

Histograms and frequency polygons

About 55 minutes Calculator allowed 39 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/stats-histograms-and-frequency-polygons/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

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| <p>A1 Needed today [2 marks]</p> <p>32 books are grouped by number of pages: 150–249 (11), 250–349 (7), 350–549 (14). The exact values are not known. Work out the greatest the range could be.</p> | <p>A2 From chapter 3 [2 marks]</p> <p>A set of exam marks has mean 58 and standard deviation 5. Using the mean $\pm$ 3 standard deviations rule, is a value of 71 an outlier? Show your working.</p> |
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Answer

Answer

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| <p>A3 Last lesson [2 marks]</p> <p>A chart shows the trees a charity planted: 290 in 2023 and 406 in 2025. The 2025 bar is drawn 1.4 times as tall AND 1.4 times as wide as the 2023 bar. How many times as big does the 2025 bar look?</p> | <p>A4 Maths skill [2 marks]</p> <p>Work out 0.16^2.</p> |
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Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

The table shows the times, t minutes, that 120 runners took to finish a race. Work out the frequency density of each class. Then estimate the number of runners who took between 25 and 34 minutes.

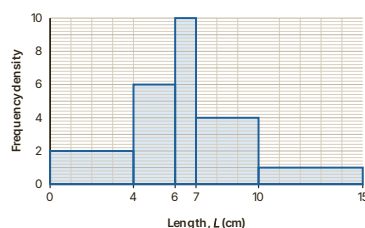
Time, t (minutes)	Frequency
$15 < t \leq 20$	14
$20 < t \leq 30$	40
$30 < t \leq 40$	50
$40 < t \leq 60$	16

Hint Frequency density = frequency $\div$ class width.

Answer , , , parcels

EXAMPLE 2

The histogram shows the lengths, L cm, of some leaves. How many of the leaves are longer than 6 cm?



Hint Frequency = frequency density $\times$ class width.

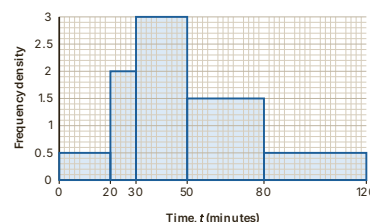
B1 The table shows the masses, m kg, of 60 parcels. Work out the frequency density of each class. Then estimate the number of parcels with a mass between 4 kg and 8 kg. [4 marks]

The table shows the masses, m kg, of 60 parcels. Work out the frequency density of each class. Then estimate the number of parcels with a mass between 4 kg and 8 kg.

Mass, m (kg)	Frequency
$0 < m \leq 2$	9
$2 < m \leq 3$	12
$3 < m \leq 5$	24
$5 < m \leq 10$	15

B2 The histogram shows the times, t minutes, that some visitors spent in a museum. How many stayed more than 30 minutes? [2 marks]

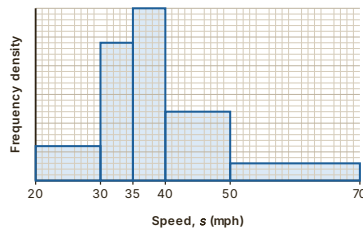
The histogram shows the times, t minutes, that some visitors spent in a museum. How many stayed more than 30 minutes?



Answer

EXAMPLE 3

The histogram shows the speeds, s mph, of some cars. It has no scale on the vertical axis. 24 cars are in the class $30 < s \leq 35$. How many cars are there altogether?



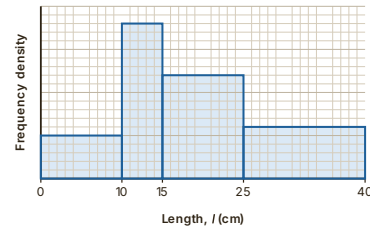
Hint Find the frequency density of the bar you know.

EXAMPLE 4

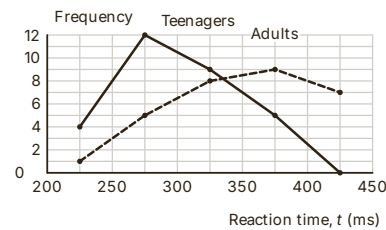
The table shows the times, t minutes, that 40 boys and 40 girls spent on homework. Write down the points for the boys' frequency polygon. Then compare the two distributions.

