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GCSE MATHEMATICS • DATA & STATISTICS

Time Series

Worked Solutions

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

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



Tap a section to jump straight to it

Full worked solutions for every question on the Time Series 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

Data & Statistics revision engine

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A**Your turn answers**

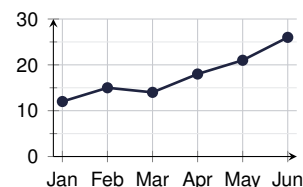
Compare each line of your working with the solution. Predictions can differ slightly: any sensible value close to the one given is fine.

FOUNDATION**A1** **98** cm**A2** The values fall over the period: **decreasing**. Change = $16 - 30 = -14$ thousand**A3** **Q3** each year: the summer quarter, when most sunscreen is needed**HIGHER****A4** Change = $-12 \times \frac{-12}{80} \times 100 = -15$ a **15**% decrease**A5** $60 - 95 = -35$ over 10 years **-3.5** per year (a fall of 3.5 per year)**A6** Year 3: $40 < 46$; year 4: $45 > 44$ Year **4****A7** Increases of 2 and 5, a mean of 3.5 $67 + 3.5 = \mathbf{70.5}$, so about £70.50**B****Fluency solutions**

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

FOUNDATION**B1** (a) **80** mm (b) **January** (c) **June** (d) **April****B2** (a) **5** mm (b) $80 + 65 + 55 = \mathbf{200}$ mm (c) $335 \div 6 \approx \mathbf{55.8}$ mm (d) $80 - 30 = \mathbf{50}$ mm

- B3** (a) Points plotted and joined with straight lines
 (b) **increasing** overall
 (c) **May to June** (a rise of 5)
 (d) about 30 thousand (accept 28 to 32)



- B4** (a) **80** (b) **Q4** (c) **increasing**: each quarter is higher than the same quarter a year before
 (d) highest in Q3, lowest in Q4, every year

- B5** (a) **True** (42 against 35) (b) **True** (c) **False**: Q4 (38) was lowest

- B6** (a) small changes look very large (b) the steepness of the line is distorted
 (c) you cannot tell how big the values or the changes are (d) two months may not show the true trend or the seasonal pattern

HIGHER

- B7** (a) **15**% increase (b) **25**% decrease (c) **20**% increase (d) **25**% increase *Always divide by the starting value.*

- B8** (a) $30 \div 10 = \mathbf{3}$ (b) $-40 \div 8 = \mathbf{-5}$ (c) $7.5 \div 25 = \mathbf{0.3}$ (d) $9 \div 2 = \mathbf{4.5}$

- B9** (a) $40 + 65 + 80 + 35 = \mathbf{220}$ (b) $238 \div 4 = \mathbf{59.5}$ (c) $256 \div 4 = \mathbf{64}$ (d) $(64 - 55) \div 2 = \mathbf{4.5}$

- B10** (a) increases 3, 4: **32.5** (b) increases 3, 4: **58.5** (c) increases 5, 4: **74.5** (d) increases 2, 4: **39**
Always compare the same quarter from year to year.

C

Reasoning solutions

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

FOUNDATION

- C1** The fall from Q3 to Q4 happens every year: it is the seasonal pattern. The trend is found by comparing the same quarter each year, and every quarter is higher each year, so the trend is upward.
- C2** It is only an estimate: the value between the times was not measured, so the line assumes a steady change.



C3 Five years is far beyond the data. The trend may change: a new competitor, a recession or a change in demand.

C4 Increase = $8 \times \frac{8}{32} \times 100 = 25\%$, as required

HIGHER

C5 Sales always change between seasons, so a rise from Q4 to Q1 may just be the seasonal pattern. She should compare Q1 with Q1 of the previous year.

C6 No. An average of 6 per year could come from larger rises in some years and smaller rises, or falls, in others.

C7 The steepness depends on the scale. A line can look steeper only because its vertical axis is stretched. Compare the actual values or the changes instead.

