

Drawing Histograms

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 (2 marks)

The table gives information about the lengths of some leaves.

Complete the table.

Class width = upper end – lower end, e.g. $15 - 10 = 5$

Frequency density = frequency $\div$ class width

$15 \div 10 = 1.5$, $20 \div 5 = 4$, $24 \div 15 = 1.6$, $10 \div 20 = 0.5$

Length (x cm)	Frequency	Class width	Frequency density
$0 < x \leq 10$	15	10	1.5
$10 < x \leq 15$	20	5	4
$15 < x \leq 30$	24	15	1.6
$30 < x \leq 50$	10	20	0.5

Answer: Widths 10, 5, 15, 20; frequency densities 1.5, 4, 1.6, 0.5

Marks: 1 mark for the class widths. 1 mark for the frequency densities.

2 (1 mark)

In a histogram, a bar for the class $10 < x \leq 25$ has a height of 2.4
Work out the frequency of this class.

The height of the bar is the frequency density.

$$\text{Class width} = 25 - 10 = 15$$

$$\text{Frequency} = \text{frequency density} \times \text{class width} = 2.4 \times 15 = 36$$

Answer: 36

Tip: The frequency is the **area** of the bar, not its height.

3 (5 marks)

The table gives information about the times, in minutes, that 75 people spent in a museum.

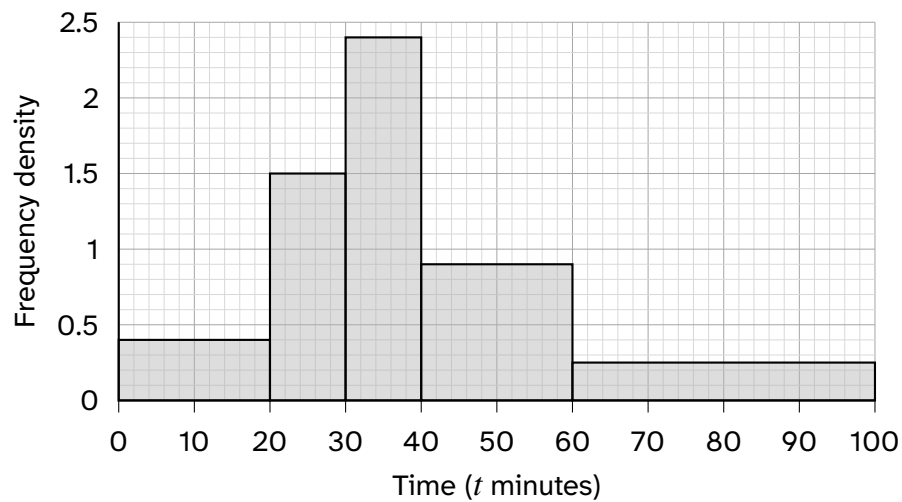
Time (t minutes)	Frequency
$0 < t \leq 20$	8
$20 < t \leq 30$	15
$30 < t \leq 40$	24
$40 < t \leq 60$	18
$60 < t \leq 100$	10

(a) On the grid, draw a histogram for this information.

Frequency density = frequency $\div$ class width:

$$8 \div 20 = 0.4, \quad 15 \div 10 = 1.5, \quad 24 \div 10 = 2.4, \quad 18 \div 20 = 0.9, \quad 10 \div 40 = 0.25$$

Draw each bar across its whole class, with no gaps.



Answer: See histogram

Tip: Do not draw bars with heights equal to the frequencies. Each small square on the vertical axis is 0.1.

Marks: 3 marks for all five bars correct. 2 marks for four correct bars. 1 mark for two correct bars or all the frequency densities.

- (b) Work out an estimate for the number of people who spent more than 50 minutes in the museum.

The class $40 < t \leq 60$ has 18 people.

50 to 60 is half of this class, so estimate half of $18 = 9$ people.

All 10 people in $60 < t \leq 100$ spent more than 50 minutes.

Total = $9 + 10 = 19$

Answer: 19

Marks: 1 mark for 9 (half of 18). 1 mark for 19.

4 (5 marks)

The table gives information about the distances, in km, that 120 members of a cycling club rode last weekend.

