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FORMULA SHEET

CFA Level III: Private Wealth

Chartered Financial Analyst · Specialised pathway + core

107 formulas **11** subject areas

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HOW TO USE THIS SHEET

This sheet covers the Private Wealth pathway plus the four core areas every Level III candidate sits. The pathway sections come first; the shared core follows.

Private Wealth is the most human of the pathways and the most tax-driven. Many questions turn on a single sentence in the vignette — a marginal rate, a domicile, a five-year holding period.

A warning on the tax figures: exclusions, exemptions and thresholds are indexed annually and the ones shown here reflect 2026 US amounts. The MECHANICS are what the exam tests; verify any specific number against the current curriculum before you rely on it.

The ▸ notes flag what the grader wants in the essay — usually the reasoning, not the arithmetic. "Recommend gifting because RV > 1" earns more than a correct RV with no conclusion attached.

THE PRIVATE WEALTH INDUSTRY · 3 formulas

Fee mechanics. Simple arithmetic, but clients notice when advisers get it wrong.

Annual advisory revenue

$$\text{Revenue} = \text{AUM} \times f$$

Where: f = annual fee rate.

▸ *The AUM model aligns adviser and client on growth, but not on risk — the adviser is paid on assets, not on suitability. Expect that conflict to be examinable.*

Effective blended fee on a tiered schedule

$$\bar{f} = \Sigma(f_i \times A_i) \,/\, \text{AUM}$$

Where: f_i = the marginal rate applying to tier i, A_i = assets sitting in that tier.

▸ *Tiers are MARGINAL. Applying the top-tier rate to the whole balance overstates the fee — that is the arithmetic trap, and it is the same shape as an income-tax bracket calculation.*

Total client cost of a wrap programme

$$C = \text{AUM} \times f_w + \text{AUM} \times w_f \times \bar{e}$$

Where: f_w = wrap fee, $\bar{e}$ = average expense ratio of the underlying funds.

▸ *Clients see the wrap fee and miss the underlying fund expenses. The total cost is what matters — surfacing the second layer is a fiduciary act, and the exam treats it as one.*

EXAM TIPS — THE PRIVATE WEALTH INDUSTRY

- When a question asks about fee structures, answer on transparency and alignment, not just on the number. Total cost, conflicts of interest, and what the client actually receives for the fee.
- Fee drag compounds. A 1% annual fee over thirty years consumes roughly a quarter of the terminal wealth — a sentence worth having ready.

WORKING WITH WEALTHY FAMILIES · 1 formulas

Family governance. Almost entirely qualitative — the one formula here is illustrative, not computational.

Family charter adherence (illustrative)

$$P_{adherence} = P_{clarity} \times P_{commitment} \times P_{review}$$

Where: Process clarity × leadership commitment × frequency of scheduled review.

▸ *It is multiplicative, and that is the whole message: if any one factor is near zero, the charter fails regardless of how strong the others are. A beautifully drafted charter that nobody reviews is worthless.*

EXAM TIPS — WORKING WITH WEALTHY FAMILIES

- Family governance questions want structure: a family charter, a family council, a defined decision process, and a communication cadence. Name the mechanisms.
- The classic family-wealth risk is not investment risk. It is generational — no shared purpose, no succession plan, and heirs who were never taught to steward capital.

WEALTH PLANNING · 5 formulas

The holistic balance sheet and the tax-wrapper decision. Foundational to everything else in the pathway.

Human capital present value

$$HC_0 = \Sigma\ [w_t \times (1 - p\_death,t)] / (1 + r)^t$$

Where: w_t = expected earnings, adjusted for mortality probability.

▸ *Human capital is bond-like for a tenured academic and equity-like for a founder. The financial portfolio should be built to OFFSET that character — this is the single most-tested idea in the pathway.*

Total wealth (holistic balance sheet)

$$\text{Total wealth} = \text{Financial capital} + \text{Human capital}$$

Where: Financial capital = sellable assets today; human capital = PV of future after-tax wages net of consumption.

▸ *A 30-year-old with modest savings is overwhelmingly long human capital. That is why the standard advice — hold more equities when young — is a hedging argument, not a risk-appetite argument.*

Tax-deferred account accumulation

$$FV = (1 + r)^n \times (1 - T_n)$$

Where: T_n = the tax rate at withdrawal. Contributions go in pre-tax; withdrawals are taxed as ordinary income.

▸ *Favourable when the FUTURE tax rate is lower than the current one — the classic case of a high earner today who will retire into a lower bracket.*

Tax-exempt account accumulation

$$FV = (1 + r)^n$$

Where: After-tax contributions; all growth and withdrawals are tax-free (Roth structure).

▸ *Favourable when the future tax rate is HIGHER than today's — a young professional in a low bracket now, or an investor expecting rates to rise. Compare T_n against T_today and the whole choice resolves.*

Goals-based funding ratio

$$\text{Funding ratio} = PV(\text{Assets}) / \Sigma\ PV(\text{Goal}_i)$$

Where: Above 1 means over-funded.

▸ *Goals-based planning splits the portfolio by objective: essential needs get a low-risk, high-certainty sleeve; aspirational goals get the risky sleeve. The funding ratio tells you which goals are actually funded and which are hopes.*

EXAM TIPS — WEALTH PLANNING

- For any life-cycle question: young ⇒ high human capital, low financial capital, greater capacity for equity risk (assuming labour income is stable). Approaching retirement ⇒ the reverse.
- Tax-deferred versus tax-exempt reduces to one comparison: today's marginal rate versus the expected rate at withdrawal. Everything else is detail.
- Insurance belongs in this conversation. Human capital is an asset that can be destroyed by disability or death — life and disability cover are the hedge on that asset.

