

## Mean average from grouped data

### Starter

1. (Review of last lesson)

The table shows the number of goals scored in a series of football matches.

|                   |   |   |     |
|-------------------|---|---|-----|
| Number of goals   | 1 | 2 | 3   |
| Number of matches | 8 | 8 | $x$ |

- (a) If the mean number of goals is 2.04, find  $x$ .  
 (b) If the modal number of goals is 3, find the smallest possible value of  $x$ .  
 (c) If the median number of goals is 2, find the largest possible value of  $x$ .

**Working:** (a) *Mean is 2.04:* 
$$\frac{(1 \times 8) + (2 \times 8) + 3x}{8 + 8 + x} = 2.04$$
  

$$\frac{24 + 3x}{16 + x} = 2.04$$
  
*Multiply both sides by  $16 + x$ :*  $24 + 3x = 2.04(16 + x)$   
*Expand the brackets:*  $24 + 3x = 32.64 + 2.04x$   
*Collect like terms:*  $0.96x = 8.64$   
*Divide both sides by 0.96:*  $x = 9$

- (b)  $x$  needs to be the smallest integer above 8 so the smallest possible value of  $x$  is 9

- (c) The last value of 2 is the 16th value so the sum of the frequency cannot exceed twice this number i.e. 32.

$$8 + 8 + x < 32$$

*Simplify:*  $16 + x < 32$   
*Solve:*  $x < 16$

The largest value of  $x$  is 15.

*Alternatively...*

Total number of matches is  $16 + x$

The median value is given by  $\frac{16 + x + 1}{2}$ th value.

The median is 2 so the largest value the formula can be is 16 because from the table the 17th value is 3 goals.

$$\frac{16 + x + 1}{2} = 16$$

Multiply both sides by 2:  $17 + x = 32$

Subtract 17 from both sides:  $x = 15$

The largest value of  $x$  is 15.

2. (Review of last lesson)

The marks obtained by the members of a class are summarised in the table.

|           |     |     |     |
|-----------|-----|-----|-----|
| Mark      | $a$ | $b$ | $c$ |
| Frequency | $x$ | $y$ | $z$ |

Calculate the mean mark in terms of  $a$ ,  $b$ ,  $c$ ,  $x$ ,  $y$  and  $z$ .

**Working:** Total marks =  $ax + by + cz$   
 Total frequency =  $x + y + z$   
 Mean =  $\frac{ax + by + cz}{x + y + z}$

**E.g. 1** The table shows the number of letters delivered to the houses in a street.

|           |       |       |       |        |
|-----------|-------|-------|-------|--------|
| Mark      | 0 – 2 | 3 – 4 | 5 – 7 | 8 – 12 |
| Frequency | 10    | 8     | 5     | 3      |

- (a) Calculate an estimate of the mean number of letters delivered per house.  
 (b) What is the modal class?  
 (c) Find the median class.

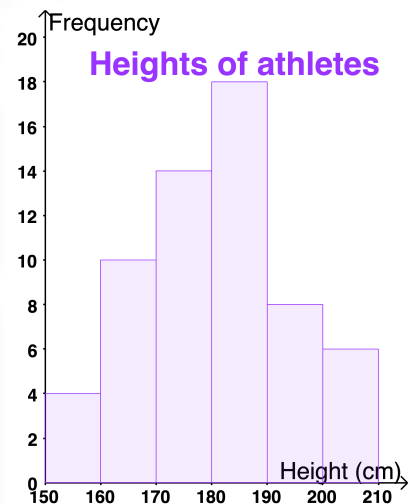
**Working:** (a) Mean  $\approx \frac{(1 \times 10) + (3.5 \times 8) + (6 \times 5) + (10 \times 3)}{26}$   
 $= 3.77$

(b) Modal class = 0 – 2 letters (since this has the highest frequency)

(c) Median is given by the  $\frac{26 + 1}{2} = 13.5$ th value  
 i.e. the mean of the 13th and 14th values  
 The running total goes: 10, 18, 23, 26  
 So the 13th and 14th values are both in the 2nd interval i.e.  
 $70 \leq t < 80$   
 Therefore, the median class is 3 – 4 letters

**E.g. 2** The bar chart shows the heights of 60 athletes.

- (a) Calculate an estimate for the mean height of the 60 athletes.  
 (b) Explain why your answer is an **estimate** for the mean height.



**Working:** (a) The mid-interval values are 155, 165, 175, 185, 195, 205.  
 The corresponding frequencies are 4, 10, 14, 18, 8, 6

Mean  $\approx \frac{(4 \times 155) + (10 \times 165) + (14 \times 175) + (18 \times 185) + (8 \times 195) + (6 \times 205)}{60}$

Mean  $\approx 180\frac{2}{3}$  cm

- (b) The answer in (a) is an estimate because the raw data is unavailable and an assumption has been made with the midpoint of each interval.

**Video:** [Estimating the mean from grouped data](#)

**Exercise**

|                      |                   |
|----------------------|-------------------|
| 9-1 class textbook:  | p475 M14.4 Qu 1-6 |
| A*-G class textbook: | p429 M14.4 Qu 1-6 |
| 9-1 homework book:   | p163 M14.4 Qu 1-3 |
| A*-G homework book:  | p120 M14.4 Qu 1-3 |

