Estimated Mean from Grouped Data

Practice Worksheet (Problem Solving)

I Do

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

Height (h cm)	**Frequency**
$10 < h \leq 20$	8
$20 < h \leq 30$	14
$30 < h \leq 40$	12
$40 < h \leq 50$	6

(a) Write down the modal class interval. (1)

(b) Calculate an estimate for the mean height of the plants. (3)

..... cm

(Total for Question is 4 marks)

Video walkthrough

We Do

The table shows information about the weights, w kg, of 50 parcels.

Weight (w kg)	**Frequency**
$0 < w \leq 2$	10
$2 < w \leq 4$	15
$4 < w \leq 6$	20
$6 < w \leq 8$	5

(a) Write down the modal class interval. (1)

(b) Calculate an estimate for the mean weight of the parcels. (3)

..... kg

(Total for Question is 4 marks)

You Do 1

The table shows information about the times, t minutes, taken by 60 students to travel to school.

Time (t minutes)	**Frequency**
$0 < t \leq 10$	12
$10 < t \leq 20$	24
$20 < t \leq 30$	18
$30 < t \leq 40$	6

(a) Write down the modal class interval. (1)

(b) Calculate an estimate for the mean time taken. (3)

..... minutes

(c) Write down the class interval which contains the median. (1)

(Total for Question is 5 marks)

You Do 2

The table shows information about the distances, d km, travelled by 80 delivery trucks in a day.

Distance (d km)	**Frequency**
$0 < d \leq 20$	15
$20 < d \leq 40$	35
$40 < d \leq 60$	20
$60 < d \leq 80$	10

(a) Write down the modal class interval. (1)

(b) Calculate an estimate for the mean distance travelled. (3)

..... km

(c) Write down the class interval which contains the median. (1)

(Total for Question is 5 marks)

You Do 3

The table shows information about the speeds, s km/h, of 100 cyclists passing a checkpoint.

Speed (s km/h)	**Frequency**
$10 < s \leq 15$	20
$15 < s \leq 20$	45
$20 < s \leq 25$	25
$25 < s \leq 30$	10

(a) Write down the modal class interval. (1)

(b) Calculate an estimate for the mean speed of the cyclists. (3)

..... km/h

(c) Write down the class interval which contains the median. (1)

(Total for Question is 5 marks)

Challenge 1

The table gives information about the lengths, L cm, of some pieces of wood.

Length (L cm)	**Frequency**
$0 < L \leq 10$	4
$10 < L \leq 20$	8
$20 < L \leq 30$	x
$30 < L \leq 40$	6

(a) An estimate for the mean length of the pieces of wood is 21 cm. Work out the value of x. Show clear algebraic working. (4)

(b) Write down the modal class interval. (1)

(c) Write down the class interval which contains the median. (1)

(Total for Question is 6 marks)

Challenge 2

The table gives information about the ages, A years, of 50 members of a sports club.

Age (A years)	**Frequency**
$0 < A \leq 10$	x
$10 < A \leq 20$	15
$20 < A \leq 30$	12
$30 < A \leq 40$	y
$40 < A \leq 50$	5

(a) An estimate for the mean age of the members is 24.6 years. Work out the value of x and the value of y. Show clear algebraic working. (5)

(b) Write down the modal class interval. (1)

(c) Write down the class interval which contains the median. (1)

(Total for Question is 7 marks)

Extreme Challenge

A researcher recorded the masses of 50 rocks in a grouped frequency table. The classes used were $0 - 10$, $10 - 20$, $20 - 30$, $30 - 40$, and $40 - 50$ (all in kg).

From this table, the researcher calculated an estimate for the mean mass to be 25.4 kg.

Later, the researcher discovered an error in the table. Exactly 10 rocks that were recorded in the $10 < m \leq 20$ class should have been recorded in the $30 < m \leq 40$ class.

(a) Without knowing any of the other original frequencies, calculate the new, correct estimate for the mean mass of the 50 rocks. (4)

(b) Explain why the median class interval of the corrected data cannot be determined from the information given. (1)

(Total for Question is 5 marks)

Answers & Worked Solutions

I Do

(a) The highest frequency is 14, so the modal class interval is $20 < h \leq 30$.

(b) Midpoints: 15, 25, 35, 45.

Products of midpoint and frequency: 120, 350, 420, 270.

Total frequency $= 8 + 14 + 12 + 6 = 40$.

Sum of products $= 120 + 350 + 420 + 270 = 1160$.

Estimated mean $= \frac{1160}{40} = 29$ cm.

We Do

(a) The highest frequency is 20, so the modal class interval is $4 < w \leq 6$.

