



Index numbers

About 55 minutes Calculator allowed 53 marks

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

A1 Needed today [2 marks] **A2** From chapter 3 [2 marks]

20% of 40 is equal to 25% of B .
Find B .

Kemi collects the shoe sizes of Year 7 students. One value, a shoe size of 64, is an outlier. Should Kemi remove it? Give a reason.

Answer

A3 From chapter 6 [2 marks] **A4** Last lesson [2 marks]

The journey times, in minutes, of 34 commuters were grouped:
5 in $0 < t \leq 5$, 10 in $5 < t \leq 10$, 5 in $10 < t \leq 20$, 14 in $20 < t \leq 40$.
Use interpolation to estimate the median.

In a spelling quiz, the mean mark was 35 and the standard deviation was 15. Pia scored 24. Work out Pia's standardised score, to 2 decimal places.

Answer

Answer

B Examples, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

A loaf cost £1.20 in 2019 and £1.47 in 2024. With 2019 as the base year, work out the index number for 2024 and interpret it.

Hint Divide the new price by the price in the base year, then multiply by 100.

B1 A cinema ticket cost £8.40 in 2020 and £9.87 in 2025. With 2020 as the base year, work out the index number for 2025 and interpret it in context. [3 marks]

EXAMPLE 2

A bus pass cost £36.50 in 2021. With 2021 as the base year, its index number in 2024 is 108. Work out its price in 2024.

Hint An index of 108 means the price is 1.08 times the base-year price.

- B2** With 2021 as the base year, [2 marks]
the index number for a gas bill in 2025 is 136. The 2025 bill was £1224. Work out the 2021 bill.

Answer

EXAMPLE 3

The table shows the price of a tin of paint. Work out the chain base index numbers for 2022, 2023 and 2024. What does the one for 2024 tell you?

Year	2021	2022	2023	2024
Price (£)	24.00	25.20	27.72	26.88

Hint Each year is compared with the year before it, not with 2021.

- B3** The table shows the price of a [4 marks]
rail season ticket. Work out the chain base index numbers for 2024 and 2025, to 1 decimal place. What does the one for 2025 tell you?

Year	2022	2023	2024	2025
Price (£)	640	672	700	686

- B4** The chain base index numbers [3 marks]
for the mean house price in a town for three quarters in a row are 101.5, 99.2 and 102.8. Work out their geometric mean and interpret it in context.

EXAMPLE 4

The chain base index numbers for a gym membership from 2022 to 2025 are 104, 102, 107 and 98. Work out the average yearly rate of change of the price.

Hint Multiply the four index numbers and take the fourth root: the geometric mean.

- B5** The table shows a café's [4 marks]
costs. Work out its weighted index number. Compare it with the CPI, which rose from 100 to 106.5.

Item	Food	Transport	Energy	Clothing
Index number	108	112	125	96
Weight	40	25	20	15

Hint Multiply each index number by its weight, add, then divide by the sum of the weights.

Cost	Beans	Milk	Wages	Rent
Index number	118	106	104	110
Weight	5	3	10	2

EXAMPLE 6

The Consumer Price Index (CPI) is a weighted index number. Explain why it is weighted, not a plain mean of its items' index numbers.

Hint Think about how much of their money a household spends on each item.

B6 In a year the CPI rose from 100 [2 marks] to 106 and energy prices rose by 20%. Kai spends more of his money on energy than the CPI assumes. Did his costs rise by more or less than 6%? Give a reason.

c Practice

C1 In 2021 a box of tea bags cost [3 marks] £2.40 and a jar of coffee cost £4.50. In 2025 they cost £2.70 and £5.13. With 2021 as the base year, work out an index number for each. Which price rose by the greater percentage?

C2 Using 2019 as the base year, the [2 marks] index numbers for the price of a school blazer are 110 in 2022 and 132 in 2025. Lily says the price rose by 22% from 2022 to 2025. Work out the correct percentage increase.

C3 A bike service cost £48 in 2023. [2 marks] The chain base index numbers for its price are 106 in 2024 and 105 in 2025. Work out the price of a bike service in 2025.

Answer

C4 The monthly chain base index [3 marks] numbers for the price of a used car model are 98.5, 97.0, 99.0 and 98.0. Work out the average monthly rate of change, and say what it means.

Answer

D Exam-style questions

- D1** A coffee roaster records the price of 1 kg of coffee beans each year. The table shows the prices and some of the chain base index numbers.

Year	2020	2021	2022	2023	2024
Price of 1 kg (£)	16.00	16.80	18.48	17.92	19.08
Chain base index		105	110	?	?

- (a) Work out the chain base index numbers for 2023 and 2024. Give your answers to 1 decimal place. [2 marks]

Answer

- (b) Sam says, "The mean of the four chain base index numbers is 104.6, so the price rose by 4.6% a year on average." Explain why Sam is wrong. Work out the correct average yearly rate of increase, and interpret it in context. [4 marks]

Total for D1: 6 marks

- D2** The table shows index numbers and weights for a bakery's costs from 2020 to 2025. Over the same years the CPI rose from 100 to 112.4.

Cost	Flour	Butter	Energy	Wages
Index number	122	135	141	106
Weight	15	10	20	55

- (a) Work out the weighted index number for the bakery's costs. Use it to comment on how the bakery's costs changed compared with prices in general. [4 marks]

- (b) The owner says, "This shows the bakery made less profit in 2025 than in 2020." Explain why the index numbers cannot show this. [1 mark]

Total for D2: 5 marks

- D3** The chain base index numbers for the rent of a flat are 103 in 2023, 106 in 2024 and 97 in 2025. Mo says, "The rent in 2025 was lower than the rent in 2022, because the index number for 2025 is below 100." [3 marks]

Is Mo correct? You must show your working.

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 The table shows the index numbers and weights of three items in a shop. Their weighted index number is 108. Find the weight w . [3 marks]

Item	A	B	C
Index number	104	120	106
Weight	6	3	w

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Write the weighted index number as a fraction with w in the top and the bottom.
- Hint 2**
$$\frac{104 \times 6 + 120 \times 3 + 106w}{6 + 3 + w} = 108.$$
- Hint 3** $984 + 106w = 108(9 + w) = 972 + 108w$, so $12 = 2w$ and $w = 6$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can work out simple and chain base index numbers and say what they mean.
- I can find the average rate of change with a geometric mean.
- I can work out a weighted index number and compare it with the CPI.