

E9.7 Histograms

Name: _____ Class: _____ Date: _____

Total: 14 marks

KEY WORDS frequency density 频数密度 • class width 组距 • histogram 直方图
• modal class 众数组 • unequal classes 不等组距

Objective

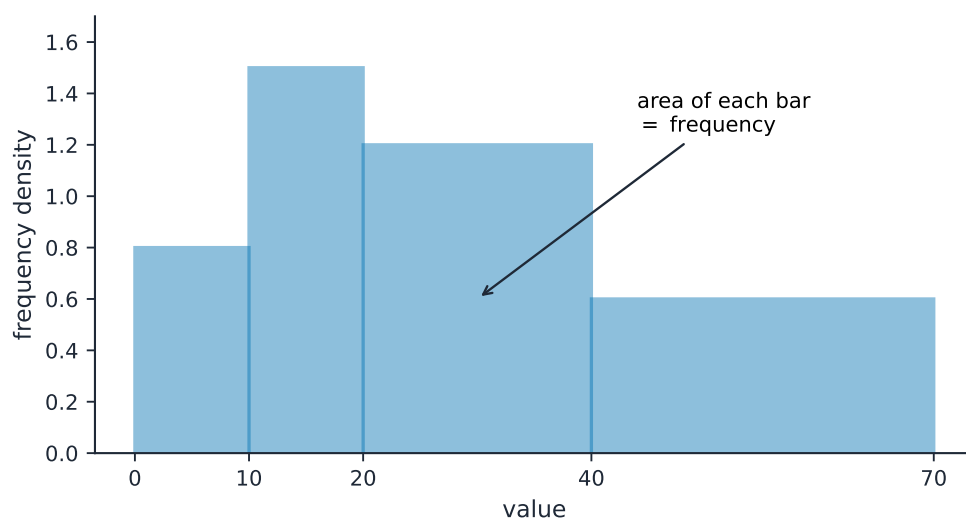
Build the skills to answer Extended exam questions on **histograms** 直方图 — calculating **frequency density** 频数密度, reading a frequency from a bar, and explaining why a histogram is used when the **class widths** 组距 are unequal.

You must be able to:

- calculate frequency density as $\text{frequency} \div \text{class width}$
- find a frequency from a bar's height and width
- identify the modal class from a histogram and explain why area represents frequency

1 Worked examples

■ Height is frequency DENSITY; area is frequency



$$\text{density} = \text{freq} / \text{width} \cdot \text{area} = \text{frequency}$$

A wide class must be drawn shorter, or it would look far more common than it is

- **Frequency density** = $\frac{\text{frequency}}{\text{class width}}$, and going back, frequency = density $\times$ width — which is the AREA of the bar.
- **Why not just frequency?** With unequal widths, a tall wide bar would exaggerate a class. Using density makes every bar's AREA proportional to its frequency.
- **Worked:** a class $0 < x \leq 20$ with frequency 30 has density $30 \div 20 = 1.5$.
- **Modal class:** the one with the greatest frequency DENSITY, which is not always the one with the greatest frequency.
- **No gaps:** the bars touch, because the data is continuous.

Answer shapes (marked by **method marks** — M1 for a correct method, A1 for the correct answer): the class width, written down before the division, is the method mark.

2 Practice

2.1 A class $0 < x \leq 20$ has a frequency of 30. Find its frequency density.

[2]

2.2 A bar has a frequency density of 2.4 and covers a class of width 5. Find its frequency. [2]

2.3 Explain why a histogram uses frequency density rather than frequency on the vertical axis. [2]

3 Exam-style questions

3.1 The table shows the times t seconds taken by a group of runners.

Time (t seconds)	Frequency
$0 < t \leq 10$	15
$10 < t \leq 25$	30
$25 < t \leq 45$	24
$45 < t \leq 75$	18

(a) Calculate the frequency density of each class. [4]

(b) Write down the modal class, and explain your choice. [2]

3.2 In a histogram, a bar covering $20 < x \leq 30$ has a height of 3.5. Find the frequency of that class. [2]
