

Repeated percentage increase or decrease

Starter

1. **(Review of last lesson)** When VAT is added to the cost of a tyre, its price increases from £54.50 to £61.04. What is the rate at which VAT is charged?

Working: *Calculating the VAT rate is a percentage change calculation.*

$$\text{VAT rate} = \frac{\text{Change}}{\text{Original}} \times 100\% = \frac{61.04 - 54.50}{54.50} \times 100\% = 12\%$$

2. **(Review of last lesson)** Two years ago a new house was worth £270000. In each year since it was built, its value increased by 6%. How much is the house now worth?

Working: Increase by 6% \Rightarrow $\times 1.06$
 Value of house after the first year = $270000 \times 1.06 = 286200$
 Value of house after the second year = $286200 \times 1.06 = 303372$
 The house is now worth £303372

E.g. 1 A new house is worth £120000. Write down the calculation to find its value:

- (a) after 4 years when its value increased by 5% each year
 (b) after 7 years when its percentage increase was 2.6% a year
 (c) after 3 years when its value **decreased** by 2% each year
 (d) increase by 3% in the first 2 years and then increased by 1.7% in the next 6 years.

Working:

(a) Increase by 5% \Rightarrow $\times 1.05$
 Number of years at 5% is 4 so the power of 1.05 is 4.
 New value of house = 120000×1.05^4

(b) Increase by 2.6% \Rightarrow $\times 1.026$
 Number of years at 2.6% is 7 so the power of 1.026 is 7.
 New value of house = 120000×1.026^7

(c) **Decrease** by 2% \Rightarrow $\times 0.98$
 Number of years at 2% is 3 so the power of 0.98 is 3.
 New value of house = 120000×0.98^3

(d) Increase by 3% for 2 years \Rightarrow $\times 1.03^2$
 Increase by 1.7% for 6 years \Rightarrow $\times 1.017^6$
 New value of house = $120000 \times 1.03^2 \times 1.017^6$

E.g. 2 A bank pays 2% interest on savings so long as the money is untouched for 4 years. Sara invests £5000 in the bank.

- (a) How much money does she have in the bank after 4 years?
 (b) How much interest has she earned?

Working:

(a) Increase by 2% for 4 years \Rightarrow $\times 1.02^4$
 Amount in bank after 4 years = $5000 \times 1.02^4 = £5412.16$

(b) Interest earned = New amount in bank – Original amount in bank
 = $5412.16 - 5000 = 412.16$

E.g. 3 Jack invests £9000 at 3% interest. Calculate the value of the investment and how much interest was earned after 5 years for (a) compound interest and (b) simple interest.

Working:

(a) Compound interest: Increase by 3% for 5 years $\Rightarrow \times 1.03^5$
Amount in bank after 5 years = $9000 \times 1.03^5 = 10433.47$
Interest earned = $10433.47 - 9000 = \text{£}1433.47$

(b) Simple interest
3% of £9000 $\Rightarrow 0.03 \times 9000 = 270$
Interest gained in 5 years = $270 \times 5 = \text{£}1350$
Amount in bank after 5 years = $9000 + 1350 = \text{£}10350$

E.g. 4 The population of Ripon is currently 16000 inhabitants. If the population increases by 1% per year, what would the population be:

(a) 3 years from now (b) 5 years **ago**.
Round your answers to the nearest number of people.

Working:

(a) Population in 3 years = $16000 \times 1.01^3 = 16485$ people

(b) To go back in time we need to divide.
Population 5 years ago = $16000 \div 1.01^5 = 15223$ people

E.g. 5 At the start there are 3000 bacteria in a petri dish. They decrease by 6% per hour.

(a) How many bacteria will there be in 8 hours?
(b) After how many complete hours will the bacteria have dropped to less than half the original bacteria?

Working:

(a) Decrease by 6% $\Rightarrow \times 0.94$
Bacteria after 8 hours = $3000 \times 0.94^8 = 1829$ bacteria

(b) The number of bacteria must drop below 1500
Use trial and improvement
After 10 hours = $3000 \times 0.94^{10} = 1616$ bacteria
After 11 hours = $3000 \times 0.94^{10} = 1519$ bacteria
After 12 hours = $3000 \times 0.94^{10} = 1428$ bacteria
So after 12 complete hours the number of bacteria will have dropped to less than half the starting value.

Video: [Repeated percentage increase or decrease](#)

[Solutions to Starter and E.g.s](#)

Exercise

9-1 class textbook: p31 M2.3 Qu 1-15
A*-G class textbook: p29 M2.3 Qu 1-15
9-1 homework book: p9 M2.3 Qu 1-8
A*-G homework book: p7 M2.3 Qu 1-8