

Interpreting Histograms

Solutions

For AQA GCSE Mathematics (8300) • Higher 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 histogram shows the masses of some parcels (bar heights 1.5, 4, 6, 2.5 and 0.5).

(a) Use the histogram to complete the frequency table.

Frequency = frequency density $\times$ class width

$$10 \times 1.5 = 15, \quad 5 \times 4 = 20, \quad 5 \times 6 = 30, \quad 10 \times 2.5 = 25, \quad 20 \times 0.5 = 10$$

Mass (m kg)	Frequency
$0 < m \leq 10$	15
$10 < m \leq 15$	20
$15 < m \leq 20$	30
$20 < m \leq 30$	25
$30 < m \leq 50$	10

Answer: 15, 20, 30, 25, 10

Tip: The height of a bar is the frequency density, not the frequency. Multiply by the class width.

Marks: 2 marks for all five correct. 1 mark for three correct.

(b) How many parcels were weighed?

Add up the frequencies from part (a):

$$15 + 20 + 30 + 25 + 10 = 100$$

Answer: 100

- (c) Estimate the number of parcels with a mass between 12 kg and 25 kg.

Split 12 to 25 kg into parts and find the area of each part:

12 to 15: width 3, height 4, so $3 \times 4 = 12$

15 to 20: the whole bar, 30

20 to 25: width 5, height 2.5, so $5 \times 2.5 = 12.5$

Total = $12 + 30 + 12.5 = 54.5$, so about 55 parcels

Answer: 54.5 (about 55)

Tip: For part of a class, use only the width you need, e.g. 12 to 15 is 3 kg wide, not the whole 5 kg.

Marks: 1 mark for a correct method using parts of the bars, e.g. 3×4 or 5×2.5 . 1 mark for 54.5 (or 55).

2 (2 marks)

In a histogram, the bar for the class $0 < x \leq 5$ has frequency 20 and height 4 cm.

The bar for the class $5 < x \leq 15$ has frequency 30

Work out the height of this bar.

First bar: frequency density = $20 \div 5 = 4$

This is shown by a height of 4 cm, so 1 cm stands for 1 unit of frequency density.

Second bar: frequency density = $30 \div 10 = 3$

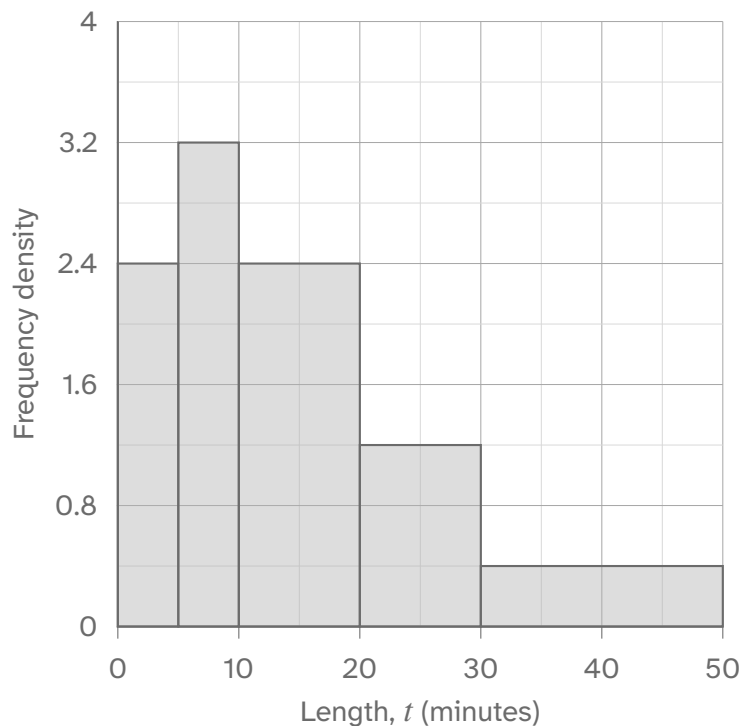
So the height is 3 cm.

Answer: 3 cm

Marks: 1 mark for working out a frequency density (e.g. $20 \div 5 = 4$ or $30 \div 10 = 3$). 1 mark for 3 cm.

3 (5 marks)

The histogram shows the lengths, in minutes, of the calls made to a helpline one morning.



- (a) Work out an estimate of the mean length of a call.
You may use the table to help you.