Time, t (minutes)	Boys	Girls
$0 < t \leq 10$	6	0
$10 < t \leq 20$	14	8
$20 < t \leq 30$	11	15
$30 < t \leq 40$	6	12
$40 < t \leq 50$	3	5

Hint Plot each frequency at the midpoint of its class.

B3 The histogram shows the lengths, l cm, of some fish. It has no vertical scale. 18 fish are in the class $10 < l \leq 15$. How many fish are longer than 15 cm? [3 marks]

Answer

B4 The frequency polygons show the reaction times, t milliseconds, of 30 teenagers and 30 adults. Compare the two distributions. [2 marks]

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c Practice

- C1** Ali groups the lengths, t minutes, of 60 phone calls: 24 calls in $0 < t \leq 5$, 18 in $5 < t \leq 10$ and 18 in $10 < t \leq 30$. He draws a diagram with bars whose heights are 24, 18 and 18. Explain why his diagram gives a misleading picture of the calls. [2 marks]

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- C2** The journey times, t minutes, of 150 commuters are grouped: 30 in $0 < t \leq 20$, 54 in $20 < t \leq 40$, 46 in $40 < t \leq 60$ and 20 in $60 < t \leq 90$. Estimate the number of commuters whose journey took more than 50 minutes. State one assumption you have made. [3 marks]

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- C3** Kai draws a frequency polygon for the masses, m grams, of 40 eggs: 7 in $50 < m \leq 55$, 13 in $55 < m \leq 60$, 12 in $60 < m \leq 65$ and 8 in $65 < m \leq 70$. He plots $(55, 7)$, $(60, 13)$, $(65, 12)$ and $(70, 8)$. Explain his mistake, and write down the points he should plot.

[2 marks]

- C4** On a histogram of the waiting times, t minutes, at a doctor's surgery, the bar for $10 < t \leq 15$ is 6 cm tall and stands for 15 patients. The class $15 < t \leq 35$ has 28 patients. How tall should its bar be?

[3 marks]

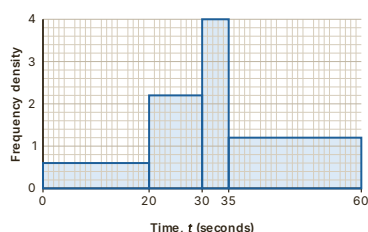
Answer

D Exam-style questions

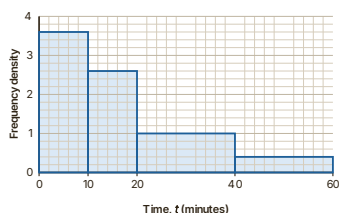
- D1** Ella says, "More students took between 30 and 35 seconds than between 35 and 60 seconds, because that bar is taller."

[2 marks]

The histogram shows the times, t seconds, that some students took to solve a puzzle. Is Ella correct? You must give a reason.



- D2** The histogram shows the waiting times, t minutes, of 90 patients at Clinic B.



- (a) Write down the modal class.

[1 mark]

Answer

- (b) Estimate the number of these patients who waited more than 30 minutes.

[2 marks]

Answer

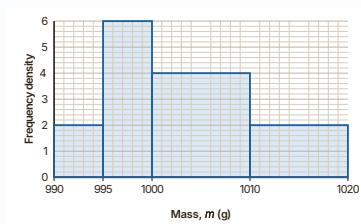
- (c) At Clinic A, an estimated 31% of 90 patients waited more than 30 minutes, and the modal class was $10 < t \leq 20$. The manager of Clinic B says, "Patients usually wait longer at Clinic B than at Clinic A." Is the manager correct? Give a reason. [2 marks]

Total for D2: 5 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** The histogram shows the masses, m grams, of 100 bags of flour. Estimate the median mass. [3 marks]



Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** The median has half of the area of the histogram on each side of it.
- Hint 2** The frequencies are 10, 30, 40 and 20, so the 50th bag is in $1000 < m \leq 1010$.
- Hint 3** 10 more bags are needed after 1000 g, out of 40 spread over 10 g: $1000 + \frac{10}{40} \times 10 = 1002.5$ g.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can work out frequency densities, and read frequencies from a histogram with or without a scale. ☐ ☐ ☒

I can estimate how many values lie in part of a class, and say what I assumed. ☐ ☐ ☒

I can plot frequency polygons and compare two distributions in context. ☐ ☐ ☒