HIGHER

4.1 Histograms and Frequency Density: Test Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A class $120 \leq x < 140$ has frequency 6 and a class width 20. Calculate its frequency density and give units used to describe the vertical axis on a histogram of x.

(Total for Question 1 is 2 marks)

---

2 A grouped table for speeds (km/h) shows: $0 \leq s < 20$: frequency 3 (width 20), $20 \leq s < 40$: frequency 12 (width 20), $40 \leq s < 60$: frequency 25 (width 20). What height should the bar for $40 \leq s < 60$ have on a histogram where vertical axis is frequency density?

(Total for Question 2 is 2 marks)

---

3 A frequency table is partially blank. Classes: $0 \leq v < 5$ width 5 density 0.6, $5 \leq v < 12$ width 7 density unknown with frequency 21, $12 \leq v < 20$ width 8 density 1.0. Complete the missing density for $5 \leq v < 12$ and the total frequency for all classes.

(Total for Question 3 is 3 marks)

© Revision Library | revisionlibrary.co.uk

4 A histogram shows information about the lengths, l cm, of fish caught in a fishery.
Bar heights (frequency density): $0 < l \leq 10$: height 0.8; $10 < l \leq 30$: height 1; $30 < l \leq 35$: height 2.4; $35 < l \leq 45$: height 0.8.
Estimate the number of fish with l greater than 33.

(Total for Question 4 is 3 marks)

---

5 A histogram shows information about the lengths, l cm, of fish caught in a harbour.
Bar heights (frequency density): $10 < l \leq 40$: height 2.6; $40 < l \leq 60$: height 1.4; $60 < l \leq 70$: height 1.2; $70 < l \leq 90$: height 3.
Estimate the number of fish with l greater than 71.

(Total for Question 5 is 3 marks)

---

6 A histogram shows information about the distances, d km, travelled by workers to get to a hospital.
Bar heights (frequency density): $0 < d \leq 10$: height 2.6; $10 < d \leq 30$: height 2.4; $30 < d \leq 60$: height 2.8; $60 < d \leq 80$: height 3.
Estimate the number of workers with d less than or equal to 72.

(Total for Question 6 is 3 marks)

© Revision Library | revisionlibrary.co.uk

7 The table gives information about the heights, h cm, of plants in a nursery.
Class and frequency: $0 < h \leq 5$: 12; $5 < h \leq 25$: 48; $25 < h \leq 35$: 12; $35 < h \leq 40$: 5.
A histogram is drawn from this table. The bar for $0 < h \leq 5$ is 4.8 cm tall.
Work out the height of the bar for $35 < h \leq 40$.

(Total for Question 7 is 3 marks)

---

8 A histogram shows information about the masses, m kg, of parcels at a delivery hub.
Bar heights (frequency density): $0 < m \leq 20$: height 2.4; $20 < m \leq 40$: height 1; $40 < m \leq 60$: height 0.8; $60 < m \leq 80$: height 0.6; $80 < m \leq 90$: height 2.6.
Estimate the number of parcels with m less than or equal to 85.

(Total for Question 8 is 3 marks)

---

9 A histogram representing age groups has classes $0 \leq a < 10$, $10 \leq a < 30$, $30 \leq a < 60$. The heights are 0.8, 0.6 and 0.4 respectively. Estimate the total population represented by the histogram and explain briefly why heights decrease as class width increases in some histograms.

(Total for Question 9 is 4 marks)

---

10 Explain briefly why, when drawing a histogram from a grouped frequency table with unequal class widths, the vertical axis must show frequency density rather than frequency. Give a short numerical example to support your explanation.

(Total for Question 10 is 3 marks)

© Revision Library | revisionlibrary.co.uk

11 Complete the following: a histogram for exam marks has bars for classes $0 \le m < 10$, $10 \le m < 30$, $30 \le m < 50$. The class $10 \le m < 30$ has frequency 40 and width 20. The histogram shows the height of this bar as 2.0. Using this, calculate the total number of students represented by the three classes if the other bars have heights 1.5 (width 10) and 1.8 (width 20) respectively. Show working for each class area.

(Total for Question 11 is 4 marks)

---

12 A histogram bar for the interval $50 \le y < 70$ has height 0.9. Estimate the frequency in the sub-interval $60 \le y < 70$ (the upper half of that class) assuming uniform distribution within the class. State your method.