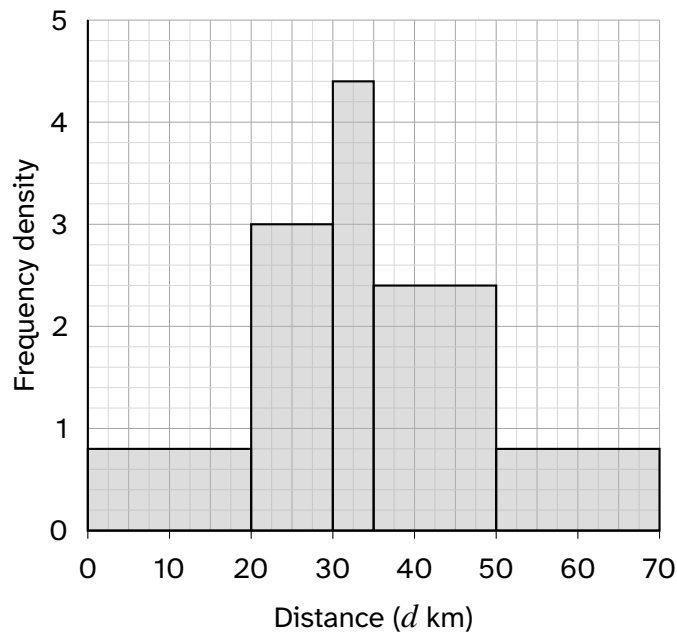
Distance (d km)	Frequency
$0 < d \leq 20$	16
$20 < d \leq 30$	30
$30 < d \leq 35$	22
$35 < d \leq 50$	36
$50 < d \leq 70$	16

- (a) On the grid, draw a histogram for this information.

Frequency density = frequency $\div$ class width:

$$16 \div 20 = 0.8, \quad 30 \div 10 = 3, \quad 22 \div 5 = 4.4, \quad 36 \div 15 = 2.4, \quad 16 \div 20 = 0.8$$

The largest is 4.4, so label the axis from 0 to 5.



Answer: See histogram

Tip: Label the frequency density axis with a sensible scale, and draw the bars at the class boundaries (e.g. 30 to 35).

Marks: 3 marks for a fully correct histogram. 2 marks for three correct bars. 1 mark for two correct bars or all the frequency densities.

- (b) Work out an estimate for the number of these members who rode between 25 km and 45 km.

Split the distance from 25 to 45 km into parts:

$$25 < d \leq 30 \text{ is half of the class } 20 < d \leq 30: \frac{1}{2} \times 30 = 15$$

$$30 < d \leq 35 \text{ is a whole class: } 22$$

$$35 < d \leq 45 \text{ is } \frac{10}{15} \text{ of the class } 35 < d \leq 50: \frac{10}{15} \times 36 = 24$$

Estimate = $15 + 22 + 24 = 61$ members

Answer: 61

Tip: Only part of the $35 < d \leq 50$ class is below 45 km: 10 of its 15 km, so take $\frac{10}{15}$ of 36.

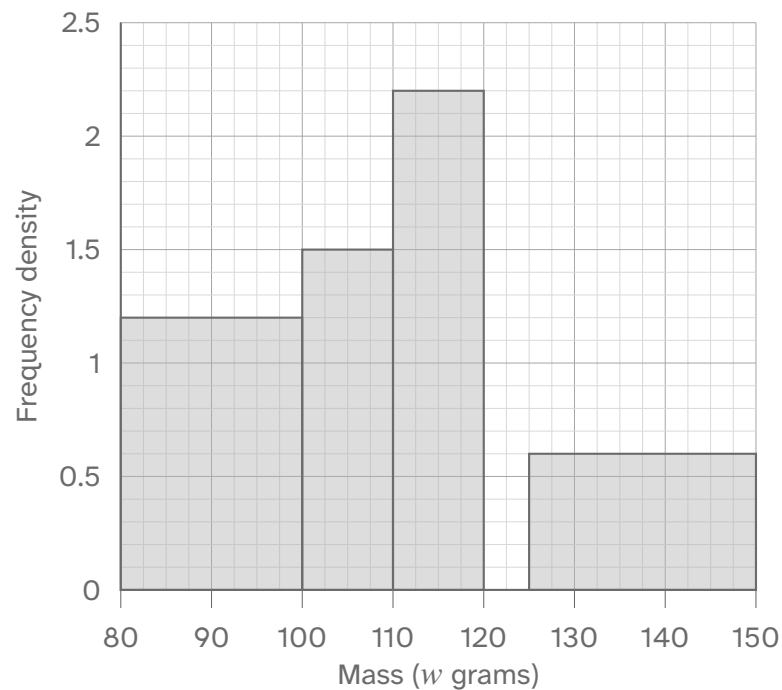
Marks: 1 mark for two of 15, 22 and 24. 1 mark for 61.

5 (2 marks)

The table gives information about the masses, in grams, of some apples.

Mass (w grams)	Frequency
$80 < w \leq 100$	12
$100 < w \leq 110$	15
$110 < w \leq 120$	22
$120 < w \leq 150$	18

Ifan drew this histogram for the information in the table.



Write down **two** mistakes Ifan made.

1. The first bar is the wrong height.

Its frequency density is $12 \div 20 = 0.6$, but Ifan drew it at 1.2 (he divided by 10, not 20).

2. There is a gap between 120 and 125.

The last bar should start at 120, so the bars touch.