Frequency = frequency density $\times$ class width, e.g. $2.4 \times 5 = 12$

Length, t (minutes)	Frequency	Midpoint
$0 < t \leq 5$	12	2.5
$5 < t \leq 10$	16	7.5
$10 < t \leq 20$	24	15
$20 < t \leq 30$	12	25
$30 < t \leq 50$	8	40

Total number of calls = $12 + 16 + 24 + 12 + 8 = 72$

$$2.5 \times 12 = 30, 7.5 \times 16 = 120, 15 \times 24 = 360, 25 \times 12 = 300, 40 \times 8 = 320$$

Total of midpoint $\times$ frequency = 1130

Mean $\approx 1130 \div 72 = 15.69 \dots$

Answer: 15.7 minutes

Tip: The heights of the bars are frequency densities. Change them to frequencies before you multiply by the midpoints.

Marks: 1 mark for three correct frequencies. 1 mark for three midpoint $\times$ frequency values. 1 mark for dividing by the total frequency, 72. 1 mark for 15.7.

- (b) Later that morning, 10 more calls are made to the helpline.
Each of these calls is shorter than 5 minutes.
Will the estimate of the mean length of a call increase, decrease or stay the same?
Give a reason for your answer.

Each new call is shorter than 5 minutes.

This is well below the mean of about 15.7 minutes.

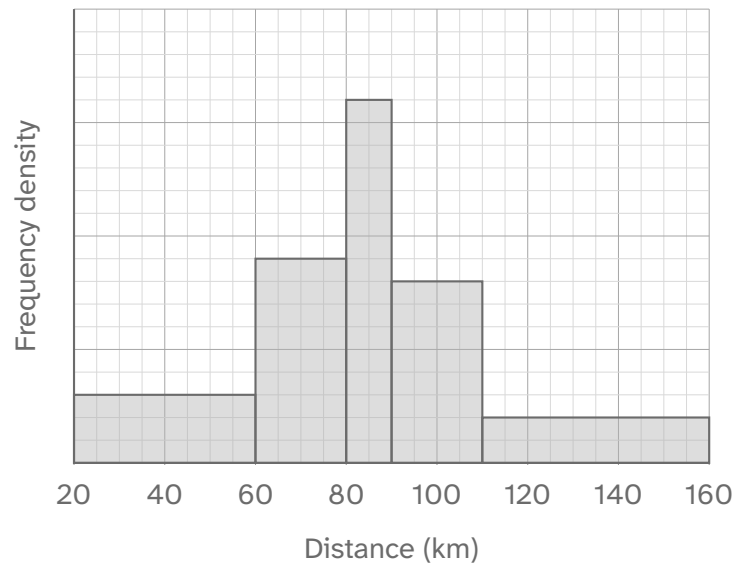
Adding values below the mean makes the mean smaller.

Answer: Decrease: the new calls are all shorter than the mean

4 (4 marks)

The histogram shows the distances cycled by the members of a cycling club one weekend.

The scale on the frequency density axis is not shown.



Estimate the fraction of the members who cycled between 70 km and 100 km.

The axis has no scale, so use areas. Count small squares (each is 5 km wide).

Areas of the bars: $8 \times 3 = 24$, $4 \times 9 = 36$, $2 \times 16 = 32$, $4 \times 8 = 32$, $10 \times 2 = 20$

Total area = $24 + 36 + 32 + 32 + 20 = 144$ squares

70 to 80 km: half of the 60 to 80 bar, $2 \times 9 = 18$ squares

80 to 90 km: the whole bar, 32 squares

90 to 100 km: half of the 90 to 110 bar, $2 \times 8 = 16$ squares

$18 + 32 + 16 = 66$ squares

$$\text{Fraction} = \frac{66}{144} = \frac{11}{24}$$

Answer: $\frac{66}{144} = \frac{11}{24}$

Tip: You do not need a scale for a fraction: compare areas. For 70 to 80 km and 90 to 100 km use only half of those bars.

Marks: 1 mark for the area of at least three bars. 1 mark for the total area, 144. 1 mark for 66 squares between 70 and 100 km. 1 mark for $\frac{66}{144}$ or $\frac{11}{24}$.

5 (6 marks)

The histogram shows information about the lengths of 840 leaves. The scale on the frequency density axis is missing.

- (a) How many leaves have a length between 30 mm and 40 mm?