(Total for Question 12 is 3 marks)

---

13 A histogram is given for weights of parcels with unequal class widths. The class $0 \le w < 2$ has frequency 8, $2 \le w < 5$ has unknown frequency f, and $5 \le w < 10$ has frequency 30. The histogram shows heights: $0 \le w < 2$ height 4, $2 \le w < 5$ height 3, $5 \le w < 10$ height 6. Complete the frequency f using areas and show steps.

(Total for Question 13 is 4 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 4.1 Histograms and Frequency Density: Test Pack

Question 1

finds frequency density = 6 / 20 or writes correct division **M1**

frequency density = 0.3 (per unit on x) or 0.3 per cm, cao **A1**

Answer: 0.3, units: frequency density in 'frequency per unit x' (e.g. per cm)

Question 2

divides 25 by class width 20 **M1**

height = 1.25 (frequency per km/h) cao **A1**

Answer: 1.25

Question 3

uses density = frequency / width to find density for middle class: 21 / 7 **M1**

calculates densities and frequencies for other classes: first freq = 0.6*5 = 3; third freq = 1.0*8 = 8 **M1**

density for $5 \le v < 12$ = 3.0 and total frequency = 3 + 21 + 8 = 32 cao **A1**

Answer: middle density = 3.0, total frequency = 32

Question 4

the part of the class $30 < l \le 35$ above 33 has width 2 **M1**

frequency in that part = 2.4 x 2 = 4.8, then adds the frequencies of the later classes **M1**

12.8 **A1**

Answer: 12.8

Question 5

the part of the class $70 < l \le 90$ above 71 has width 19 **M1**

frequency in that part = 3 x 19 = 57, then adds the frequencies of the later classes **M1**

57 **A1**

Answer: 57

Question 6

the part of the class $60 < d \le 80$ up to 72 has width 12 **M1**

frequency in that part = 3 x 12 = 36, then adds the frequencies of the earlier classes **M1**

194 **A1**

Answer: 194

Question 7

bar height is proportional to frequency density **M1**

densities 2.4 and 1, giving a height scale of 4.8 / 2.4 = 2 cm per unit **M1**

height = 2 cm **A1**

Answer: 2 cm

Question 8

the part of the class $80 < m \le 90$ up to 85 has width 5 **M1**

frequency in that part = 2.6 x 5 = 13, then adds the frequencies of the earlier classes **M1**

109 **A1**

Answer: 109

Question 9

calculates areas: 0.8*10 = 8, 0.6*20 = 12, 0.4*30 = 12 **M1**

adds correctly to give total 32 **M1**

gives a correct reason linking height to frequency density and class width, e.g. density = frequency/width so wider classes often have lower heights for same frequency, or to keep area equal to frequency **M1**

total = 32 and sensible explanation about density and width, cao **A1**

Answer: Total = 32, explanation: heights are frequency densities; density = frequency/width so if class width increases for similar frequencies the height falls to keep area equal to frequency

Question 10

states that area of bar must represent frequency, so height must be frequency/width when widths vary **M1**

gives a correct short numerical example, e.g. class A width 2 freq 6 density 3, class B width 6 freq 18 density 3 so equal densities give proportional areas **M1**

concludes that using frequency as height would misrepresent data when widths differ, cao **A1**

Answer: Because area represents frequency. Example: class width 2 freq 6 gives density 3, width 6 freq 18 gives density 3; plotting densities gives areas 2*3=6 and 6*3=18. If heights were frequencies, bars would be 6 and 18 and areas would be 12 and 108, misrepresenting counts.

Question 11

calculates frequency for first class from area: 1.5 * 10 = 15 **M1**

uses given for middle class: 2.0 * 20 = 40 **M1**

calculates frequency for third class: 1.8 * 20 = 36 **M1**

total = 15 + 40 + 36 = 91 cao **A1**

Answer: frequencies: 15, 40, 36. Total = 91

Question 12

uses area method and recognises width of full class = 20 and sub-interval width = 10 **M1**

calculates full class frequency = 0.9 * 20 = 18, then takes half for 10 width = 9 **M1**

estimate = 9 cao **A1**

Answer: 9

Question 13

uses area = height * width to find frequencies for known bars: first and third **M1**

calculates first area = 4 * 2 = 8 and third gives 6 * 5 = 30 **M1**

sets f = height * width for middle class: f = 3 * (5 - 2) = 3 * 3 **M1**

f = 9 cao **A1**

Answer: f = 9

© Revision Library | revisionlibrary.co.uk