HIGHER

4.1 Histograms and Frequency Density: 2-hour Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The table gives information about the masses, m kg, of parcels at a garden centre.
Class and frequency: $0 < m \leq 10$: 6; $10 < m \leq 20$: 2; $20 < m \leq 40$: 52; $40 < m \leq 45$: 7.
A histogram is to be drawn. Work out the frequency density for each class.

(Total for Question 1 is 3 marks)

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2 A histogram shows information about the heights, h cm, of plants in a garden centre.
Bar heights (frequency density): $10 < h \leq 15$: height 3; $15 < h \leq 25$: height 1; $25 < h \leq 45$: height 2.4; $45 < h \leq 65$: height 2.6; $65 < h \leq 75$: height 0.8.
Work out the frequency of the class $25 < h \leq 45$.

(Total for Question 2 is 2 marks)

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3 A histogram shows information about the time, t minutes, spent on homework by pupils at an academy.
Bar heights (frequency density): $10 < t \leq 30$: height 0.2; $30 < t \leq 40$: height 1.2; $40 < t \leq 70$: height 1.6; $70 < t \leq 80$: height 0.4; $80 < t \leq 85$: height 1.8.
One item is chosen at random. Estimate the probability that $t > 77$.

(Total for Question 3 is 4 marks)

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4 The table gives information about the time, t minutes, spent on homework by pupils at an academy. There are 65 items altogether. Frequencies of the other classes: $10 < t \leq 20$: 4; $20 < t \leq 30$: 28; $30 < t \leq 35$: 13; $35 < t \leq 45$: 18.
A histogram is drawn for all the classes. Work out the height of the bar for the class $0 < t \leq 10$.

(Total for Question 4 is 3 marks)

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5 The table gives information about the ages, a years, of people at a theatre.
Class and frequency: $20 < a \leq 50$: 12; $50 < a \leq 60$: 26; $60 < a \leq 90$: 24; $90 < a \leq 110$: 44.
A histogram is drawn from this table. The bar for $20 < a \leq 50$ is 0.4 cm tall.
Work out the height of the bar for $60 < a \leq 90$.

(Total for Question 5 is 3 marks)

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6 A histogram shows information about the ages, a years, of people at a swimming pool.
Bar heights (frequency density): $20 < a \leq 30$: height 0.6; $30 < a \leq 50$: height 1.6; $50 < a \leq 80$: height 0.6; $80 < a \leq 90$: height 1.6; $90 < a \leq 95$: height 2.4.
Calculate an estimate of the mean. Give your answer to 1 decimal place if it is not exact.

(Total for Question 6 is 4 marks)

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7 A histogram shows information about the time, t minutes, spent on homework by pupils at a sixth form college.

Bar heights (frequency density): $20 < t \leq 25$: height 1.4; $25 < t \leq 35$: height 1.8; $35 < t \leq 45$: height 1.4; $45 < t \leq 50$: height 2.

Estimate the median. Give your answer to 1 decimal place if it is not exact.

(Total for Question 7 is 5 marks)

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8 The table gives information about the time, t minutes, spent on homework by pupils at a high school.

Class and frequency: $0 < t \leq 20$: 28; $20 < t \leq 25$: 1; $25 < t \leq 45$: 36; $45 < t \leq 55$: 10; $55 < t \leq 65$: 10.

A histogram is to be drawn. Work out the frequency density for each class.

(Total for Question 8 is 3 marks)

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9 A histogram shows information about the heights, h cm, of plants in a greenhouse.

Bar heights (frequency density): $0 < h \leq 10$: height 2.8; $10 < h \leq 20$: height 3; $20 < h \leq 40$: height 1.8.

Work out the frequency of the class $10 < h \leq 20$.

(Total for Question 9 is 2 marks)

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10 A histogram shows information about the heights, h cm, of plants in a garden centre.
Bar heights (frequency density): $0 < h \leq 10$: height 2.6; $10 < h \leq 30$: height 1.6; $30 < h \leq 60$: height 1.6; $60 < h \leq 80$: height 2.6.
One item is chosen at random. Estimate the probability that $h \leq 8$.

