



eClassroom

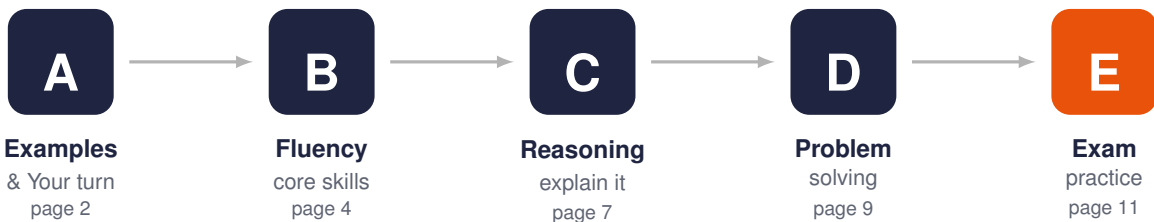
GCSE MATHEMATICS • DATA & STATISTICS

Histograms

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Free Histograms worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: find class widths and midpoints • read and draw frequency diagrams with equal class widths • estimate how many values lie in part of a class • *Higher:* frequency density, drawing and reading histograms with unequal widths, and estimating the median and mean from a histogram.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER Higher only: histograms with unequal class widths, frequency density, and estimating from a histogram. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	15
Higher marks	16	14	17	15
My score				

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A

Worked examples & Your turn

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION

Everyone starts here

Worked example A1

Find the width and the midpoint of the class $10 < h \leq 20$

$$\text{Width} = 20 - 10. \text{ Midpoint} = \frac{10 + 20}{2}$$

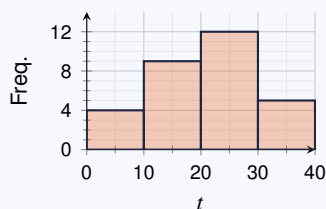
10; 15

Your turn A1

Find the width and the midpoint of the class $5 < t \leq 7.5$

Worked example A2

The frequency diagram shows some times. How many values are there, and which is the modal class?



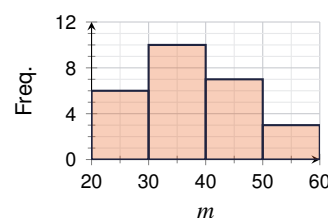
Add the bar heights:

$$4 + 9 + 12 + 5$$

30; $20 < t \leq 30$

Your turn A2

How many values are there, and which is the modal class?



Worked example A3

Using the example diagram in A2, estimate how many values are between 25 and 30. *25 to 30 is half of the class $20 < t \leq 30$, which has 12 values.*

6

Your turn A3

Using the Your turn diagram in A2, estimate how many values are more than 35



HIGHER*Higher only: frequency density and histograms***Worked example A4: frequency density**

The class $20 < t \leq 40$ has frequency 30. Find its frequency density. *Frequency density = frequency $\div$ class width = $30 \div 20$*

1.5

Your turn A4

The class $5 < m \leq 7$ has frequency 9. Find its frequency density.

Worked example A5: drawing a histogram

Work out the bar heights for: $0 < x \leq 10$: 8, $10 < x \leq 15$: 12, $15 < x \leq 30$: 18 *Divide each frequency by its width: $8 \div 10$, $12 \div 5$, $18 \div 15$*

0.8, 2.4, 1.2

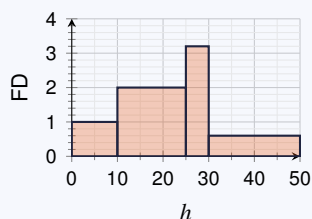
Your turn A5

Work out the bar heights for: $0 < x \leq 5$: 9, $5 < x \leq 20$: 24, $20 < x \leq 25$: 16

Worked example A6: reading a histogram

How many values are in the class $10 < h \leq 25$?

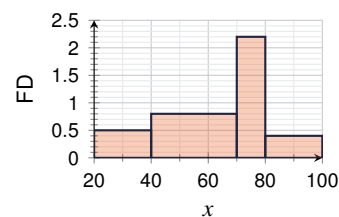
Frequency = height $\times$ width = 2×15



30

Your turn A6

How many values are in the class $40 < x \leq 70$?

**Worked example A7: estimating from a histogram**

Using the example histogram in A6, estimate how many values are between 20 and 28 *20 to 25: $5 \times 2 = 10$. 25 to 28: $3 \times 3.2 = 9.6$*

about 20

Your turn A7

Using the Your turn histogram in A6, estimate how many values are more than 75



B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION

Everyone starts here

B1 Find the width and the midpoint of each class.