(b) Midpoints: 1, 3, 5, 7.

Products: $10 \times 1 = 10$; $15 \times 3 = 45$; $20 \times 5 = 100$; $5 \times 7 = 35$.

Total frequency $= 50$. Sum of products $= 10 + 45 + 100 + 35 = 190$.

Estimated mean $= \frac{190}{50} = 3.8$ kg.

You Do 1

(a) The highest frequency is 24: modal class interval $10 < t \leq 20$.

(b) Midpoints: 5, 15, 25, 35.

Products: $12 \times 5 = 60$; $24 \times 15 = 360$; $18 \times 25 = 450$; $6 \times 35 = 210$.

Total frequency $= 60$. Sum of products $= 60 + 360 + 450 + 210 = 1080$.

Estimated mean $= \frac{1080}{60} = 18$ minutes.

(c) The median lies between the 30th and 31st values.

Cumulative frequencies: 12, 36, 54, 60. Both middle values are in $10 < t \leq 20$.

Median class interval: $10 < t \leq 20$.

You Do 2

(a) The highest frequency is 35: modal class interval $20 < d \leq 40$.

(b) Midpoints: 10, 30, 50, 70.

Products: $15 \times 10 = 150$; $35 \times 30 = 1050$; $20 \times 50 = 1000$; $10 \times 70 = 700$.

Total frequency $= 80$. Sum of products $= 150 + 1050 + 1000 + 700 = 2900$.

Estimated mean $= \frac{2900}{80} = 36.25$ km.

(c) The median lies between the 40th and 41st values.

Cumulative frequencies: 15, 50, 70, 80. Both middle values are in $20 < d \leq 40$.

Median class interval: $20 < d \leq 40$.

You Do 3

(a) The highest frequency is 45: modal class interval $15 < s \leq 20$.

(b) Midpoints: 12.5, 17.5, 22.5, 27.5.

Products: 250, 787.5, 562.5, 275.

Total frequency $= 100$. Sum of products $= 250 + 787.5 + 562.5 + 275 = 1875$.

Estimated mean $= \frac{1875}{100} = 18.75$ km/h.

(c) The median lies between the 50th and 51st values.

Cumulative frequencies: 20, 65, 90, 100. Both middle values are in $15 < s \leq 20$.

Median class interval: $15 < s \leq 20$.

Challenge 1

(a) Midpoints: 5, 15, 25, 35. Total frequency $= 18 + x$.

Sum of products $= 4 \times 5 + 8 \times 15 + 25x + 6 \times 35 = 350 + 25x$.

$\frac{350 + 25x}{18 + x} = 21$.

$350 + 25x = 21(18 + x) = 378 + 21x$.

$4x = 28$, so $x = 7$.

(b) Frequencies are 4, 8, 7, 6. The modal class interval is $10 < L \leq 20$.

(c) There are 25 pieces, so the median is the 13th value.

Cumulative frequencies: 4, 12, 19, 25. Median class interval: $20 < L \leq 30$.

Challenge 2

(a) $x + 15 + 12 + y + 5 = 50$, so $x + y = 18$ and $y = 18 - x$.

Midpoints: 5, 15, 25, 35, 45.

Sum of products $= 5x + 225 + 300 + 35y + 225 = 750 + 5x + 35y$.

Substitute $y = 18 - x$: sum of products $= 1380 - 30x$.

$\frac{1380 - 30x}{50} = 24.6$, so $1380 - 30x = 1230$.

$30x = 150$, giving $x = 5$ and $y = 13$.

(b) Frequencies are 5, 15, 12, 13, 5. Modal class interval: $10 < A \leq 20$.

(c) The median lies between the 25th and 26th values.

Cumulative frequencies: 5, 20, 32, 45, 50. Median class interval: $20 < A \leq 30$.

Extreme Challenge

(a) Original estimated total mass $= 50 \times 25.4 = 1270$ kg.

The affected midpoints are 15 kg and 35 kg, a difference of 20 kg.

Correcting 10 rocks increases the estimated total by $10 \times 20 = 200$ kg.

Corrected estimated total $= 1270 + 200 = 1470$ kg.

Corrected estimated mean $= \frac{1470}{50} = 29.4$ kg.

(b) The full class frequencies are not given. The mean and total frequency do not determine which class contains the 25th and 26th values.

For example, two possible original frequency lists are 0, 10, 34, 0, 6 and 0, 24, 0, 26, 0. Both have total 50 and estimated mean 25.4 kg.

After correction they become 0, 0, 34, 10, 6 and 0, 14, 0, 36, 0.

Their median classes are $20 < m \leq 30$ and $30 < m \leq 40$ respectively.