

Estimating the mean from a grouped frequency table

Worked solutions

GCSE Maths topic practice



This topic online

- 1 The table shows the number of children in each of 20 families.

Number of children	Frequency
0	3
1	8
2	6
3	3

Work out the mean number of children per family.

(3 marks)

$$\text{Total children} = (0 \times 3) + (1 \times 8) + (2 \times 6) + (3 \times 3) = 0 + 8 + 12 + 9 = 29$$

$$\text{Total families} = 20$$

$$\text{Mean} = 29 \div 20 = 1.45$$

1.45

2

The grouped frequency table shows the time, t minutes, that 30 pupils took to get to school.

Time (t minutes)	Frequency
$0 < t \leq 10$	4
$10 < t \leq 20$	9
$20 < t \leq 30$	12
$30 < t \leq 40$	5

- a. Write down the modal class.
b. Work out an estimate for the mean time.

(4 marks)

a)

Highest frequency is 12

modal class: $20 < t \leq 30$

b) midpoint $\times$ frequency

$$5 \times 4 = 20$$

$$15 \times 9 = 135$$

$$25 \times 12 = 300$$

$$35 \times 5 = 175$$

$$\text{total} = 630$$

$$630 \div 30 = 21$$

a) $20 < t \leq 30$ b) 21 minutes

3

The table shows information about the time, t minutes, that 30 customers waited at a garage.

Time (t minutes)	Frequency
$0 < t \leq 10$	4
$10 < t \leq 20$	9
$20 < t \leq 30$	12
$30 < t \leq 40$	5

Work out an estimate for the mean waiting time.

(3 marks)

The individual measurements are unknown. Represent each class by its midpoint, halfway between its boundaries, then multiply by its frequency to estimate that class's total. Divide the sum of these totals by the total frequency

Use the midpoints 5, 15, 25 and 35

$$(5 \times 4) + (15 \times 9) + (25 \times 12) + (35 \times 5) = 20 + 135 + 300 + 175 = 630$$

$$\text{Estimated mean} = 630 \div 30 = 21 \text{ minutes}$$

21 minutes

4

The table shows information about the masses, m kg, of 40 parcels handled by a courier.

Mass (m kg)	Frequency
$0 < m \leq 2$	7
$2 < m \leq 4$	10
$4 < m \leq 6$	14
$6 < m \leq 8$	9

Calculate an estimate for the mean mass of the parcels.

(3 marks)

The individual measurements are unknown. Represent each class by its midpoint, halfway between its boundaries, then multiply by its frequency to estimate that class's total. Divide the sum of these totals by the total frequency

Use the midpoints 1, 3, 5 and 7

$$(1 \times 7) + (3 \times 10) + (5 \times 14) + (7 \times 9) = 7 + 30 + 70 + 63 = 170$$

$$\text{Estimated mean} = 170 \div 40 = 4.25 \text{ kg}$$

4.25 kg

5

The table shows information about the lengths, l cm, of 40 courgettes grown on an allotment.

Length (l cm)	Frequency
$10 < l \leq 20$	6
$20 < l \leq 30$	11
$30 < l \leq 40$	13
$40 < l \leq 50$	10

a. Write down the class interval that contains the median.

b. Work out an estimate for the mean length.

(4 marks)

The individual measurements are unknown. Represent each class by its midpoint, halfway between its boundaries, then multiply by its frequency to estimate that class's total. Divide the sum of these totals by the total frequency

Cumulative frequencies: 6, 17, 30, 40. The median lies between the 20th and 21st values, which are in the class $30 < l \leq 40$

Use midpoints 15, 25, 35, 45

$$(15 \times 6) + (25 \times 11) + (35 \times 13) + (45 \times 10) = 90 + 275 + 455 + 450 \\ = 1270$$

$$\text{Estimated mean} = 1270 \div 40 = 31.75 \text{ cm}$$

6

The table shows information about the times, t seconds, taken by 40 swimmers to complete one length of a pool.

Time (t seconds)	Frequency
$20 < t \leq 30$	8
$30 < t \leq 40$	15
$40 < t \leq 50$	12
$50 < t \leq 60$	5

- a. Work out an estimate for the mean time.
b. Explain why your answer to part (a) is an estimate.

(4 marks)

The individual measurements are unknown. Represent each class by its midpoint, halfway between its boundaries, then multiply by its frequency to estimate that class's total. Divide the sum of these totals by the total frequency

Use midpoints 25, 35, 45, 55

$$(25 \times 8) + (35 \times 15) + (45 \times 12) + (55 \times 5) = 200 + 525 + 540 + 275 = 1540$$

$$\text{Estimated mean} = 1540 \div 40 = 38.5 \text{ seconds}$$

The mean is an estimate because the individual times within each class are unknown, so midpoints are used to represent them

7

The table shows the heights, h cm, of 20 plants.

Height (h cm)	Frequency
$140 \leq h < 150$	3
$150 \leq h < 160$	8
$160 \leq h < 170$	6
$170 \leq h < 180$	3

- a. Work out an estimate for the mean height.
b. Explain why your answer to part (a) is only an estimate.

(3 marks)

a) midpoint $\times$ frequency

$$145 \times 3 = 435$$

$$155 \times 8 = 1240$$

$$165 \times 6 = 990$$

$$175 \times 3 = 525$$

$$\text{total} = 3190$$

$$3190 \div 20 = 159.5$$

b)

Exact values not known, midpoints assumed

a) 159.5 cm

8

The table shows information about the distances, d km, that 40 employees travel to work.

Distance (d km)	Frequency
$0 < d \leq 5$	9
$5 < d \leq 10$	16
$10 < d \leq 15$	11
$15 < d \leq 20$	4

- Work out an estimate for the mean distance travelled.
- Write down the modal class.
- Work out the fraction of the employees who travel more than 10 km. Give your fraction in its simplest form.

(5 marks)

The individual measurements are unknown. Represent each class by its midpoint, halfway between its boundaries, then multiply by its frequency to estimate that class's total. Divide the sum of these totals by the total frequency

Use midpoints 2.5, 7.5, 12.5, 17.5

$$(2.5 \times 9) + (7.5 \times 16) + (12.5 \times 11) + (17.5 \times 4) = 22.5 + 120 + 137.5 + 70 = 350$$

$$\text{Estimated mean} = 350 \div 40 = 8.75 \text{ km}$$

The modal class is the class with the highest frequency: $5 < d \leq 10$

More than 10 km

$$11 + 4 = 15 \text{ employees, so the fraction is } \frac{15}{40} = \frac{3}{8}$$

The table shows information about the heights, h cm, of 40 students.

Height (h cm)	Frequency
$140 < h \leq 150$	6
$150 < h \leq 160$	14
$160 < h \leq 170$	16
$170 < h \leq 180$	4

- Work out an estimate for the mean height.
- Work out the percentage of the students who are more than 160 cm tall.
- Explain why your answer to part (a) is only an estimate.

(6 marks)

The individual measurements are unknown. Represent each class by its midpoint, halfway between its boundaries, then multiply by its frequency to estimate that class's total. Divide the sum of these totals by the total frequency

Use midpoints 145, 155, 165, 175

$$(145 \times 6) + (155 \times 14) + (165 \times 16) + (175 \times 4) = 870 + 2170 + 2640 + 700 = 6380$$

$$\text{Estimated mean} = 6380 \div 40 = 159.5 \text{ cm}$$

Students more than 160 cm tall are in the last two classes

$$16 + 4 = 20$$

$$20 \text{ out of } 40 = 50\%$$

The mean is an estimate because the individual heights within each class are not known