(a) $0 < t \leq 20$

(b) $20 < t \leq 25$

(c) $25 < t \leq 60$

(d) $1.5 < m \leq 2.5$

[4 marks]

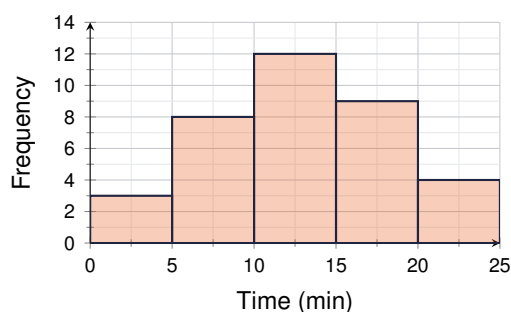
B2 The diagram shows some times.

(a) How many are in $10 < t \leq 15$?

(b) How many values are there?

(c) Which is the modal class?

(d) What fraction are more than 15?



[4 marks]

B3 The table shows some masses.

Mass w (kg)	$0 < w \leq 20$	$20 < w \leq 40$	$40 < w \leq 60$	$60 < w \leq 80$
Frequency	5	11	8	4

(a) What is the width of each bar?

(b) How tall is the bar for $20 < w \leq 40$?

(c) Which is the modal class?

(d) How many masses are there?

[4 marks]

B4 Use the diagram in B2. Assume the values in each class are evenly spread. Estimate how many times are

(a) less than 7.5

(b) more than 12.5

(c) between 5 and 12.5

(d) more than 22.5

[4 marks]

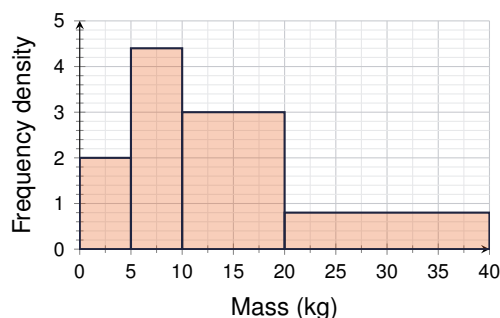


FOUNDATION*continued: bars, gaps and widths*

- B5** (a) Why are there no gaps between the bars of a frequency diagram for times?
(b) Why does a bar chart of favourite colours have gaps?
(c) When is it fair to use the height of each bar to compare frequencies? [3 marks]
- B6** Classes $0 < t \leq 10$ and $10 < t \leq 20$ have frequencies 8 and 12. They are joined into one class, $0 < t \leq 20$
(a) What is the frequency of the new class? (b) What is its width?
(c) If the new bar's height were its frequency, how would it compare with the old bars?
(d) What height would keep the area of the new bar equal to the total area of the old bars? [4 marks]

HIGHER*Higher tier only*

- B7** Find the frequency density for each class.
- (a) $0 < t \leq 10$, frequency 14 (b) $10 < t \leq 15$, frequency 22
(c) $15 < t \leq 30$, frequency 21 (d) $2 < m \leq 2.5$, frequency 9 [4 marks]
- B8** The histogram shows some masses. Find the frequency of each class.
- (a) $0 < w \leq 5$ (b) $5 < w \leq 10$
(c) $10 < w \leq 20$ (d) $20 < w \leq 40$



[4 marks]



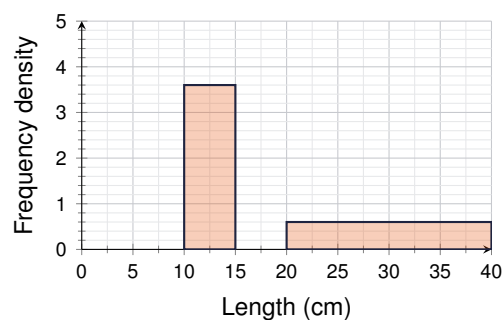
HIGHER

continued: completing and estimating

B9 The table and the histogram show the same information, but both are incomplete.

Length l (cm)	$0 < l \leq 10$	$10 < l \leq 15$	$15 < l \leq 20$	$20 < l \leq 40$
Frequency	12		24	

- Find the frequency for $10 < l \leq 15$
- Find the frequency for $20 < l \leq 40$
- Find the height of the bar for $0 < l \leq 10$
- Find the height of the bar for $15 < l \leq 20$



[4 marks]

B10 Use the histogram in B8. Estimate how many masses are

- (a) less than 8 kg (b) more than 30 kg
(c) between 7 kg and 15 kg (d) Which class contains the median?