C8 (a) $\frac{2200}{2000} = 1.1$ and $\frac{2420}{2200} = 1.1$: a 10% increase each year

(b) $2420 \times 1.1^2 = 2928.2$ about **2928**

(c) A straight line adds the same amount (about 210) each year, but a percentage increase adds more each year as the population grows.

D**Problem solving solutions**

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

FOUNDATION

D1 $42 + 48 + 55 + 51 + 60 + 58 = 314$ $314 \div 6 \approx \mathbf{52.3}$ $52.3 \geq 50$, so the target was met.

D2 (a) Ice creams: highest in Q3, lowest in Q1. Hot drinks: highest in Q1 and Q4, lowest in Q3
(b) Ice creams sell best in the warm summer quarter; hot drinks sell best in the cold winter quarters.

D3 Total = $6 \times 45 = 270$ $270 - (40 + 52 + 38 + 50 + 47) = 270 - 227 = \mathbf{43}$

D4 The line reaches 18°C halfway between 10 am and 12 pm, at 11 am, and falls to 18°C at 4:30 pm **5.5** hours



HIGHER

D5 (a) 220, 238, 256

(b) Year 1 to 2: $\frac{18}{220} \times 100 \approx 8.18\%$. Year 2 to 3: $\frac{18}{238} \times 100 \approx 7.56\%$. No: the same rise is a smaller percentage of a bigger total.

D6 (a) Year 4: $130 < 137$; year 5: $145 > 142$ Year 5

(b) $\frac{145 - 90}{90} \times 100 \approx 61.1\%$

D7 (a) Q4: 35, 38, 42. Increases 3 and 4, a mean of 3.5 $42 + 3.5 = 45.5$, about 46

(b) For example: the trend may change; only three years of data were used.

D8 (a) $Q3 + Q4 = 250 - 50 - 70 = 130$. $Q4 = 0.625 \times Q3$, so $1.625 \times Q3 = 130$ $Q3 = 80$, $Q4 = 50$

(b) $\frac{80}{250} \times 100 = 32\%$

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION *Foundation and Higher crossover*

E1 (a) 30 hundred (3000)

B1

(b) June

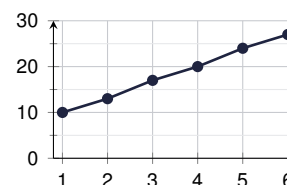
B1

(c) $42 - 35 = 7$ hundred (700)

B1

E2 (a) Points at (4, 20), (5, 24), (6, 27), joined

(b) The height increases by about 3 to 4 cm each day



B2 B1



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- E3** (a) Increasing: every quarter is higher than a year before B1
 (b) Highest in Q3 and lowest in Q4 each year B1
 (c) **Q3** B1

- E4** Increase = $42 - 20 = 22$ M1
 $\frac{22}{20} \times 100$ M1
110% A1

- E5** (a) **24** (£24 000) B1
 (b) Profits keep rising by £3000 each year C1
 (c) Ten years is far beyond the data, and the trend may change C1

HIGHER

- E6** Q2 sales: 65 in year 1 and 74 in year 3 M1
 $\frac{9}{65} \times 100 \approx 13.8\%$ A1
 Comparing the same quarter removes the seasonal effect C1

- E7** Increase = $60\,000 - 36\,000 = 24\,000$ M1
 over 8 years M1
£3000 per year A1

- E8** (a) Year **4** (both 60) B1
 (b) Total = $61 + 70 = 131$ $\frac{70}{131} \times 100$ M1
 $\approx 53.4\%$ A1
 (c) *B* rises steadily by 10 a year, while *A*'s growth is slowing down C1

- E9** (a) Means: 55, 59.5, 64, an increase of **4.5** per year M1 A1
 (b) Q3 minus the mean: 25, 26.5, 27; average ≈ 26.2 M1 A1
 (c) Year 4 mean $\approx 64 + 4.5 = 68.5$, so Q3 $\approx 68.5 + 26.2 \approx$ **95** B1