(Total for Question 10 is 4 marks)

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11 The table gives information about the time, t minutes, spent on homework by pupils at an academy. There are 142 items altogether. Frequencies of the other classes: $40 < t \leq 50$: 22; $50 < t \leq 70$: 44; $70 < t \leq 90$: 16.
A histogram is drawn for all the classes. Work out the height of the bar for the class $10 < t \leq 40$.

(Total for Question 11 is 3 marks)

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12 The table gives information about the masses, m kg, of parcels at a delivery hub.
Class and frequency: $10 < m \leq 15$: 1; $15 < m \leq 35$: 40; $35 < m \leq 40$: 7; $40 < m \leq 70$: 36; $70 < m \leq 90$: 40.
A histogram is drawn from this table. The bar for $15 < m \leq 35$ is 1 cm tall.
Work out the height of the bar for $70 < m \leq 90$.

(Total for Question 12 is 3 marks)

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13 A histogram shows information about the distances, d km, travelled by workers to get to a factory.

Bar heights (frequency density): $20 < d \leq 30$: height 0.8; $30 < d \leq 50$: height 1; $50 < d \leq 55$: height 3; $55 < d \leq 60$: height 2.8.

Calculate an estimate of the mean. Give your answer to 1 decimal place if it is not exact.

(Total for Question 13 is 4 marks)

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14 A histogram shows information about the lengths, l cm, of fish caught in a river.

Bar heights (frequency density): $10 < l \leq 20$: height 0.6; $20 < l \leq 25$: height 1.4; $25 < l \leq 45$: height 0.6; $45 < l \leq 50$: height 0.6; $50 < l \leq 70$: height 0.6.

Estimate the median. Give your answer to 1 decimal place if it is not exact.

(Total for Question 14 is 5 marks)

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15 A histogram shows information about the distances, d km, travelled by workers to get to a hospital.

Bar heights (frequency density): $0 < d \leq 20$: height 2; $20 < d \leq 30$: height 1.6; $30 < d \leq 60$: height 2; $60 < d \leq 65$: height 2.2; $65 < d \leq 70$: height 0.4.

Calculate an estimate of the mean. Give your answer to 1 decimal place if it is not exact.

(Total for Question 15 is 4 marks)

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16 A histogram shows information about the masses, m kg, of parcels at a depot.
Bar heights (frequency density): $10 < m \leq 40$: height 0.2; $40 < m \leq 70$: height 0.2; $70 < m \leq 80$: height 2.6; $80 < m \leq 110$: height 2.6.
Estimate the number of parcels with m less than or equal to 23.

(Total for Question 16 is 3 marks)

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17 The table gives information about the masses, m kg, of parcels at a sorting office.
Class and frequency: $0 < m \leq 10$: 14; $10 < m \leq 20$: 14; $20 < m \leq 30$: 16; $30 < m \leq 50$: 44.
A histogram is to be drawn. Work out the frequency density for each class.

(Total for Question 17 is 3 marks)

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18 A histogram shows information about the ages, a years, of people at a theatre.
Bar heights (frequency density): $10 < a \leq 30$: height 0.6; $30 < a \leq 50$: height 1; $50 < a \leq 80$: height 2.6; $80 < a \leq 110$: height 0.6; $110 < a \leq 130$: height 1.
Work out the frequency of the class $10 < a \leq 30$.

(Total for Question 18 is 2 marks)

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19 A histogram shows information about the lengths, l cm, of fish caught in a lake.
Bar heights (frequency density): $20 < l \leq 50$: height 0.2; $50 < l \leq 70$: height 1.4; $70 < l \leq 90$: height 2; $90 < l \leq 110$: height 3.
One item is chosen at random. Estimate the probability that $l > 58$.

(Total for Question 19 is 4 marks)

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20 The table gives information about the time, t minutes, spent on homework by pupils at a high school. There are 130 items altogether. Frequencies of the other classes: $0 < t \leq 10$: 8; $15 < t \leq 45$: 90; $45 < t \leq 55$: 14; $55 < t \leq 60$: 11.