[4 marks]





Reasoning

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Sam draws a frequency diagram of times with gaps between the bars. Explain why this is wrong. [2 marks]
- C2** In a frequency diagram with equal class widths, how can you tell which class has the most values? Explain. [2 marks]
- C3** Explain why the height of a bar can be used to compare frequencies only when all the classes have the same width. [3 marks]
- C4** A frequency diagram with equal widths has bars of heights 6, 9, 12 and 3
Show that 40% of the values are in the tallest bar's class. [3 marks]



HIGHER*Higher tier only*

- C5** Kai draws a histogram of classes with different widths, using the frequency for the height of each bar. Explain his mistake, and what he should plot instead. [3 marks]
- C6** Explain why the area of each bar of a histogram, not its height, shows the frequency. [3 marks]
- C7** Jo says, "The tallest bar in a histogram is always the class with the most values."
Give an example with two classes to show that Jo is wrong. [3 marks]
- C8** On a histogram, the bar for $0 < x \leq 10$ is 2 cm wide and 3 cm tall and represents 30 people.
- (a) How many people does 1 cm^2 represent?
- (b) The bar for $10 < x \leq 30$ is 4 cm wide and 2 cm tall. How many people does it represent?
- (c) The class $30 < x \leq 60$ has 15 people. How tall should its bar be? [5 marks]



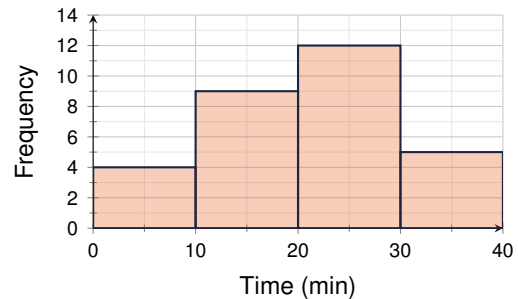
D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

- D1** The diagram shows the times of some runners. What percentage took more than 30 minutes?



[3 marks]

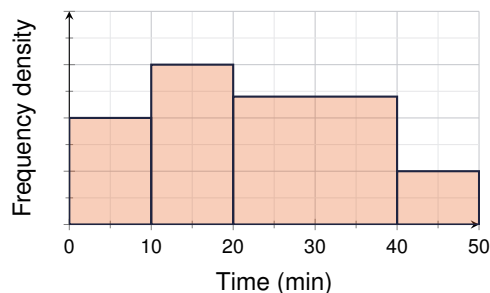
- D2** The heights of 30 boys and 30 girls were grouped in the same 10 cm classes. The modal class for the boys was $160 < h \leq 170$ and for the girls $150 < h \leq 160$
- (a) What does this suggest about the heights?
- (b) For the boys, the frequencies were 3, 8, 12 and x . Find x . [4 marks]
- D3** An equal-width frequency diagram has 40 values. Three bars have heights 7, 15 and 11. How tall is the fourth bar? [3 marks]
- D4** Estimate the mean time from the frequency diagram in D1, using the midpoints of the classes. [3 marks]



HIGHER*Higher tier only*

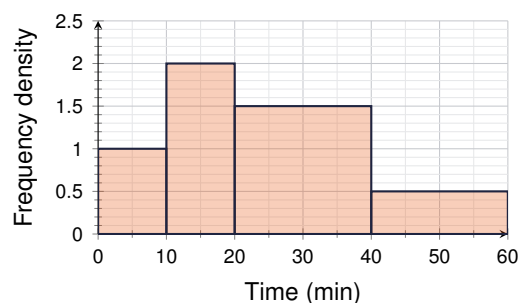
- D5** The histogram has no scale on the vertical axis. The bar for $10 < t \leq 20$ represents 15 people.

How many people are shown altogether?



[4 marks]

- D6** Estimate the median from the histogram.



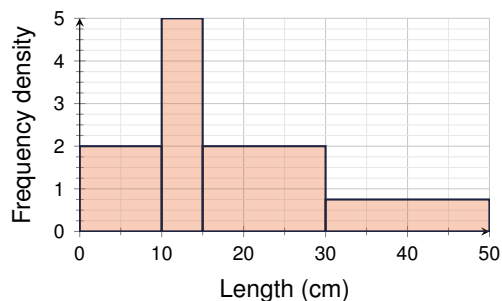
[4 marks]

- D7** Use the histogram in D6. Estimate the mean time.

[4 marks]

- D8** The histogram shows some lengths.

- (a) Find the total number of lengths.
(b) One length is chosen at random. Find the probability that it is more than 15 cm.
(c) Given that it is more than 15 cm, find the probability that it is more than 30 cm.



[5 marks]



E

Exam practice

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION

Foundation and Higher crossover

- E1** The frequency diagram shows the masses of some parcels.

(a) How many parcels are in $20 < w \leq 30$?

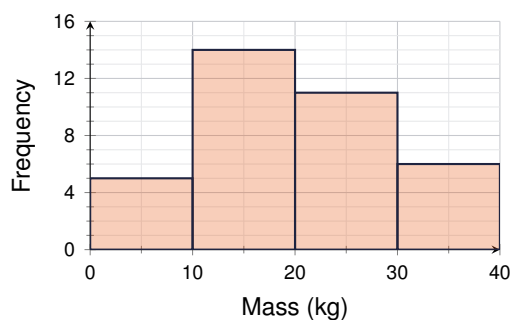
.....
(1)

(b) How many parcels are there?

