Money: Earning, Borrowing, Investing & Trade

Prepared by Nikolas Agisilaou

Earning Money

Gross Pay	Total earned **before** any deductions.
Net Pay	Take-home pay **after** all deductions.
Wage	Hourly rate × hours worked.
Salary	Fixed annual amount ÷ 12.
Overtime	×1.5 (time-and-a-half); ×2 (double time).
Commission	% of qualifying sales value.
Deductions	Tax + National Insurance + Pension.

Gross = Basic + Overtime + Commission

Net Pay = Gross Pay − Total Deductions

Percentage Toolkit (Used Everywhere)

Find % of amount	$\frac{\%}{100} \times$ amount
% Change	$\frac{\text{new} - \text{old}}{\text{old}} \times 100$
Increase by $k\%$	$\times(1 + k/100)$ e.g. $+20\% \to \times 1.20$
Decrease by $k\%$	$\times(1 - k/100)$ e.g. $-30\% \to \times 0.70$
Reverse %	original $= \frac{\text{value after}}{\text{multiplier}}$

Reverse trap: After +25%, price is £150. Original $= \frac{150}{1.25} =$ £120. **Never** subtract 25% from £150.

Simple Interest vs. Compound Interest

Simple Interest (SI) — same fixed amount on the original principal each period.

$$I = \frac{P \times R \times T}{100} \qquad A = P + I$$

P=Principal R=Rate (% p.a.)
T=Time (yrs) A=Total ($P + I$)

Ex: £4 800 at 3.5%, 5 yrs: $I =$ £840; $A =$ £5 640

Compound Interest (CI) — interest added to balance and earns further interest each period.

$$A = P\left(1 + \frac{r}{100}\right)^n \qquad I = A - P$$

r=rate **per period** (%) n=number of periods

Non-annual: $r_{\text{per}} = r_{\text{ann}}/k$; $n_{\text{total}} = \text{yrs} \times k$

Ex: £5 500 at 4%, 6 yrs: $A = 5500 \times (1.04)^6 =$ £6 959.26
CI earns **£139.26 more** than SI here.

Growth, Depreciation & Decay

Any repeated % change: same CI structure, r as a **decimal**.

$$A = P(1 \pm r)^n \qquad n = \frac{\log(A/P)}{\log(1 \pm r)}$$

Growth $(+r)$	Savings, inflation, population.
Depreciation $(-r)$	Vehicles, equipment, assets.
Decay $(-r)$	Drug levels, radioactive decay.

Ex: Motorbike £11 600 at 25%/yr for 4 yrs:
$A = 11600 \times (0.75)^4 =$ £3 670

Find n**:** Revenue £3.6m at 9%/yr exceeds £6m after $n = \frac{\log(6/3.6)}{\log(1.09)} = 5.93 \Rightarrow$ **6 complete years**

Borrowing: Loans, APR & Hire Purchase

APR	True yearly cost incl. all fees. Higher APR = more expensive. Always compare APRs.
Loan	Fixed monthly instalments over an agreed term.
HP	Deposit + instalments; own the item only after the final payment.

Total repaid = Instalment × Months

Interest paid = Total Repaid − Principal
HP total = Deposit + (Instalment × Months)
Extra HP cost = HP Total − Cash Price

Ex: £10 000 at £312.50/month × 36:
Total = £11 250; Interest = £1 250

Always compare total repaid, not just monthly payment.

