

Averages from Grouped Frequency Tables

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (5 marks)

The table gives information about the times, in minutes, that 20 students took to walk to school.

Time (t minutes)	Frequency	Midpoint	Midpoint $\times$ frequency
$0 < t \leq 10$	4	5	20
$10 < t \leq 20$	9	15	135
$20 < t \leq 30$	5	25	125
$30 < t \leq 40$	2	35	70

(a) Write down the modal class interval.

The modal class is the class with the highest frequency.

The highest frequency is 9.

Answer: $10 < t \leq 20$

(b) Complete the last two columns of the table.

Each midpoint is halfway between the ends of the class, e.g. $(0 + 10) \div 2 = 5$.

Midpoints: 5, 15, 25, 35

Then multiply each midpoint by its frequency:

$$5 \times 4 = 20, \quad 15 \times 9 = 135, \quad 25 \times 5 = 125, \quad 35 \times 2 = 70$$

See the completed table above.

Answer: 5, 15, 25, 35 and 20, 135, 125, 70

Marks: 1 mark for the midpoints. 1 mark for the products.

- (c) Work out an estimate for the mean time.

Add up the last column: $20 + 135 + 125 + 70 = 350$

There are 20 students.

Mean $\approx 350 \div 20 = 17.5$

Answer: 17.5 minutes

Tip: Divide by the total frequency (20 students), not by 4 (the number of classes).

Marks: 1 mark for $350 \div 20$. 1 mark for 17.5.

2 (5 marks)

The table shows information about the distances 40 people travel to work.

Distance (d km)	Frequency
$0 < d \leq 10$	4
$10 < d \leq 20$	9
$20 < d \leq 30$	14
$30 < d \leq 40$	8
$40 < d \leq 50$	5

- (a) Write down the modal class interval.

The modal class is the class with the highest frequency.

The highest frequency is 14.

Answer: $20 < d \leq 30$

- (b) Work out an estimate for the mean distance.

Midpoints: 5, 15, 25, 35, 45

Multiply each midpoint by its frequency:

$$5 \times 4 = 20, \quad 15 \times 9 = 135, \quad 25 \times 14 = 350, \quad 35 \times 8 = 280, \quad 45 \times 5 = 225$$

$$\text{Add these up: } 20 + 135 + 350 + 280 + 225 = 1010$$

$$\text{Total frequency: } 4 + 9 + 14 + 8 + 5 = 40$$

$$\text{Mean} \approx 1010 \div 40 = 25.25$$

Answer: 25.25 km

Tip: Use the midpoints (5, 15, ...), not the ends of the classes. Your answer must be between 0 and 50 km.

Marks: 1 mark for using the midpoints. 1 mark for $1010 \div 40$. 1 mark for 25.25.

- (c) Find the class interval that contains the median.

There are 40 people, so the median is halfway between the 20th and 21st values.

$$\text{Running totals: } 4, \quad 4 + 9 = 13, \quad 13 + 14 = 27$$

The 20th and 21st values are in the third class.

Answer: $20 < d \leq 30$

Tip: Do not just pick the middle row of the table. Use running totals to find where the 20th and 21st values are.

3 (1 mark)

The table shows information about the ages of 30 people.

Age (a years)	Frequency
$0 < a \leq 20$	4
$20 < a \leq 40$	11
$40 < a \leq 60$	9
$60 < a \leq 80$	6

Kim works out an estimate for the mean.

Here is her working.

$$\frac{4 + 11 + 9 + 6}{4} = \frac{30}{4} = 7.5$$

Kim's method is wrong.

Explain why.

Kim has added the frequencies and divided by 4.

This is just the mean of the frequencies, not the mean age.

She should multiply each midpoint by its frequency, add these up, and then divide by 30.

Answer: Averaged the frequencies instead of using midpoints

4 (3 marks)

The table shows information about the weights of 20 apples.

Weight (w grams)	Frequency
$40 < w \leq 50$	3
$50 < w \leq 60$	4
$60 < w \leq 70$	7
$70 < w \leq 80$	4
$80 < w \leq 90$	2

Show that an estimate for the mean weight is 64 g.

Midpoints: 45, 55, 65, 75, 85

Multiply each midpoint by its frequency:

$$45 \times 3 = 135, \quad 55 \times 4 = 220, \quad 65 \times 7 = 455, \quad 75 \times 4 = 300, \quad 85 \times 2 = 170$$

$$\text{Add these up: } 135 + 220 + 455 + 300 + 170 = 1280$$

There are 20 apples.

$$\text{Mean} \approx 1280 \div 20 = 64 \text{ g}$$

Answer: $1280 \div 20 = 64$

Marks: 1 mark for using the midpoints. 1 mark for the total 1280. 1 mark for showing $1280 \div 20 = 64$.

