{Total frequency}}$$

Mode = the value with the highest frequency.

Range = Highest value — Lowest value

Median: look for the first number in the cumulative frequency above $\frac{n + 1}{2}$, where n is the total frequency. The median is this category.

[Textbook answers \(only available during a lockdown\)](#)