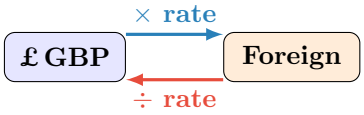
The Panda Math Tutor

Buying & Selling: Profit, Loss, Discount, VAT & Best Buy

Concept	Formula	Worked Example
Profit	SP − CP	Bought £64, sold £80 ⇒ Profit = £16
Loss	CP − SP	Bought £90, sold £72 ⇒ Loss = £18
% Profit/Loss	$\frac{\text{Profit or Loss}}{\textbf{CP}} \times 100$ *(always over CP)*	$\frac{16}{64} \times 100 = 25\%$ profit
Target SP	CP × (1 + profit decimal)	45% on £640: $640 \times 1.45 = £928$
Reverse (loss)	SP ÷ loss multiplier = CP	£357 after 16% loss: $\frac{357}{0.84} = £425$
Discount	Sale Price = Original $\times(1-d)$	35% off £115: $115 \times 0.65 = £74.75$
Rev. discount	Original = Sale Price $\div(1-d)$	Paid £110 after 45% off: $\frac{110}{0.55} = £200$
Add VAT (20%)	Price excl. VAT × 1.20	£1 300 excl. → $1300 \times 1.20 = £1\,560$
Remove VAT (20%)	Price incl. VAT ÷ 1.20	£1 416 incl. → $\frac{1416}{1.20} = £1\,180$
Best Buy	Price per unit (p/g, p/ml…); **lowest wins**	180 tabs £21.60 = 12p/tab vs. 30 tabs £4.50 = 15p/tab

Foreign Currency Exchange

Rate: £1 = (rate) foreign units.



- **Commission:** Deduct from £**first**, then convert.
- **Return trip:** Two conversions; rates may differ each way.

Ex A: £1 = CHF 1.13
£620 → CHF: $620 \times 1.13 =$ CHF 700.60
CHF 508.50 → £: $508.50 \div 1.13 = £450.00$

Ex B (commission): 3% on £1 200; £1=€1.17:
Pounds after comm.: $1200 - 36 = £1\,164$
Euros received: $1164 \times 1.17 = 1\,361.88$

Common Traps & Pitfalls

1. **Gross vs. Net:** Given net? Use a *reverse %* to find gross. Adding the tax rate to net is wrong.
2. **SI vs. CI:** "Simple" → $I = PRT/100$. "Compound" → $A = P(1 + r/100)^n$. Wrong formula = wrong marks.
3. **Compounding Frequency:** Annual rate, monthly compounding → $r/12$ per period; count months not years.
4. **Reverse %:** After $+k\%$: divide by $(1 + k/100)$. After $-k\%$: divide by $(1 - k/100)$. Never add/subtract the % from the current value.
5. **% Profit Base:** Profit/loss % is **always** over **CP**, not SP. Using SP gives a lower, incorrect percentage.
6. **VAT Inclusion:** Excl. VAT → ×1.20. Incl. VAT → ÷1.20. Subtracting 20% from an inclusive price is always wrong.
7. **Best-Buy Units:** Convert all to the **same unit** before dividing. Larger packs are not always cheaper per unit.
8. **Currency Direction:** £→foreign: **multiply**. Foreign→£: **divide**. Deduct commission in £*before* applying the rate.

The Panda Math Tutor

Quick Exam Shortcuts & Keyword Cues

- **"overtime / commission"** ⇒ Gross = basic + OT + commission; Net = Gross − deductions.
- **"simple interest"** ⇒ $I = PRT/100$; fixed amount every year. Find R: $\frac{100I}{PT}$; find T: $\frac{100I}{PR}$.
- **"compound interest" / "compounded monthly/quarterly"** ⇒ $A = P(1+r/100)^n$; adjust $r = r_{\text{ann}}/k$ and $n = \text{yrs} \times k$.
- **"depreciates" / "decays"** ⇒ $A = P(1-r)^n$ (r as decimal). e.g. 18%/yr → $(0.82)^n$.
- **"after how many years?"** ⇒ Trial substitution or $n = \log(A/P)/\log(1 \pm r)$. Round **up** for both "exceed" and "fall below".
- **"hire purchase" / "total cost of borrowing"** ⇒ Total = instalment × months; subtract principal for interest paid.
- **"original price before discount / rise"** ⇒ Reverse %: divide known price by the multiplier.
- **"incl. VAT"** ⇒ ÷1.20. **"excl. VAT"** ⇒ ×1.20. **"best value"** ⇒ price per unit (same unit); lowest wins.