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GCSE MATHEMATICS • DATA & STATISTICS

Histograms

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Full worked solutions for the free Histograms worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Histograms worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

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A**Your turn answers**

Compare each line of your working with the solution. Estimates within a class can differ slightly: any value close to the one given is fine.

FOUNDATION

A1 Width = $7.5 - 5 = 2.5$ Midpoint = $\frac{5 + 7.5}{2} = 6.25$

A2 $6 + 10 + 7 + 3 = 26$ Modal class $30 < m \leq 40$

A3 Half of $30 < m \leq 40$: 5, then all of the last two classes: $5 + 7 + 3 = 15$

HIGHER

A4 $9 \div 2 = 4.5$

A5 $9 \div 5, 24 \div 15, 16 \div 5$: $1.8, 1.6, 3.2$

A6 $0.8 \times 30 = 24$

A7 75 to 80: $5 \times 2.2 = 11$. 80 to 100: $20 \times 0.4 = 8$ $11 + 8 = 19$

B**Fluency solutions**

One mark for each correct part. The notes in italics explain why each sequence was chosen.

FOUNDATION

B1 (a) $20, 10$ (b) $5, 22.5$ (c) $35, 42.5$ (d) $1, 2$

B2 (a) 12 (b) $3 + 8 + 12 + 9 + 4 = 36$ (c) $10 < t \leq 15$ (d) $\frac{9+4}{36} = \frac{13}{36}$

B3 (a) 20 (b) 11 (c) $20 < w \leq 40$ (d) 28



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B4 (a) $3 + 4 = 7$ (b) $6 + 9 + 4 = 19$ (c) $8 + 6 = 14$ (d) half of 4: 2

Take the same fraction of a class as the part of its width you need.

- B5** (a) Time is continuous: every value belongs to some class, so the classes touch
 (b) Colours are separate categories with nothing in between (c) Only when every class has the same width

- B6** (a) 20 (b) 20 (c) it would be taller than both old bars, although the values are spread over twice the width
 (d) $20 \div 20 = 1$, the frequency density

HIGHER

B7 (a) $14 \div 10 = 1.4$ (b) $22 \div 5 = 4.4$ (c) $21 \div 15 = 1.4$ (d) $9 \div 0.5 = 18$

B8 (a) $5 \times 2 = 10$ (b) $5 \times 4.4 = 22$ (c) $10 \times 3 = 30$ (d) $20 \times 0.8 = 16$

B9 (a) $5 \times 3.6 = 18$ (b) $20 \times 0.6 = 12$ (c) $12 \div 10 = 1.2$ (d) $24 \div 5 = 4.8$

B10 (a) $10 + 3 \times 4.4 = 23.2$, about 23 (b) $10 \times 0.8 = 8$ (c) $3 \times 4.4 + 5 \times 3 = 28.2$, about 28 (d) 39.5th of 78: running totals 10, 32, 62: $10 < w \leq 20$

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

- C1** Time is continuous: the end of one class is the start of the next, so the bars must touch.

- C2** With equal widths, the tallest bar has the most values, because each bar's height is its frequency.

- C3** A wider class holds values spread over more of the scale. With unequal widths, a wide bar drawn to its frequency would look too big, so heights can be compared only when the widths are equal.

C4 Total = $6 + 9 + 12 + 3 = 30$ $\frac{12}{30} \times 100 = 40\%$, as required



HIGHER

- C5** With unequal widths, bars drawn to the frequency make wide classes look too big. He should plot frequency density = frequency $\div$ class width.
- C6** Height $\times$ width = frequency density $\times$ class width = frequency, so the area of a bar is its frequency.
- C7** For example, $0 < x \leq 10$ with frequency 20 (height 2) and $10 < x \leq 40$ with frequency 30 (height 1). The first bar is taller, but the second class has more values.
- C8** (a) Area = 6 cm^2 for 30 people: **5** people per cm^2
 (b) $4 \times 2 = 8 \text{ cm}^2$, so $8 \times 5 =$ **40** people
 (c) 15 people need 3 cm^2 . The class is 30 units wide, which is 6 cm, so the height is **0.5** cm

