Histograms

GCSE Mathematics • **Higher Tier** • Grades 7–8 • Non-calculator

WORKED SOLUTIONS

Name: worked example Class: _____ Total: 51 / 51

Show all your working. Marks are given for correct method as well as the final answer.

1. Write down the formula for frequency density. **[1 mark]**

it is a DENSITY: how packed the class is

Answer: frequency ÷ class width

2. Complete the class width row of the table. **[2 marks]**

Time t (min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 70$
Frequency	12	28	30	18
Class width				
Frequency density				

upper bound – lower bound

Answer: 10, 10, 20, 30

3. Work out the frequency density for $0 < t \leq 10$. **[2 marks]**

Time t (min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 70$
Frequency	12	28	30	18
Class width				
Frequency density				

12 ÷ 10 = 1.2

Answer: 1.2

4. Work out the frequency density for $10 < t \leq 20$. **[2 marks]**

Time t (min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 70$
Frequency	12	28	30	18
Class width				
Frequency density				

28 ÷ 10 = 2.8

Answer: 2.8

5. Work out the frequency density for $20 < t \leq 40$. **[2 marks]**

Time t (min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 70$
Frequency	12	28	30	18
Class width				
Frequency density				

30 ÷ 20 = 1.5
the width is 20, not 10

Answer: 1.5

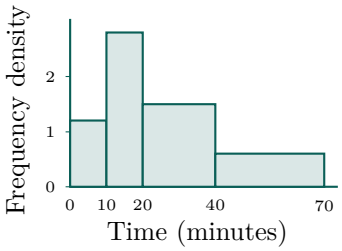
6. Work out the frequency density for $40 < t \leq 70$. **[2 marks]**

Time t (min)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 70$
Frequency	12	28	30	18
Class width				
Frequency density				

$18 \div 30 = 0.6$

Answer: 0.6

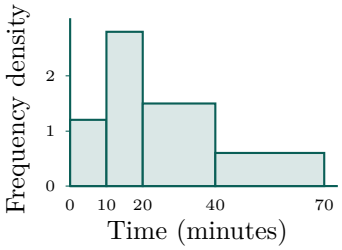
7. Explain why the $20 < t \leq 40$ bar is shorter than the $10 < t \leq 20$ bar even though it holds more data. **[3 marks]**



30 in a width of 20 gives fd 1.5
28 in a width of 10 gives fd 2.8
height is density, AREA is frequency

Answer: it is spread over twice the width

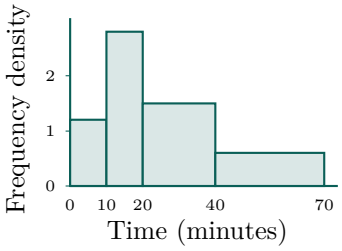
8. Use the histogram to work out the frequency for $0 < t \leq 10$. **[2 marks]**



frequency = fd $\times$ width
$1.2 \times 10 = 12$

Answer: 12

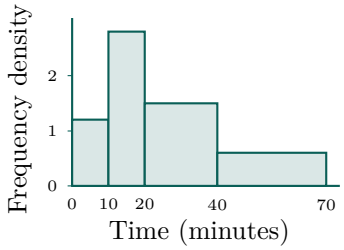
9. Use the histogram to work out the frequency for $40 < t \leq 70$. **[2 marks]**



$0.6 \times 30 = 18$

Answer: 18

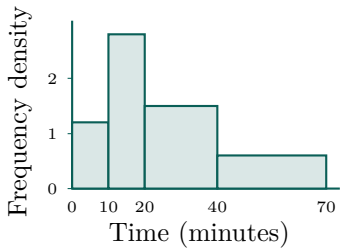
10. Use the histogram to work out the total frequency. **[3 marks]**



12 + 28 + 30 + 18
= 88

Answer: 88

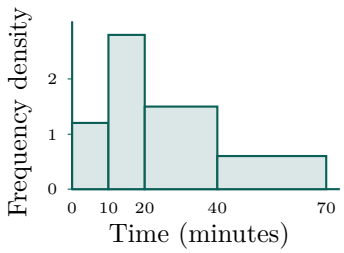
11. Use the histogram to estimate how many took between 20 and 30 minutes. **[3 marks]**



half of the 20--40 class
fd 1.5 × width 10
= 15

Answer: 15

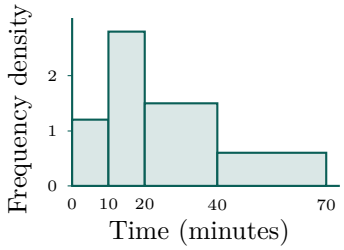
12. Use the histogram to estimate how many took between 15 and 25 minutes. **[4 marks]**



15--20: fd 2.8 × 5 = 14
20--25: fd 1.5 × 5 = 7.5
do each part in its OWN class
14 + 7.5 = 21.5

Answer: 21.5

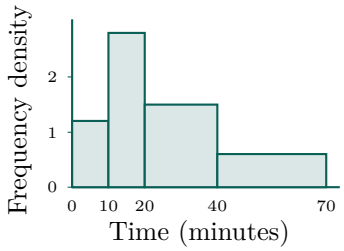
13. Use the histogram to estimate how many took more than 50 minutes. **[3 marks]**



50--70 is a width of 20
0.6 × 20 = 12

Answer: 12

14. Use the histogram to estimate the fraction who took 10 minutes or less. **[3 marks]**



12 out of 88
divide both by 4

Answer: $\frac{12}{88} = \frac{3}{22}$

15. Explain the difference between a histogram and a bar chart. **[2 marks]**

a bar chart has gaps and equal-width bars
a histogram has no gaps and can have unequal widths

Answer: histogram: continuous data, area = frequency

16. A histogram bar is 4 cm^2 in area and represents 20 people. Work out how many people 1 cm^2 represents. **[2 marks]**

20 ÷ 4 = 5

Answer: 5

17. On that histogram, another bar has area 7 cm^2. Work out its frequency. **[2 marks]**

7 × 5 = 35

Answer: 35

18. Explain why you can only ESTIMATE the number in part of a class from a histogram. **[2 marks]**

the original values are lost once they are grouped
it may not really be evenly spread

Answer: the data is assumed evenly spread within the class

19. A histogram has classes $0 < x \leq 5$ with frequency 20, and $5 < x \leq 25$ with frequency 30.

(a) Work out the two frequency densities. **[3 marks]**

$20 \div 5 = 4$

$30 \div 20 = 1.5$

(b) Write down which bar is taller and why. **[2 marks]**

the first bar, fd 4 against 1.5

it packs 20 into only 5 units of width

Answer: 4 and 1.5 ; the first bar

20. The table shows the ages at a club. $30 < a \leq 50$ has frequency 24, and the bar for $50 < a \leq 60$ has frequency density 0.9.

(a) Work out the frequency density for $30 < a \leq 50$. **[2 marks]**

$24 \div 20$

$= 1.2$

(b) Work out the frequency for $50 < a \leq 60$. **[2 marks]**

0.9×10

$= 9$

Answer: 1.2 ; 9 people

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