.....
(1)

(c) Write down the modal class.

.....
(1)



(Total for Question E1 is 3 marks)

- E2** The table shows some times.

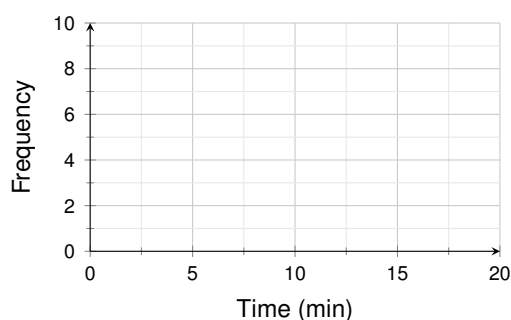
Time t (min)	$0 < t \leq 5$	$5 < t \leq 10$	$10 < t \leq 15$	$15 < t \leq 20$
Frequency	6	9	4	2

(a) Draw a frequency diagram.

(2)

(b) Write down the modal class.

.....
(1)



(Total for Question E2 is 3 marks)



- E3** (a) Write down the width of each class: $0 < t \leq 5$, $5 < t \leq 15$, $15 < t \leq 20$, $20 < t \leq 40$

.....
(2)

- (b) Which class is the widest?

.....
(1)

(Total for Question E3 is 3 marks)

- E4** Use the diagram in E1. Assuming the masses in each class are evenly spread, estimate how many parcels weigh more than 15 kg.

.....
(Total for Question E4 is 3 marks)

- E5** Tom has two classes: $0 < t \leq 10$ with frequency 10, and $10 < t \leq 40$ with frequency 15. He draws bars with heights 10 and 15

- (a) Explain why his diagram gives the wrong impression.

(2)

- (b) What heights should he use instead?

.....
(1)

(Total for Question E5 is 3 marks)

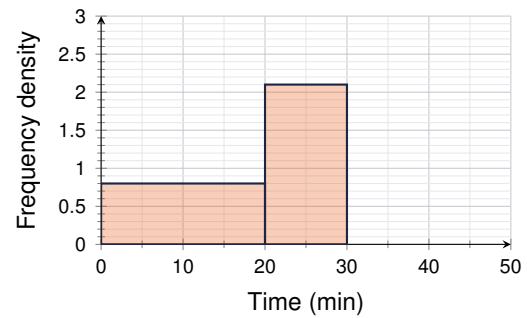


HIGHER*Higher tier only*

E6 The table shows some times. Two bars of the histogram have been drawn.

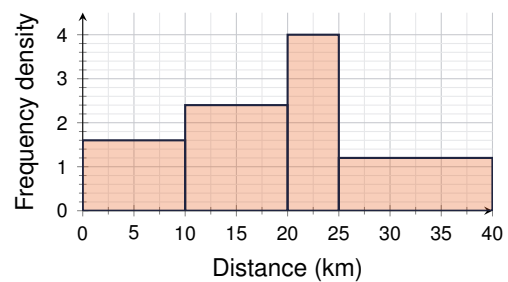
Time t (min)	$0 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 50$
Frequency	16	21	14	12

Complete the histogram.



(Total for Question E6 is 3 marks)

E7 The histogram shows some distances. Work out the total number of distances.



(Total for Question E7 is 3 marks)



E8 The table and the histogram show the same masses. Both are incomplete.

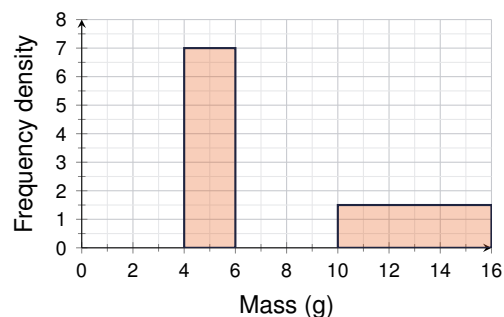
Mass w (g)	$0 < w \leq 4$	$4 < w \leq 6$	$6 < w \leq 10$	$10 < w \leq 16$
Frequency	12		18	

(a) Complete the table.

(2)

(b) Complete the histogram.

(2)



(Total for Question E8 is 4 marks)

E9 A histogram has three bars: $0 < x \leq 10$ with frequency density 1.2, $10 < x \leq 30$ with frequency density k , and $30 < x \leq 40$ with frequency density 0.8. There are 40 values.

(a) Find k .

.....
(2)

(b) Estimate the median.

.....
(2)

(c) Estimate the percentage of values greater than 35

.....
(1)

(Total for Question E9 is 5 marks)

Finished? Mark your work with the **full worked solutions**, fill in your scores on the front page, then keep the skill sharp with unlimited questions on the **Data & Statistics revision engine**.

