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FINANCIAL MATHS

Exam Cog

1 Percentages — 5 types

% = out of 100

Type 1: Find % of a number → 6% of €520

Type 2: % increase → 9% on €730

Type 3: % given, find number → 8% of ? = 654

Type 4: Convert to % → 4 as % of 5

Type 5: End value + % change → find original (€165 sale, 21% off → original?)

2 Profit, margin, error

Profit = selling price − cost price

Mark-up = (profit / cost price) × 100

Margin = (profit / selling price) × 100

% Error = (error / real value) × 100

> ★ *Mark-up uses **COST**, Margin uses **SELLING** — don't mix them up!*

3 Ratio, sig figs, FX, tax

Ratio & proportion:

Write in same units.

- **Direct:** one up → other up
- **Indirect:** one up → other down (men at work)

Significant figures:

Like decimals, but rest turn to 0's.

Scientific notation:

BIG number → positive index.

Foreign exchange:

Multiply or divide.

Tax:

Net tax = Gross tax − Tax credit.

4 Compound interest

$F = P(1 + i)^t$ $P = F / (1 + i)^t$

P = principal, F = future value

t = time, i = rate as a **DECIMAL**

Continuous growth:

$F = Pe^{rt}$

- r > 0 → growth
- r < 0 → decay / depreciation

APR = borrowing rate AER = lending rate

> ⚠ ***WATCH:** i must be a **DECIMAL** — 4% is i = 0.04, not 4*

5 Depreciation (decay)

$F = P(1 - i)^t$ $P = F / (1 - i)^t$ (in tables)

Know **NEW** price → find later: $F = P(1 - i)^t$

Know **later** price → find NEW: $P = F / (1 - i)^t$

Net Book Value (NBV):

Bring all values to PRESENT and add.

- NBV > 0 → invest
- NBV < 0 → do not invest

6 Annuities — timing is everything

APR → monthly: $(1 + i)^{12} = 1 + APR$

e.g. 4% APR → monthly $i = 1.04^{1/12} - 1$

> ★ *THE BIG QUESTION: when do you spend the money?*

Saving (spend in future):

Series of P values → F

$F = P(1+i) + P(1+i)^2 + \ldots$

Spend now / won now (payments in future):

$P = F/(1+i)^1 + F/(1+i)^2 + \ldots$

Start of month: first t = 72, n = 72

End of month: first t = 71, n = 72 (still 72 payments)

7 Loans & mortgages

Amortisation Formula:

$A = P \cdot [\, i(1+i)^t / ((1+i)^t - 1) \,]$

- P = amount borrowed
- t = number of instalments
- i = interest rate per period
- A = monthly instalment

8 Pensions — pay in, receive out

Concept: Pay In → Pension Pot → Receive Out

Months from retirement to death:

e.g. (86 − 65) × 12 = 252 months

Part 1 — paying in (present values → future lump):

$F = P(1+i)^t + P(1+i)^{t-1} + \ldots + P(1+i)^1$

Part 2 — pension out (lump → future values):

$P = F/(1+i)^1 + F/(1+i)^2 + \ldots$

> ★ *Live forever? Use infinite series: $S_\infty = a / (1 - r)$*

9 Bonds

Two parts — bring BOTH back to present value:

- 1. A lump sum at maturity
- 2. Annuity-style coupon payments

> ✓ ***TIP:** Add the present values of both parts to get bond price today*

10 Golden rules

✓ i is a **DECIMAL** (0.04 not 4)

✓ Match i to t — monthly i with monthly t

✓ Saving = present values → future

✓ Spending = future values → present

✓ Always identify: P, F, i, t before starting

✓ Read carefully: start vs end of month