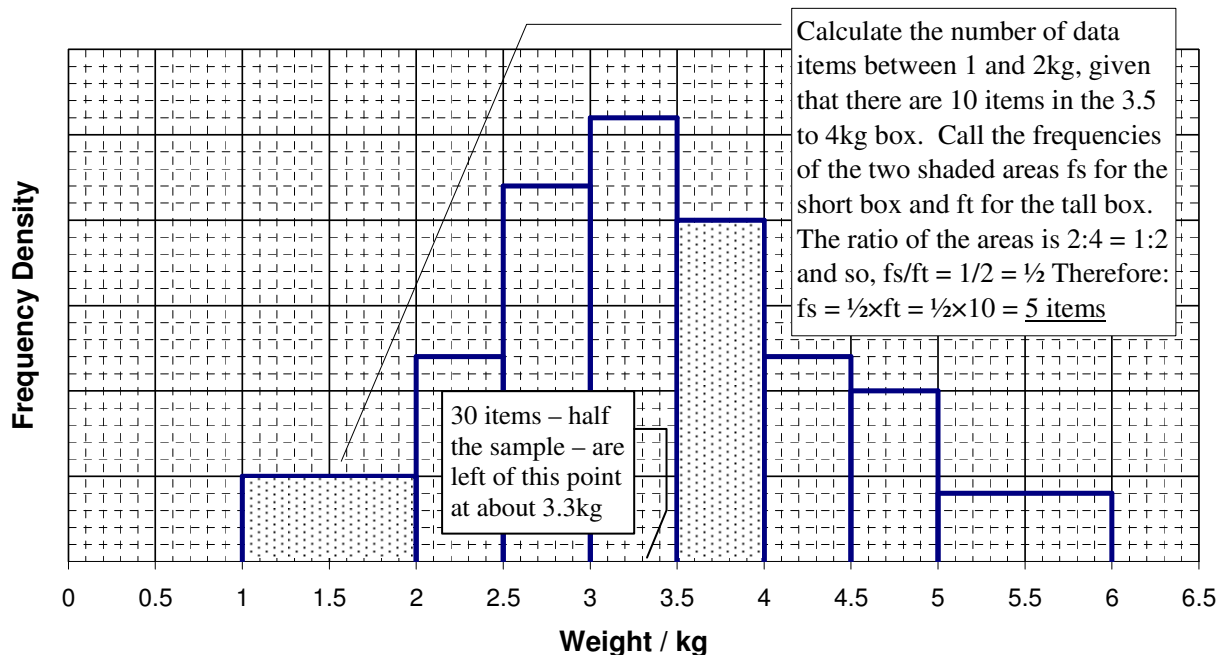


Extract from the Histograms Booklet – Exam Questions on Histograms

In a histogram, if the bars (the classes) are the same width, the height of a bar is proportional to the frequency it represents. In a typical Higher exam question the bars are **not** all the same width – see the example question below. In that case you use the areas of the bars, **not** the heights, to compare the frequencies. For example, if a bar is three times the area it is three times the frequency.

If you are asked to draw a histogram in the Higher tier, you are expected to plot frequency density. You will be given the frequency density values or you may have to calculate them.



Usually, a chart's grid consists of 1cm squares. In this example the histogram, for the weights of 60 items, is already drawn. The question is to calculate the frequency between 1 and 2kg. We'll call the bars 'boxes', because they are like containers that hold the data. Count the 1cm squares. The short shaded box, from 1 to 2kg, is 2 squares and the tall box is 4 squares. You are told that the number of items (the frequency) in the tall box, from 3.5 to 4kg, is 10. How many items are in the short box? Compare the areas. The frequency for the short box is half of 10 because the short box is half the area. You could write the calculation like this: $f = \frac{1}{2} \times 10 = 5$. The frequency is 5.

An alternative method is to calculate the number of items in one square. There are 10 items in the 4 squares of the tall box ($f=10$), and so the number of items in 1 square = $10/4 = 2.5$. Therefore, in a box with two squares, the number of items = $2 \times 2.5 = 5$.

You may be asked to calculate the median weight – that's the weight on the x-axis that divides the chart into two equal areas, with half the sample (30 items) in each. The median is between 3 and 3.5kg because there are 22 items up to 3kg and 35 up to 3.5kg. There are 13 items between 3 and 3.5kg and 8 of those 13 make up the 30 items to the left of the median ($22+8 = 30$). Estimate the median point by calculating the fraction $8/13$ of 0.5kg and add the result to 3kg. $8 \times 0.5/13 = 4/13 = 0.308\text{kg}$. Median = $3+0.308 = 3.308 = \underline{3.3\text{kg}}$.

