

Mean, median, mode and averages from grouped data



Hints online, answers free with an account:
mathswariz.uk/worksheets/stats-mean-median-mode-and-averages-from-grouped-data/

About 80 minutes Calculator allowed 79 marks

Date _____

A Do Now

The first two are what this chapter needs. The rest bring back earlier chapters so nothing is forgotten.

A1 Needed today [2 marks]

The mean of 4 numbers is 21. One more number is added and the mean becomes 23. What number was added?

Answer

A2 Needed today [2 marks]

20 phone calls are in the class $80 < t \leq 120$ (minutes). Assuming they are spread evenly through the class, estimate how many are at most 92 minutes.

Answer

A3 From chapter 4 [2 marks]

A bar chart of the mean height of plants (in cm) has a vertical axis that starts at 100. The bar for Plot A is 120 and the bar for Plot B is 180. How many times as tall as the Plot A bar does the Plot B bar look?

Answer

A4 Maths skill [2 marks]

Work out $\sqrt{24^2 + 18^2}$.

Answer

Work out $5.2 \div 0.02$.

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

The annual salaries, in thousands of pounds, of the 7 staff at a small firm are 21, 23, 24, 24, 26, 28 and 95. Find the mean, median and mode. Which average best represents a typical salary? Give a reason.

Hint Look at how many salaries are below the mean.

B1 The numbers of texts sent in one hour by 9 people are 3, 4, 4, 5, 6, 6, 7, 8 and 48. Work out the mean and the median. Which of the two is the better average here? Give a reason.

EXAMPLE 2

40 families were asked how many children they have. The table shows the results. Calculate the mean, the median and the mode number of children.

Number of children	Frequency
1	14
2	11
3	8
4	5
5	2

Hint Multiply each number of children by its frequency to get the total number of children.

B2 50 households were asked how many pets they own. The table shows the results. Work out the mean and the median.

Number of pets	Frequency
0	12
1	18
2	11
3	6
4	3

Answer

EXAMPLE 3

Class A has 24 students with a mean test mark of 62. Classes A and B together have 54 students with a mean mark of 59. Work out the mean mark of class B.

Hint Work with total marks, not with the means.

EXAMPLE 4

A town's population grew by 20% in the first year, 50% in the second year and fell by 10% in the third year. Use the geometric mean to work out the average yearly percentage change.

Hint Change each percentage into a multiplier first.

EXAMPLE 5

The table shows the lengths, t minutes, of 40 phone calls. Work out an estimate of the mean length. Explain why it is only an estimate.

Length, t (minutes)	Frequency
$0 < t \leq 5$	8
$5 < t \leq 10$	12
$10 < t \leq 20$	10
$20 < t \leq 30$	6
$30 < t \leq 60$	4

Hint Use the midpoint of each class for every call in it.

B3 The mean mass of 12 boxes is 4.5 kg. Three more boxes are added, and the mean mass of all 15 boxes is 4.8 kg. Work out the mean mass of the 3 boxes that were added. [2 marks]

Answer

B4 The price of a bus pass rose by 4%, 10%, 6% and 2% in four years. Use the geometric mean to work out the average yearly percentage rise. Give your answer to 2 decimal places. [3 marks]

Answer

B5 The table shows the masses, m grams, of 60 eggs. Work out an estimate of the mean mass, to 1 decimal place. Explain why it is only an estimate. [4 marks]

Mass, m (grams)	Frequency
$40 < m \leq 50$	6
$50 < m \leq 55$	14
$55 < m \leq 60$	22
$60 < m \leq 65$	12
$65 < m \leq 80$	6

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EXAMPLE 6

The table shows the ages, a years, of 80 people at a cinema. Estimate the median age by interpolation.

Age, a (years)	Frequency
$0 < a \leq 15$	12
$15 < a \leq 25$	20
$25 < a \leq 40$	30
$40 < a \leq 60$	12
$60 < a \leq 90$	6

Hint The median is the 40th person. Find the class they are in, then how far into it.

B6 The table shows the journey times, t minutes, of 120 commuters. Estimate the median journey time by interpolation. [3 marks]

Time, t (minutes)	Frequency
$0 < t \leq 10$	20
$10 < t \leq 25$	30
$25 < t \leq 35$	40
$35 < t \leq 50$	20
$50 < t \leq 80$	10

Answer

C Practice

Each question asks for something different.

C1 Work out the median and the range of these masses, in kg: 3.2, 4.8, 2.9, 5.1, 3.6, 4.0 [2 marks]

Answer

C2 A data set has a mean of 12 and a median of 10. Every value in the data set is increased by 5. Write down the new mean and the new median. [2 marks]

Answer

C3 The four numbers x , $x + 3$, $2x$ and 10 have a mean of 9. Work out the value of x . [2 marks]

Answer

- C4** The table shows the times, t seconds, that 50 people took to solve a puzzle. [2 marks]
Which class is the modal class? In which class does the median lie?

