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GCSE MATHEMATICS • DATA & STATISTICS

Averages - Raw Data

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Averages from Raw Data worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Averages - Raw Data 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.

FOUNDATION

A1 In order: 2, 5, 7, 9, 9, 10, 14 Mode **9** Median (4th value) **9** Mean = $56 \div 7 =$ **8** Range = $14 - 2 =$ **12**

A2 Total = $4 \times 12.5 = 50$ $50 - (10 + 15 + 11) =$ **14**

A3 21.0 is an outlier, so use the median. In order: 13.2, 13.5, 13.8, 14.1, 21.0 Median = **13.8** seconds

HIGHER

A4 15 values: LQ is the 4th, median the 8th, UQ the 12th LQ **26**, median **31**, UQ **38** IQR = $38 - 26 =$ **12**

A5 Multiplying by 4 multiplies both the mean and the spread by 4 mean **36**, range **20**

A6 $20 \times 40 = 800$ and $30 \times 45 = 1350$ $(800 + 1350) \div 50 =$ **43**

A7 Total = $4 \times 11 = 44$ $8x + 8 = 44$ $8x = 36$ **$x = 4.5$**

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

B1 (a) **5** (b) **5** (c) $30 \div 5 =$ **6** (d) $9 - 3 =$ **6**

B2 (a) $40 \div 5 =$ **8** (b) **5** (c) **16** (d) **5** *One large value changes the mean and range, but not the median or mode.*



- B3** (a) **5.5** (b) order: 1, 2, 4, 7, 9, 10: **5.5** (c) order: 1.2, 2.6, 3.4, 5.0: **3** (d) order: -5, -3, -1, 0, 2, 4: **-0.5**

Always put the data in order first; with an even number of values, find the halfway point of the middle two.

- B4** (a) $24 - 16 =$ **8** (b) $50 - 36 =$ **14** (c) $3 + 10 =$ **13** (d) $\frac{5+x}{2} = 6$: **7**

- B5** (a) **mode**: the sizes are categories and the shop wants the most common (b) **median**: it is not affected by the manager's salary
(c) **mean**: it uses every mark and there are no outliers

- B6** (a) **84** (b) $104 \div 13 =$ **8** (c) **36** (d) $9 \times 5 = 45$, $45 - 36 =$ **9**

HIGHER

- B7** (a) 6th value: **10** (b) 3rd value: **5** (c) 9th value: **14** (d) $14 - 5 =$ **9**

- B8** (a) **17** (b) **8** (c) **36** (d) **24** Adding moves the data without spreading it; multiplying stretches the spread too.

- B9** (a) $(60 + 120) \div 25 =$ **7.2** (b) $(80 + 90) \div 10 =$ **17**
(c) $108 + 14n = 11(12 + n)$, $3n = 24$: **8** (d) $6 \times 8 - 5 \times 7 = 48 - 35 =$ **13**

- B10** (a) $3x + 6 = 30$: **$x = 8$** (b) **$x = 5$** (c) $10x + 10 = 60$: **$x = 5$** (d) $3x - x = 12$: **$x = 6$**

C

Reasoning solutions

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

FOUNDATION

- C1** Tom did not put the data in order. In order: 1, 3, 5, 8, 9 median **5**

- C2** The range is a single number, the difference between the largest and smallest values: $15 - 4 =$ **11**

- C3** Yes. For example, 2, 8, 12, 13, 15: the total is 50, so the mean is 10, and the middle value is 12



- C4** Mean = $50 \div 5 = 10$ Median = 5 The median is better: 30 is an outlier that pulls the mean above four of the five values.

HIGHER

- C5** The overall mean depends on how many students are in each class. It is 65 only if the two classes have the same number of students; if Q is bigger, the mean is above 65

- C6** Range = $60 - 12 = 48$ LQ (2.5th value) = 14.5, UQ (7.5th value) = 18.5, IQR = 4
The IQR is better: the outlier 60 makes the range misleading, but the IQR uses only the middle half of the data.