5 (4 marks)

The table gives information about the heights, h cm, of 50 sunflowers in a garden centre.

Height (h cm)	Frequency
$50 < h \leq 100$	4
$100 < h \leq 150$	11
$150 < h \leq 200$	20
$200 < h \leq 250$	15

- (a) Calculate an estimate for the mean height.

Midpoints: 75, 125, 175, 225

Multiply each midpoint by its frequency:

$$75 \times 4 = 300, \quad 125 \times 11 = 1375, \quad 175 \times 20 = 3500, \quad 225 \times 15 = 3375$$

$$\text{Add these up: } 300 + 1375 + 3500 + 3375 = 8550$$

There are 50 sunflowers.

$$\text{Mean} \approx 8550 \div 50 = 171$$

Answer: 171 cm

Tip: Use the midpoint of each class (75, 125, ...), not the upper end (100, 150, ...).

Marks: 1 mark for at least three midpoint $\times$ frequency values. 1 mark for dividing the total by 50. 1 mark for 171.

- (b) Omar says,
“The tallest sunflower is 250 cm tall.”

Is Omar correct?

Give a reason for your answer.

The tallest sunflowers are in the class $200 < h \leq 250$.

We only know that they are more than 200 cm and at most 250 cm.

The tallest one could be 250 cm, but it could also be shorter, e.g. 230 cm.

Answer: Not necessarily: the tallest is somewhere in $200 < h \leq 250$, so it could be less than 250 cm

Tip: A grouped table does not show the exact values. 250 is only the largest **possible** height.

6 (4 marks)

The table shows information about the times, in minutes, that 70 visitors spent in a museum.

Time (t minutes)	Frequency
$0 < t \leq 30$	8
$30 < t \leq 60$	21
$60 < t \leq 90$	26
$90 < t \leq 120$	15

- (a) Calculate an estimate for the mean time.
Give your answer correct to 3 significant figures.

Midpoints: 15, 45, 75, 105

Multiply each midpoint by its frequency:

$$15 \times 8 = 120, \quad 45 \times 21 = 945, \quad 75 \times 26 = 1950, \quad 105 \times 15 = 1575$$

$$\text{Add these up: } 120 + 945 + 1950 + 1575 = 4590$$

There are 70 visitors.

$$\text{Mean} \approx 4590 \div 70 = 65.571 \dots$$

To 3 significant figures: 65.6

Answer: 65.6 minutes

Tip: Divide by the total frequency, 70, not by the number of classes.

Marks: 1 mark for at least three midpoint $\times$ frequency values. 1 mark for dividing the total by 70. 1 mark for 65.6.

(b) The museum says,

“More than a quarter of our visitors stay for longer than 90 minutes.”

Is the museum correct?

You must show your working.

A quarter of 70 visitors is $70 \div 4 = 17.5$

Longer than 90 minutes means the class $90 < t \leq 120$: 15 visitors.

15 is less than 17.5, so the museum is not correct.

Answer: No: 15 visitors stayed longer than 90 minutes, but a quarter is 17.5

Tip: Compare with a quarter of the **total**, 70, not a quarter of one class.

7 (4 marks)

The table gives information about the number of hours, h , that 25 volunteers worked in a charity shop last month.

Number of hours (h)	Frequency
$0 < h \leq 4$	5
$4 < h \leq 8$	10
$8 < h \leq 12$	6
$12 < h \leq 16$	4

- (a) Work out an estimate for the mean number of hours worked.

Midpoints: 2, 6, 10, 14

Multiply each midpoint by its frequency:

$$2 \times 5 = 10, \quad 6 \times 10 = 60, \quad 10 \times 6 = 60, \quad 14 \times 4 = 56$$

$$\text{Add these up: } 10 + 60 + 60 + 56 = 186$$

There are 25 volunteers.

$$\text{Mean} \approx 186 \div 25 = 7.44$$

Answer: 7.44 hours

Tip: Divide by 25 (the number of volunteers), not by 4 (the number of classes).

Marks: 1 mark for at least three midpoint $\times$ frequency values. 1 mark for dividing the total by 25. 1 mark for 7.44.

- (b) The charity says,

“On average, each volunteer worked more than 8 hours last month.”

Does your answer to part (a) support this statement?

You must give a reason for your answer.

The estimate of the mean is 7.44 hours.

7.44 is less than 8.

So the data does not support the statement.

Answer: No: the estimated mean is 7.44 hours, which is less than 8 hours

Tip: Use your number from part (a) in the reason. “No, because it is an estimate” does not get the mark.