D**Problem solving solutions**

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

- D1** Total = $4 + 9 + 12 + 5 = 30$ $\frac{5}{30} \times 100 \approx 16.7\%$
- D2** (a) The boys tend to be taller than the girls
 (b) $30 - (3 + 8 + 12) =$ **7**
- D3** $40 - (7 + 15 + 11) =$ **7**
- D4** $\frac{5 \times 4 + 15 \times 9 + 25 \times 12 + 35 \times 5}{30} = \frac{630}{30} =$ **21** minutes

HIGHER

- D5** The bar for $10 < t \leq 20$ is 10 wide and 1.5 squares tall, and represents 15, so the scale is 1 per unit of area.
 Other bars: $10 \times 1 = 10$, $20 \times 1.2 = 24$, $10 \times 0.5 = 5$ Total = $10 + 15 + 24 + 5 =$ **54**



- D6** Frequencies 10, 20, 30, 10: 70 values, so the median is about the 35th. The first two classes hold 30, so 5 more are needed from $20 < t \leq 40$, which has 1.5 per minute.

$$20 + \frac{5}{1.5} \approx 23.3 \text{ minutes}$$

D7 $\frac{5 \times 10 + 15 \times 20 + 30 \times 30 + 50 \times 10}{70} = \frac{1750}{70} = \boxed{25} \text{ minutes}$

D8 (a) $20 + 25 + 30 + 15 = \boxed{90}$

(b) More than 15: $30 + 15 = 45$ $\frac{45}{90} = \boxed{\frac{1}{2}}$

(c) Of those 45, 15 are more than 30 $\boxed{\frac{1}{3}}$

E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1 (a) $\boxed{11}$

B1

(b) $5 + 14 + 11 + 6 = \boxed{36}$

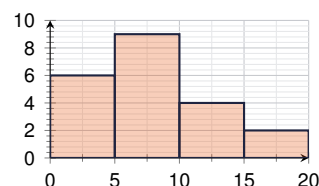
B1

(c) $\boxed{10 < w \leq 20}$

B1

E2 (a) Bars of heights 6, 9, 4, 2 with no gaps

(b) $\boxed{5 < t \leq 10}$



B2 B1

E3 (a) $\boxed{5, 10, 5, 20}$

B2

(b) $\boxed{20 < t \leq 40}$

B1

E4 Half of $10 < w \leq 20$: 7

M1

Plus all of the later classes: $11 + 6$

M1

$7 + 11 + 6 = \boxed{24}$

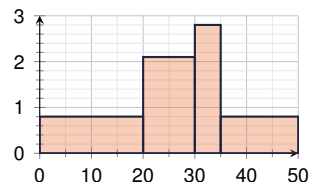
A1



- E5** (a) The second class is three times as wide, so its values are much more spread out C1
 Its taller bar makes it look more crowded, when it is actually less crowded C1
 (b) Frequency densities: **1** and **0.5** B1

HIGHER

- E6** $14 \div 5 = 2.8$ and $12 \div 15 = 0.8$
 Bars of height 2.8 for $30 < t \leq 35$ and 0.8 for $35 < t \leq 50$



M1 A1 A1

- E7** $10 \times 1.6 + 10 \times 2.4 + 5 \times 4 + 15 \times 1.2$ M1 M1
 $16 + 24 + 20 + 18 = \mathbf{78}$ A1

- E8** (a) $4 < w \leq 6$: $2 \times 7 = \mathbf{14}$; $10 < w \leq 16$: $6 \times 1.5 = \mathbf{9}$ B1 B1
 (b) Bars of height $12 \div 4 = \mathbf{3}$ for $0 < w \leq 4$ and $18 \div 4 = \mathbf{4.5}$ for $6 < w \leq 10$ B1 B1

- E9** (a) $10 \times 1.2 + 20k + 10 \times 0.8 = 40$, so $20k = 20$ M1
 $k = \mathbf{1}$ A1
 (b) 20th value: the first class holds 12, so 8 more are needed from $10 < x \leq 30$, which has 1 per unit M1
 Median $\approx 10 + 8 = \mathbf{18}$ A1
 (c) $35 < x \leq 40$: $5 \times 0.8 = 4$ values $\frac{4}{40} \times 100 = \mathbf{10}\%$ B1