- C7** Mean: $2 \times 8 - 1 = 15$ IQR: doubling doubles the spread, and subtracting 1 does not change it: 10

- C8** (a) The old total is nm , so the new mean is $\frac{nm+v}{n+1} = \frac{(n+1)m+v-m}{n+1} = m + \frac{v-m}{n+1}$ **as required**
(b) If $v = m$ the mean does not change. If $v > m$ the fraction is positive, so the mean goes up; if $v < m$ it goes down.

D

Problem solving solutions

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

FOUNDATION

- D1** Total after 5 tests = $5 \times 65 = 325$. Total after 4 = $4 \times 62 = 248$ $325 - 248 = 77$

- D2** Total = $3 \times 8 = 24$. The mode is 7, so two of the numbers are 7 $24 - 14 = 10$
Numbers $7, 7, 10$ median 7 range 3

- D3** Total = $10 \times 7.5 = 75$ $75 - 3 = 72$ $72 \div 9 = 8$

- D4** Total = $4 \times 15 = 60$. The numbers are $n, n+2, n+4, n+6$, so $4n+12 = 60$ and $n = 12$ **12, 14, 16, 18**



HIGHER

D5 Recorded total = $20 \times 30 + 30 \times 40 = 1800$. The error was 50 too small, so the correct total is 1850
 Correct mean = $1850 \div 50 = 37$

D6 11 values: LQ = 3rd = 25, UQ = 9th = 34, IQR = 9
 $34 + 1.5 \times 9 = 47.5$, and $52 > 47.5$, so 52 is an outlier. $25 - 13.5 = 11.5$, and no value is below 11.5

D7 The median is the mean of the 3rd and 4th values: $\frac{x+x}{2} = 8$, so $x = 8$
 Mean = $\frac{3+5+8+8+12+15}{6} = \frac{51}{6} = 8.5$

D8 In order: $a \leq b \leq 8 \leq d \leq e$, with total $5 \times 9 = 45$
 Mode 4: 4 must appear at least twice, and it must be below the median, so $a = b = 4$
 Range 11: $e = 4 + 11 = 15$ Total: $4 + 4 + 8 + d + 15 = 45$, so $d = 14$
 Every step was forced, so the only set is 4, 4, 8, 14, 15

E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1 (a) 4 B1
 (b) In order: 2, 3, 4, 4, 8, 9, 10, 11, 12 B1
 (c) $63 \div 9 = 7$ B1
 (d) $12 - 2 = 10$ B1

E2 $6 \times 8 = 48$ $5 + 9 + 7 + 10 + 6 = 37$ M1
 $48 - 37 = 11$ A1

E3 (a) £26 000 B1
 (b) £95 000 is an outlier C1
 It pulls the mean above what six of the seven workers earn C1



- E4** (a) $14 + 16 + 17 + 18 + 19 + 21 + 22 + 25 = 152$ M1
 $152 \div 8 = 19$ A1
(b) The mean uses every value, so an extra 63 adds $63 \div 8$ to it; the median only depends on the middle values C1
-

- E5** Total of five = 60 M1
Total of four = 52 M1
 $60 - 52 = 8$ A1
-

HIGHER

- E6** LQ = 3rd value = 20 M1
UQ = 9th value = 30 M1
IQR = 10 A1
-

- E7** Mean: $(25 + 5) \times 2 = 60$ M1 A1
Range: adding does not change it, doubling doubles it: 24 B1
-

- E8** Total for A = $20 \times 64 = 1280$ M1
 $1280 + 70n = 66(20 + n)$ M1
 $1280 + 70n = 1320 + 66n$, so $4n = 40$ M1
10 students A1
-

- E9** (a) $15n + 30 = 16(n + 1)$ M1
 $15n + 30 = 16n + 16$, so $n = 14$ A1
(b) After 15 games the total is $15 \times 16 = 240$ M1
 $\frac{240 + 30k}{15 + k} = 20$, so $240 + 30k = 300 + 20k$ M1
6 more games A1
-

