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GCSE MATHEMATICS • DATA & STATISTICS

Cumulative Frequency

Worked Solutions

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

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



Tap a section to jump straight to it

Full worked solutions for every question on the Cumulative Frequency 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. Readings from a graph can differ slightly: any value in the stated range scores the mark.

FOUNDATION

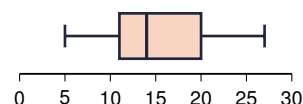
A1 6, 6 + 11, 17 + 8, 25 + 5: **6, 17, 25, 30**

A2 Running totals 3, 10, 20, 24 40 kg or less: **10** more than 50 kg: $24 - 20 =$ **4**

A3 The median is the 20.5th value. Running totals 7, 19, 28 **$20 < t \leq 30$**

HIGHER

A4 IQR = $20 - 11 =$ **9**
Range = $27 - 5 =$ **22**



A5 *C* has the higher median (60 against 55). *C* also has the smaller IQR (14 against 25), so *C* is more consistent.

A6 **$(0, 0), (5, 6), (10, 17), (15, 25), (20, 30)$**

A7 Median at 30: about **27.5** LQ at 15: 20; UQ at 45: about 37.7 IQR about **18** (accept 16 to 20)

B**Fluency solutions**

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

FOUNDATION

B1 (a) **3** (b) **11** (c) **25** (d) **35**

B2 (a) **25** (b) $40 - 25 =$ **15** (c) $35 - 11 =$ **24** (d) **$\frac{11}{40}$**



- B3** (a) 20.5th value; running totals 3, 11, 25: $20 < t \leq 30$ (b) 13th; 10, 16: $10 < t \leq 20$
 (c) 25.5th; 5, 23, 43: $20 < t \leq 30$ (d) 8th; 1, 3, 7, 15: $30 < t \leq 40$

The median class is not always the class with the largest frequency: use the running totals.

- B4** (a) 20 mm (b) day 7 (c) $45 - 20 = 25$ mm (d) days 4 to 6: the steepest part of the graph

- B5** (a) B (b) B (c) Group B scored higher on average (median 30 against 24), and its scores were more consistent (range 10 against 18)

- B6** (a) **True** (b) **True** (c) **False**: it is in $20 < t \leq 30$ (d) **True**: 29 of 40

HIGHER

- B7** 80 students: median at 40, LQ at 20, UQ at 60
 (a) about 167 (accept 166 to 168) (b) 160 (c) about 175.5 (accept 175 to 176) (d) about 15.5 (accept 15 to 16.5)

- B8** (a) 34 (b) $80 - 59 = 21$ (c) $75 - 13 = 62$ (d) $\frac{10}{80} \times 100 = 12.5\%$

Read up from the value to the graph, then across to the cumulative frequency.

- B9** (a) $14 - 7 = 7$ (b) $20 - 3 = 17$ (c) $38 - 25 = 13$ (d) $44 - 21 = 23$

- B10** (a) **False**: 52 against 55 (b) **True**: 30 against 13 (c) **False**: both ranges are 55 (d) **True**: 70 is Q 's upper quartile

C

Reasoning solutions

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

FOUNDATION

- C1** Each running total counts everyone so far. The last one has added every class, so it counts everyone.
- C2** The table only says how many are in each class of 10 minutes, not how the times are spread inside the class.



C3 The median is the middle value, not the class with the most values. 30 people: the 15.5th value. Running totals 12, 16: $10 < t \leq 20$

C4 The running total at 30 minutes is 32, and there are 50 people, so $50 - 32 = 18$ took more than 30 minutes.

HIGHER

C5 Each running total counts everyone up to the end of the class, so it must be plotted at the upper class boundary, not the midpoint.

C6 The exact values inside each class are not known; the graph joins the points as if the values were spread evenly.

C7 Both groups have the same average (median). The larger IQR of Y means its values are more spread out, so Y is less consistent, not better.

