

Exercise walk-through

3.2

Percentage change, growth and decay (R9–R16)

AQA · GCSE · Mathematics

1. Unit 3.3 at a glance

Unit 3.3 at a glance

Foundation rows R1-R16 in three tiers. Higher-only additions: compound units (density, pressure) in numerical AND algebraic contexts, percentages above 100 percent and original-value problems, the k - k squared- k cubed similarity ladder, constructed proportion equations, instantaneous rate as a tangent gradient, and general iterative processes beyond compound interest.

Must-know: multipliers $(1 \pm r/100)$ with original value dividing the final; density = m/V and pressure = F/A ; direct $y = kx^n$, inverse $y = k/x^n$; growth $A = P(1 \pm r/100)^n$; lengths k : areas k^2 : volumes k^3 .

7. Growth and decay

Growth and decay

$A = P(1 \pm r/100)^n$: 2000 at 3 percent compound for 4 years gives 2251.02.

Sequential changes multiply: the 2H June 2024 Q10 anchor - $90000 \times 1.03 \times 1.08 = 100116$, above 100000, and the multiplier route $1.1124 > 1.111\dots$ confirms it.

Higher general iterative processes: $x_{[n+1]} = 1.05 x_n$ grows without bound; a 20 percent decay $x_{[n+1]} = 0.8 x_n$ approaches zero but never reaches it - the limit solves $x = f(x)$.

Check yourself

Check yourself

Unit and compound-unit conversions incl. density and pressure (algebraic at Higher); ratio notation, sharing and best-buy contexts; percentage multipliers incl. original value and simple interest.

Direct and inverse proportion graphically and algebraically with constructed equations; the $k : k^2 : k^3$ ladder; gradients as average (chord) and instantaneous (tangent) rates; compound growth and decay with iterative processes.

Exercises 2.1·2.3

2.1 Find 35% of 240 [2]

2.2 Increase 65 by 20% [2]

2.3 A jumper priced £28 is reduced by 25%. Find the sale price. [2]

Exercises 2.1·2.3

2.1 Find 35% of 240 [2]

2.1 $0.35 \times 240 = 84.$

2.2 Increase 65 by 20% [2]

2.2 $65 \times 1.2 = 78.$

2.3 A jumper priced £28 is reduced by 25%. Find the sale price. [2]

2.3 $28 \times 0.75 = £21.$

Exercises 2.4·2.6

2.4 After a 10% rise a ticket costs £22. Find the original price. [3]

2.5 Express 84 as a percentage of 70. [2]

2.6 £500 is invested at 4% simple interest for 3 years. Find the total. [3]

Exercises 2.4·2.6

2.4 After a 10% rise a ticket costs £22. Find the original price. [3]

2.4 $22 \div 1.1 = £20$.

2.5 Express 84 as a percentage of 70. [2]

2.5 $84 \div 70 = 1.2$, so 120%.

2.6 £500 is invested at 4% simple interest for 3 years. Find the total. [3]

2.6 Interest = $500 \times 0.04 \times 3 = £60$; total £560.

Exercises 3.1·3.3

3.1 (*Edexcel-style, 2H June 2024 Q2 adapted.*) The population of a town has decreased by 12%. The population is now 2.2×10^6 . Work out the population before the decrease, giving your answer in standard form. [3]

3.2 (*Original.*) A quantity increases by 15% and is now 184. What was it? [3]

3.3 (*Original.*) A shop's profits rise 20% in 2023 and fall 10% in 2024. Overall, is the profit up or down on the start, and by what percentage? [3]

Exercises 3.1·3.3

3.1 (*Edexcel-style, 2H June 2024 Q2 adapted.*) The population of a town has decreased by 12%. The population is now 2.2×10^6 . Work out the population before the decrease, giving your answer in standard form. [3]

3.1 $2.2 \times 10^6 \div 0.88 = 2.5 \times 10^6$.

3.2 (*Original.*) A quantity increases by 15% and is now 184. What was it? [3]

3.2 $184 \div 1.15 = 160$.

3.3 (*Original.*) A shop's profits rise 20% in 2023 and fall 10% in 2024. Overall, is the profit up or down on the start, and by what percentage? [3]

3.3 $\times 1.2 \times 0.9 = 1.08$: up 8% overall (never add 20 – 10).

Local review guidance: the multiplier stated; exact values; reverse answers divide, not subtract. This is authored classroom guidance.