

GRADE 11 STUDY GUIDE | 2024

Financial Mathematics

Mathematics

1. Simple Interest vs Compound Interest

Simple Interest: $A = P(1 + in)$ **Compound Interest: $A = P(1 + i)^n$** **Where: A = accumulated amount, P = principal, i = interest rate per period, n = number of periods**

- Simple interest: interest is always calculated on the ORIGINAL principal
- Compound interest: interest is calculated on principal PLUS accumulated interest ("interest on interest")
- Convert annual rate to period rate: if 12% p.a. compounded monthly, then $i = 0.12/12 = 0.01$ per month

Example: R5000 invested for 3 years at 8% p.a. -- compare simple vs compoundSimple: $A = 5000(1 + 0.08 \times 3) = 5000(1.24) = R6\ 200$ Compound: $A = 5000(1.08)^3 = 5000 \times 1.2597 = R6\ 298.56$

Difference: R98.56 more with compound interest

2. Depreciation

Straight-line depreciation: $A = P(1 - in)$ **Reducing-balance depreciation: $A = P(1 - i)^n$**

- Straight-line: value decreases by the SAME rand amount each period
- Reducing-balance: value decreases by the same PERCENTAGE each period (more realistic)

Example: Car bought for R200 000 depreciates at 15% p.a. What is its value after 4 years?Reducing-balance: $A = 200\ 000(1 - 0.15)^4 = 200\ 000 \times 0.5220 = R104\ 400$ Straight-line: $A = 200\ 000(1 - 0.15 \times 4) = 200\ 000 \times 0.40 = R80\ 000$

3. Nominal vs Effective Interest Rates

 $(1 + i_{\text{eff}}) = (1 + i_{\text{nom}}/m)^m$ **Where: m = number of compounding periods per year**

A nominal rate of 12% p.a. compounded monthly is NOT the same as 12% p.a. compounded annually. The effective rate accounts for the compounding frequency.

Example: Find the effective annual rate for 12% p.a. compounded monthly $(1 + i_{\text{eff}}) = (1 + 0.12/12)^{12} = (1.01)^{12} = 1.12683$

$$i_{\text{eff}} = 0.12683 = 12.683\% \text{ per year}$$

4. Timelines for Multi-Step Problems

Draw a timeline with deposits, withdrawals and interest rate changes marked. Break the problem into segments and calculate each separately.

KEY: Change of interest rate means you must calculate the accumulated amount up to the change date, then use that as the new principal for the next period.

5. Present and Future Values

$$\text{Future Value: } FV = PV(1+i)^n$$

$$\text{Present Value: } PV = FV / (1+i)^n$$

These are the same formula rearranged. Present value is what a future amount is worth TODAY (discounting). Future value is what a present amount grows to (accumulating).