C8 (a) From LQ to UQ is the middle half: 20 people
 (b) A quarter of the 40 people, 10, scored at or above the UQ, 34
 (c) The upper whisker is long (up to 60), so a few high scores pull the mean above the median of 26

D

Problem solving solutions

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

FOUNDATION

D1 Running totals 6, 20, 40, 50 Over 40: $50 - 20 = 30$ $\frac{30}{50} \times 100 = 60\%$

D2 A: $\frac{18}{30} \times 100 = 60\%$ B: $\frac{14}{25} \times 100 = 56\%$ Class A

D3 Week 3: the graph is steepest there, rising by 35 mm.

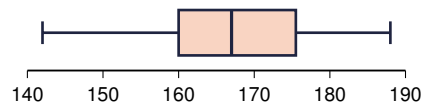
D4 $x = 8 + 12 = 20$ Third class: $33 - 20 = 13$



HIGHER

D5 40% earn more, so 60% earn less: 60 on the cumulative frequency axis $X \approx \boxed{35}$

D6 Median about 167, LQ 160, UQ about 175.5
IQR about 15.5



- D7** (a) Boys: about 30 Girls: about 23 (accept 22 to 24)
 (b) Boys: about $37 - 22 = 15$ Girls: about $30 - 14.5 = 15.5$ (accept 14 to 17)
 (c) The boys took longer on average, but the spread of times was about the same.

D8 (a) $6 + x + 2x + 12 + 6 = 60$, so $3x = 36$

$$x = \boxed{12}$$

(b) Running totals 6, 18, 42, 54, 60

Median (30th): $20 + \frac{12}{24} \times 10 = 25$ LQ (15th): $10 + \frac{9}{12} \times 10 = 17.5$ UQ (45th): $30 + \frac{3}{12} \times 10 = 32.5$

Median $\boxed{25}$, IQR = $32.5 - 17.5 = \boxed{15}$

E**Exam practice solutions**

Marks are shown on the right of each line. Any reading in the stated range scores the mark.

FOUNDATION

Foundation and Higher crossover

E1 (a) $\boxed{6, 17, 32, 44, 50}$ B2

(b) $\boxed{44}$ B1

E2 (a) 25.5th value; running totals 6, 17, 32: $\boxed{20 < t \leq 30}$ B1

(b) $50 - 32$ M1

= $\boxed{18}$ A1

E3 Year 10 had the higher median (32 against 28), so scored higher on average C1

Year 11 had the smaller range (12 against 20) C1

So Year 11's marks were more consistent C1

E4 (a) $\boxed{45}$ mm B1

(b) day 17 or 18 (the graph reaches 100 halfway between days 15 and 20) B1

(c) $90 - 45 = \boxed{45}$ mm B1



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E5 The median depends on the number of values, not the number of classes

C1

30 values: the 15.5th value; the first class holds 16

M1

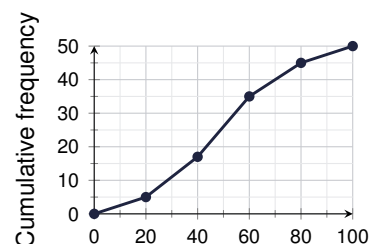
$$0 < t \leq 10$$

A1

HIGHER

E6 (a) Points (0, 0), (20, 5), (40, 17), (60, 35), (80, 45), (100, 50), joined

(b) At 25: about 49 kg (accept 48 to 51)



B2 B1

E7 (a) At 30: about 29 (accept 28 to 30)

B1

(b) LQ at 15: about 20.5; UQ at 45: about 38

M1

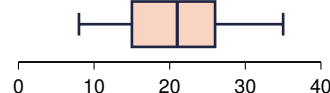
IQR about 17.5 (accept 16.5 to 19)

A1

E8 (a) Box from 15 to 26 with a line at 21; whiskers to 8 and 35

(b) Group B has a higher median (24 against 21), so took longer on average

Group B's IQR is larger (14 against 11), so group A is more consistent



B2 C1 C1

E9 (a) 30% failed: 24 students. At 24: about 46 (accept 44 to 47)

M1 A1

(b) At 70: 57; at 50: 30

M1

$$57 - 30 = 27$$

A1

(c) At 75: about 63.5, so about 16.5 scored more: $\frac{16.5}{80} \times 100 \approx 21\%$

B1