A histogram is drawn for all the classes. Work out the height of the bar for the class $10 < t \leq 15$.

(Total for Question 20 is 3 marks)

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21 The table gives information about the lengths, l cm, of fish caught in a lake.

Class and frequency: $0 < l \leq 20$: 12; $20 < l \leq 30$: 20; $30 < l \leq 50$: 8; $50 < l \leq 60$: 12; $60 < l \leq 90$: 12.

A histogram is drawn from this table. The bar for $30 < l \leq 50$ is 0.8 cm tall.

Work out the height of the bar for $0 < l \leq 20$.

(Total for Question 21 is 3 marks)

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22 A student draws a histogram for daily rainfall (mm) with unequal widths. The class $0 \leq r < 2$ has area 4 on the histogram. The class $2 \leq r < 5$ has frequency 9 and width 3. Calculate the frequency density for $2 \leq r < 5$ and then the height of the bar. Show your working.

(Total for Question 22 is 3 marks)

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23 The table gives information about the lengths, l cm, of fish caught in a pond. There are 143 items altogether. Frequencies of the other classes: $20 < l \leq 50$: 66; $50 < l \leq 80$: 18; $80 < l \leq 100$: 32; $105 < l \leq 115$: 24.
A histogram is drawn for all the classes. Work out the height of the bar for the class $100 < l \leq 105$.

(Total for Question 23 is 3 marks)

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24 The table gives information about the masses, m kg, of parcels at a sorting office.
Class and frequency: $0 < m \leq 20$: 60; $20 < m \leq 50$: 54; $50 < m \leq 60$: 18; $60 < m \leq 90$: 78.
A histogram is drawn from this table. The bar for $60 < m \leq 90$ is 5.2 cm tall.
Work out the height of the bar for $50 < m \leq 60$.

(Total for Question 24 is 3 marks)

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25 A histogram shows the following bars (frequency densities shown): class $10 \leq x < 20$ height 0.5, class $20 \leq x < 30$ height 1.0, class $30 \leq x < 50$ height 0.6. Calculate the frequency in the class $30 \leq x < 50$ by using area of the bar.

(Total for Question 25 is 3 marks)

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Mark scheme · 4.1 Histograms and Frequency Density: 2-hour Pack

Question 1

uses frequency density = frequency / class width **M1**

at least two frequency densities correct, e.g. 0.6 and 0.2 **A1**

frequency densities: 0.6, 0.2, 2.6, 1.4 **A1**

Answer: 0.6, 0.2, 2.6, 1.4

Question 2

uses frequency = frequency density x class width **M1**

2.4 x 20 = 48 **A1**

Answer: 48

Question 3

frequencies = frequency density x width: 4, 12, 48, 4, 9 **M1**

total frequency = 77 **M1**

estimates the number with $t > 77$ as 10.2 using the proportion of the class $70 < t \leq 80$ **M1**

probability = 10.2/77 = 51/385 **A1**

Answer: 51/385

Question 4

missing frequency = 65 - 63 = 2 **M1**

frequency density = frequency / width = 2/10 **M1**

height = 0.2 **A1**

Answer: 0.2

Question 5

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

densities 0.4 and 0.8, giving a height scale of 0.4 / 0.4 = 1 cm per unit **M1**

height = 0.8 cm **A1**

Answer: 0.8 cm

Question 6

frequencies = frequency density x width: 6, 32, 18, 16, 12 **M1**

midpoints: 25, 40, 65, 85, 185/2 **M1**

sum of midpoint x frequency = 5070, divided by the total frequency 84 **M1**

mean = 60.4 **A1**

Answer: 60.4

Question 7

frequencies = frequency density x width: 7, 18, 14, 10 **M1**

total frequency 49, so the median is the 24.5th value **M1**

median lies in the class $25 < t \leq 35$, with 7 values before it **M1**

interpolates: 25 + (49/2 - 7) / 1.8 **M1**

median = 34.7 **A1**

Answer: 34.7

Question 8

uses frequency density = frequency / class width **M1**

at least two frequency densities correct, e.g. 1.4 and 0.2 **A1**

frequency densities: 1.4, 0.2, 1.8, 1, 1 **A1**

Answer: 1.4, 0.2, 1.8, 1, 1

Question 9

uses frequency = frequency density x class width **M1**

3 x 10 = 30 **A1**

Answer: 30

Question 10

frequencies = frequency density x width: 26, 32, 48, 52 **M1**

total frequency = 158 **M1**

estimates the number with $h \leq 8$ as 20.8 using the proportion of the class $0 < h \leq 10$ **M1**