Count the area of each bar in small squares (1 mm wide):

$$10 \times 6 = 60, \quad 10 \times 12 = 120, \quad 5 \times 24 = 120, \quad 5 \times 12 = 60, \quad 20 \times 3 = 60$$

Total = 420 squares for 840 leaves.

So each small square represents $840 \div 420 = 2$ leaves.

30 to 40 mm: $120 + 60 = 180$ squares

$$180 \times 2 = 360 \text{ leaves}$$

Answer: 360

Tip: Find what one square is worth first. Here it is 2 leaves, not 1.

Marks: 1 mark for the area of at least three bars. 1 mark for the total area 420 (or 1 square = 2 leaves). 1 mark for 180 squares from 30 to 40 mm. 1 mark for 360.

- (b) Estimate the number of leaves with a length less than 25 mm.

10 to 20 mm: the whole first bar, 60 squares.

20 to 25 mm: half of the second bar, $5 \times 12 = 60$ squares.

$$60 + 60 = 120 \text{ squares}$$

$$120 \times 2 = 240 \text{ leaves}$$

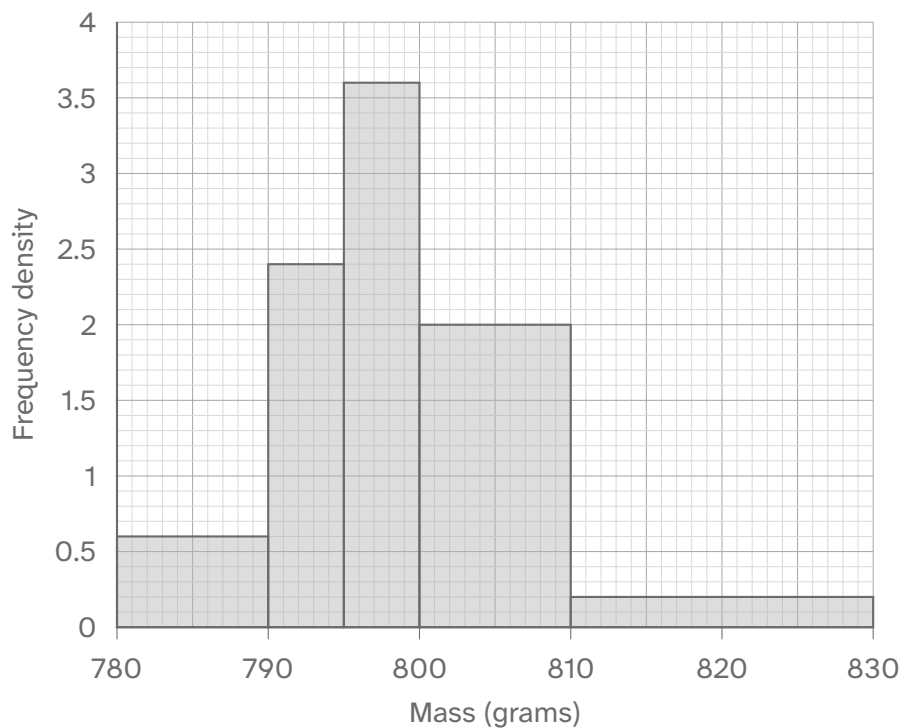
Answer: 240

Marks: 1 mark for 60 + 60 squares (or 120 + 120 leaves). 1 mark for 240.

6 (4 marks)

A bakery checks the masses of a sample of 60 loaves.

A histogram is drawn to represent the data.



Loaves with a mass less than 785 grams are rejected.

One week the bakery rejects 225 loaves.

Use the sample to estimate the total number of loaves the bakery made that week.

Frequency = class width $\times$ frequency density

The first bar is 780 to 790 g with frequency density 0.6.

780 to 785 (half of the first bar): $5 \times 0.6 = 3$ loaves

So 3 out of the 60 loaves in the sample would be rejected.

$$\frac{3}{60} = \frac{1}{20}, \text{ which is } 5\%$$

5% of the loaves made is 225, so 1% is 45

Total = $45 \times 100 = 4500$ loaves

Answer: 4500

Tip: Use only the part of the first bar below 785 g. Then the 225 rejected loaves are $\frac{3}{60}$ of all the loaves made, so divide, do not multiply.

Marks: 1 mark for frequency density $\times$ class width. 1 mark for 3 loaves in the sample. 1 mark for $\frac{3}{60}$ (or 5%). 1 mark for 4500.