Exercise 5 – Reading a Histogram

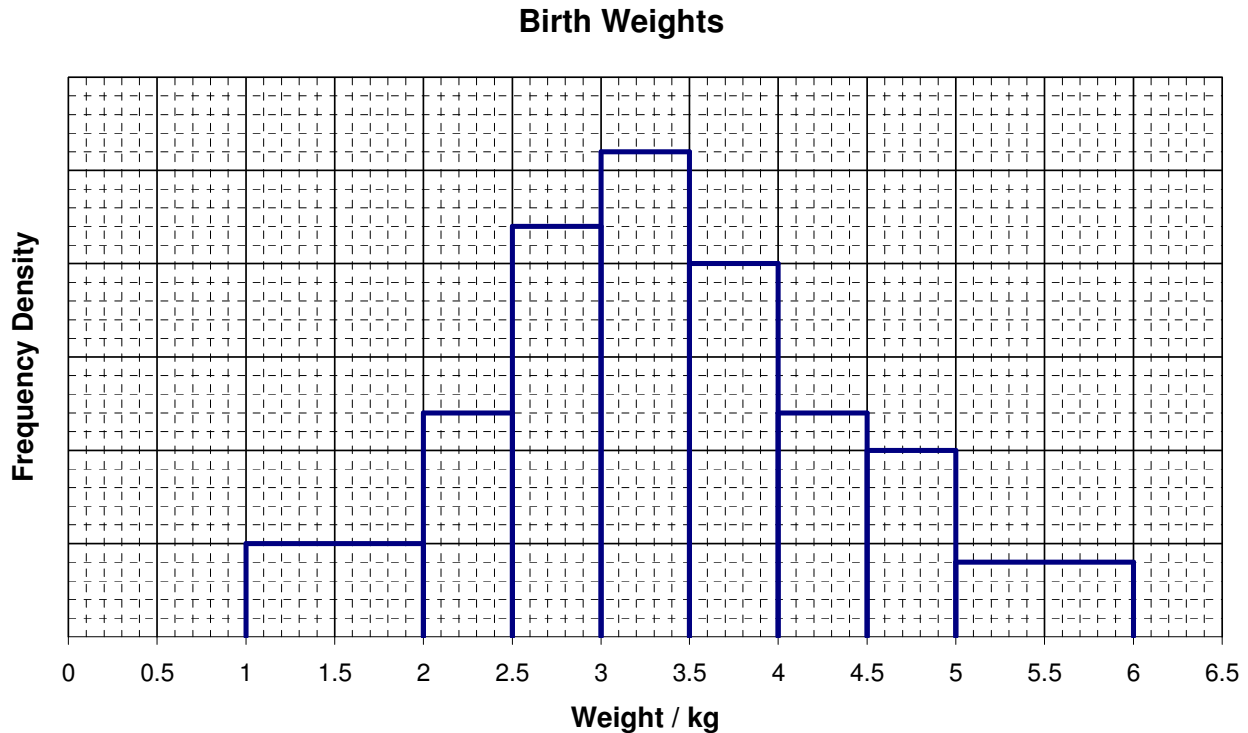
For the histogram above, each 1cm square represents 2.5 items of data. Calculate the number of items that weigh between 4.5 and 6kg. The solution is on page 26.

Sample Exam Question – Histogram

The question is based on the AQA GCSE Maths Module 1 Higher, March 2007, Section B, question 10.

<http://www.aqa.org.uk/qual/gcse/qp-ms/AQA-43001H-W-QP-MAR07.PDF>

The question is typical of the Higher paper. You are given a completed histogram. It is possible, as in this case, that the y-axis has no scale.



The histogram represents the weights of 60 babies and 6 babies weigh from 4 to 4.5kg. Calculate the number of babies weighing less than 3kg.

Things to notice about this question:

- The class width (the width of the bars) is not constant.
- The y-axis is labelled Frequency Density. The question will test your understanding of the link between frequency density and frequency.
- Of the alternative solutions below, candidates generally prefer the 'areas' method.

Solution

Either use **areas** or **frequency density**.

Areas 6 babies so:

Frequency from 4 to 4.5kg = 6.

From 4 to 4.5kg = 2.4 squares.

Frequency (f) is proportional to number of squares. 6 babies = 2.4 squares.

Therefore $6/2.4 = 2.5$ babies per square.

1 to 3kg is $2+2.4+4.4 = 8.8$ squares.

Babies from 1 to 3kg = $8.8 \times 2.5 = 22$.

Frequency Density 6 babies so:

Frequency from 4 to 4.5kg = 6.

Frequency density = f/w . Width is 0.5kg so $fd = 6/0.5 = 12$ (height of bar)

First 3 bars, from 1 to 3kg. Heights are 5, 12, 22. The frequencies are ($f=fd \times w$)

$5 \times 1 = 5$, $12 \times 0.5 = 6$, $22 \times 0.5 = 11$.

Babies from 1 to 3kg = $5+6+11 = 22$.

Answer: 22 babies weigh less than 3kg