probability = 20.8/158 = 52/395 **A1**

Answer: 52/395

Question 11

missing frequency = 142 - 82 = 60 **M1**

frequency density = frequency / width = 60/30 **M1**

height = 2 **A1**

Answer: 2

Question 12

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

densities 2 and 2, giving a height scale of 1 / 2 = 0.5 cm per unit **M1**

height = 1 cm **A1**

Answer: 1 cm

Question 13

frequencies = frequency density x width: 8, 20, 15, 14 **M1**

midpoints: 25, 40, 105/2, 115/2 **M1**

sum of midpoint x frequency = 5185/2, divided by the total frequency 57 **M1**

mean = 45.5 **A1**

Answer: 45.5

Question 14

frequencies = frequency density x width: 6, 7, 12, 3, 12 **M1**

total frequency 40, so the median is the 20th value **M1**

median lies in the class $25 < l \leq 45$, with 13 values before it **M1**

interpolates: 25 + (20 - 13) / 0.6 **M1**

median = 36.7 **A1**

Answer: 36.7

Question 15

frequencies = frequency density x width: 40, 16, 60, 11, 2 **M1**

midpoints: 10, 25, 45, 125/2, 135/2 **M1**

sum of midpoint x frequency = 8645/2, divided by the total frequency 129 **M1**

mean = 33.5 **A1**

Answer: 33.5

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Question 16

the part of the class $10 < m \leq 40$ up to 23 has width 13	**M1**
frequency in that part = 0.2 x 13 = 2.6, then adds the frequencies of the earlier classes	**M1**
2.6	**A1**

Answer: 2.6

Question 17

uses frequency density = frequency / class width	**M1**
at least two frequency densities correct, e.g. 1.4 and 1.4	**A1**
frequency densities: 1.4, 1.4, 1.6, 2.2	**A1**

Answer: 1.4, 1.4, 1.6, 2.2

Question 18

uses frequency = frequency density x class width	**M1**
0.6 x 20 = 12	**A1**

Answer: 12

Question 19

frequencies = frequency density x width: 6, 28, 40, 60	**M1**
total frequency = 134	**M1**
estimates the number with $l > 58$ as 116.8 using the proportion of the class $50 < l \leq 70$	**M1**
probability = 116.8/134 = 292/335	**A1**

Answer: 292/335

Question 20

missing frequency = 130 - 123 = 7	**M1**
frequency density = frequency / width = 7/5	**M1**
height = 1.4	**A1**

Answer: 1.4

Question 21

bar height is proportional to frequency density	**M1**
densities 0.4 and 0.6, giving a height scale of 0.8 / 0.4 = 2 cm per unit	**M1**
height = 1.2 cm	**A1**

Answer: 1.2 cm

Question 22

uses density = frequency / width: density = 9 / 3	**M1**
frequency density = 3.0 cao	**A1**
height = 3.0 (since height equals frequency density) cao	**A1**

Answer: frequency density = 3.0, height = 3.0

Question 23

missing frequency = 143 - 140 = 3	**M1**
frequency density = frequency / width = 3/5	**M1**
height = 0.6	**A1**

Answer: 0.6

Question 24

bar height is proportional to frequency density	**M1**
densities 2.6 and 1.8, giving a height scale of 5.2 / 2.6 = 2 cm per unit	**M1**
height = 3.6 cm	**A1**

Answer: 3.6 cm

Question 25

uses area = height * width with width = 50 - 30 = 20	**M1**
calculates area = 0.6 * 20 = 12	**M1**
frequency = 12 (people/items) cao	**A1**

Answer: 12

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