

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

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

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)

$$F = P(1 - i)^t \quad P = F / (1 - i)^t \text{ (in tables)}$$

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:** $(1 + i)^{12} = 1 + \text{APR}$

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

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

Spend now / won now (payments in future):

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

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. $(86 - 65) \times 12 = 252$ months

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

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

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

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

★ *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