Answer: First bar should have height 0.6, not 1.2; the last bar should start at 120 (no gap)

Marks: 1 mark for each correct mistake.

6 (3 marks)

The histogram gives information about the ages of the people at a concert. The bar for $40 < a \leq 60$ is missing.

18 people were aged $20 < a \leq 25$

24 people were aged $40 < a \leq 60$

Complete the histogram.

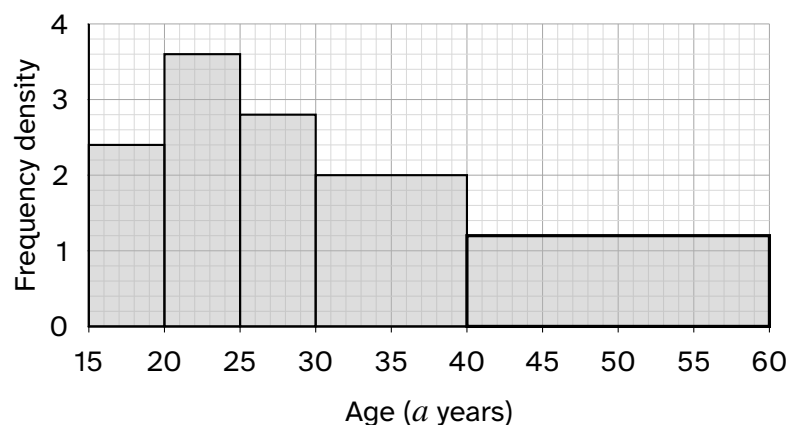
The axis has no scale, so use the bar for $20 < a \leq 25$ to find it.

Frequency density for $20 < a \leq 25 = 18 \div 5 = 3.6$

This bar is 18 small squares tall, so each small square is 0.2 (each big square is 1).

Frequency density for $40 < a \leq 60 = 24 \div 20 = 1.2$

Draw the bar from 40 to 60 with height 1.2 (6 small squares).



Answer: Bar from 40 to 60 with frequency density 1.2 (one third of the height of the $20 < a \leq 25$ bar)

Tip: The missing class is 20 years wide, so its bar is much lower than you might expect for 24 people.

Marks: 1 mark for $18 \div 5 = 3.6$ or a correct scale. 1 mark for $24 \div 20 = 1.2$. 1 mark for the correct bar.

7 (3 marks)

The table and the histogram show information about the lengths of the calls made to a helpline one morning. Both are incomplete.

(a) Use the histogram to complete the table.

The bar for $0 < t \leq 5$ has width 5 and frequency density 4.

Frequency = $5 \times 4 = 20$

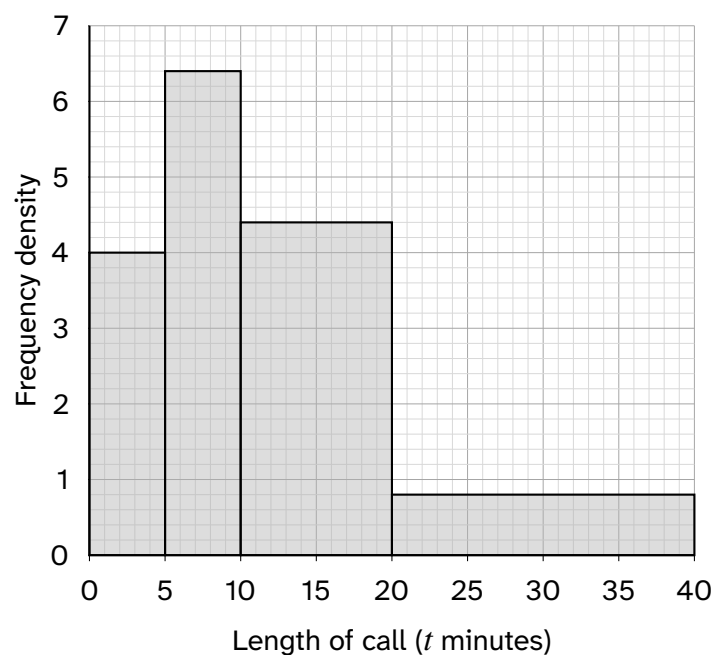
Length of call (t minutes)	Frequency
$0 < t \leq 5$	20
$5 < t \leq 10$	32
$10 < t \leq 20$	44
$20 < t \leq 40$	16

Answer: 20

(b) Use the table to complete the histogram.

$5 < t \leq 10$: frequency density = $32 \div 5 = 6.4$

$10 < t \leq 20$: frequency density = $44 \div 10 = 4.4$



Answer: Bars of height 6.4 and 4.4

Tip: Check your scale: each small square on the vertical axis is 0.2.

Marks: 1 mark for each correct bar.