Time, t (seconds)	Frequency
$0 < t \leq 10$	7
$10 < t \leq 20$	15
$20 < t \leq 30$	13
$30 < t \leq 40$	9
$40 < t \leq 50$	6

Answer

- C5** Explain why the geometric mean, and not the arithmetic mean, is used to find an average yearly growth rate. [2 marks]

- C6** A café buys 200 kg of coffee at £3.50 per kg, 300 kg at £4.20 per kg and 500 kg at £3.80 per kg. Work out the mean price per kg. [2 marks]

Answer

- C7** Tom says, "My estimate of the mean from the grouped table is exact, because I used every class." [2 marks]

Is Tom correct? Give a reason.

- C8** A hockey team recorded its goals in each match of a season, as shown in the table. The mean number of goals per match is 2.2. Work out the value of x . [3 marks]

Goals	Frequency
1	5
2	x
3	8
4	2

Answer

D Exam-style questions

Show your working: most of the marks are for method.

- D1** Ravi says, "Class P has 20 students with a mean score of 58. Class Q has 40 students with a mean score of 66. So the mean score of all 60 students is 62." [3 marks]

Is Ravi correct? Show how you decide.

- D2** The table shows the finishing times, t minutes, of 80 runners in a race.

Time, t (minutes)	Frequency
$20 < t \leq 25$	6
$25 < t \leq 30$	18
$30 < t \leq 35$	26
$35 < t \leq 45$	20
$45 < t \leq 60$	10

- (a) Work out an estimate of the mean finishing time. [3 marks]

Answer

- (b) Estimate the median finishing time by interpolation. Give your answer to 1 decimal place. [2 marks]

Answer

- (c) The estimated mean is greater than the median. What does this tell you about the finishing times? [1 mark]

Total for D2: 6 marks

- D3** The fixed base index numbers for the price of a train ticket are shown, with 2020 = 100. In 2021 the index was 104, in 2022 it was 113, in 2023 it was 121 and in 2024 it was 125. Use the geometric mean to work out the average yearly percentage rise from 2020 to 2024. Give your answer to 1 decimal place. [3 marks]

Answer

- D4** A school combines three surveys into one satisfaction score. Students have a weight of 5, parents a weight of 3 and staff a weight of 2. The students' mean score is 6.8 and the parents' mean score is 7.4. The weighted mean of all three is 7.0. Work out the staff's mean score. [3 marks]

Answer

- D5** In a town, the mean house price is £312 000 and the median house price is £245 000. An estate agent's advert says, "The typical house here costs £312 000." Explain why the advert may be misleading. [2 marks]

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- D6** In 25 netball matches, a team's mean number of goals was 18. In the next 5 matches the team scored 14, 22, 19, 16 and 25 goals. Work out the mean number of goals for all 30 matches. [2 marks]

Answer

- D7** A grouped frequency table of salaries has a last class "over £80 000". Explain why an estimate of the mean cannot be found without making an assumption, and state an assumption you could make. [2 marks]
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- D8** Three whole numbers have a mode of 7, a median of 7 and a mean of 9. Work out the three numbers. [2 marks]

Answer

- D9** The mean of 20 values is 14. One value was written down as 41 by mistake; it should have been 14. Work out the correct mean. [2 marks]

Answer

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** Five positive whole numbers have a mode of 4, a median of 5, a mean of 6 and a range of 7. Work out the five numbers. [3 marks]

Answer

- E2** Alex says, "My investment rose by 50% one year and fell by 50% the next, so on average it did not change." [3 marks]

An investment of £800 does this. Work out its value after the two years and the average yearly percentage change, using the geometric mean.

Answer

- E3** Ten values have a mean of 12 and a median of 11. Two more values, 3 and 30, are added. Work out the new mean, and explain whether the median changes. [3 marks]
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F How did it go?

Colour one circle on each line.

	Not yet	Nearly	Yes
I can find and choose averages, and work with combined, weighted and geometric means.	☐	☐	☐
I can estimate the mean and the median from grouped data and say why they are estimates.	☐	☐	☐

Extension hints

Use one hint at a time. Cover the ones below it with a sheet of paper.

E1	Hint 1	Put the five numbers in order. The middle one is the median.
	Hint 2	The mode is 4, so 4 appears twice, and both 4s are below the median.
	Hint 3	The total is $5 \times 6 = 30$ and the largest is the smallest plus 7.

E2	Hint 1	Work out the value after each year.
	Hint 2	The two multipliers are 1.5 and 0.5.
	Hint 3	The geometric mean is the square root of their product.

E3	Hint 1	Work with the total, not with the mean.
	Hint 2	Of the two new values, one is below the median and one is above it.
	Hint 3	The middle of the data does not move when one value is added on each side.