INVESTMENT PLANNING · 7 formulas

Return requirements, after-tax returns and the tax-aware portfolio decisions that follow.

After-tax return

```
r_AT = r_PT × (1 − t)
Mixed income:  r_AT = r_CG(1 − t_CG) + r_Inc(1 − t_Inc) + r_tax-free
```

Where: t_CG = capital gains rate, t_Inc = ordinary income rate.

▸ *The mixed form is the one the exam wants. Different components of return are taxed at different rates — that is the entire premise of asset location.*

Core capital estimate

$$CC = \Sigma \left[E_t / (1 + r_{AT})^t \right] \times p_{survive,t}$$

Where: E_t = spending in year t, weighted by the probability of surviving to t.

▸ *Core capital is what the client MUST keep to fund their own lifetime spending. Only the surplus above it can be gifted, given or taken risk with. Establish core capital before you discuss any estate strategy.*

Required equity weight given human capital

$$w_{eq,FC} = \left[w_{eq,target} \times W_{total} - w_{eq,HC} \times HC \right] / FC$$

Where: W_total = HC + FC.

▸ *You are solving for the equity weight in the FINANCIAL portfolio that gets total wealth to the target. If human capital is already equity-like, this can call for a bond-heavy financial portfolio — a counterintuitive answer the exam enjoys.*

Tax-loss harvesting benefit

```
Benefit = t_ST × L − t_LT × G_f
```

Where: L = loss harvested now, G_f = the larger future gain caused by the reduced cost basis.

▸ *Harvesting DEFERS tax, it does not eliminate it — the lower basis means a bigger gain later. It is net positive when short-term rates exceed long-term rates, or when the deferral runs long enough for the time value to dominate.*

Taxable-equivalent yield

```
TEY = y_muni / (1 − t)
```

Where: t = the client's marginal rate.

▸ *Compare TEY to the taxable bond, never the raw muni yield. The higher the bracket, the more the muni wins — which is why munis are a high-bracket instrument, not a universally good one.*

Required minimum distribution

$$RMD_t = B_{t-1} / LE_{age}$$

Where: B_{t-1} = prior year-end balance, LE_age = the IRS Uniform Lifetime Table factor.

▸ *Prior year-END balance, not the current one. RMDs force taxable income whether the client needs the cash or not — which is why Roth conversions in low-income years are so valuable.*

Time-weighted return

$$TWR = \Pi(1 + r_i) - 1$$

Where: Sub-period returns linked geometrically.

▸ *Judges the manager, not the client. For a private client who is contributing or withdrawing irregularly, the money-weighted return is what actually describes THEIR experience.*

EXAM TIPS — INVESTMENT PLANNING

- Asset location, not just asset allocation: put tax-inefficient assets (taxable bonds, REITs, high-turnover strategies) inside the tax-sheltered wrapper, and tax-efficient assets (equities held long term, munis) in the taxable account.
- For a required-return calculation, do it in this order: net the spending against other income, express as a rate on the portfolio, add inflation, gross up for tax, add fees. Grossing up at the wrong step is the standard error.

PRESERVING THE WEALTH · 2 formulas

Currency and inflation. Two formulas, both easy marks, both easy to fumble.

Domestic-currency return on a foreign asset

```
R_DC = (1 + R_LC)(1 + s) − 1
```

Where: R_LC = local-currency return, s = appreciation of the foreign currency.

▸ *Multiplicative, not additive. For a client with liabilities in one currency and assets in another, the currency exposure is a real risk — not an incidental one.*

Real return from nominal

```
r_real = (1 + r_nominal)/(1 + π) − 1
```

Where: π = inflation rate.

▸ *Wealthy families face a personal inflation rate that is often HIGHER than headline CPI — private schooling, healthcare, property in prime locations. Say so; it is a mark.*

EXAM TIPS — PRESERVING THE WEALTH

- Wealth preservation is a real, after-tax, after-fee concept. A 6% nominal return with 3% inflation, 30% tax and 1% fees is roughly flat in real terms — spell that arithmetic out when a client says 6% sounds fine.
- Currency hedging for private clients follows the liability: hedge to the currency the client actually spends in.

ADVISING THE WEALTHY · 4 formulas

Concentrated positions, business owners and cross-border clients. Highly technical, jurisdiction-specific.

Section 877A exit tax base

```
Base = G_MTM − $821,000
```

Where: G_MTM = mark-to-market gain on all assets the day before expatriation; the exclusion is the 2026 indexed figure.

▸ *The US taxes covered expatriates as though they sold everything on the way out. For any client considering renouncing citizenship, this is the first calculation, not the last.*

QSBS Section 1202 exclusion ceiling

```
Exclusion cap = max($10M, 10 × B)
```

Where: B = original cost basis; C-corp stock held more than 5 years, issuer met the $50M gross-asset test at issuance.

▸ *Enormously valuable for founders — and every condition is a hard gate. Miss the five-year holding period by a month and the entire exclusion is gone.*

Stacked QSBS across non-grantor trusts

```
Total = N × max($10M, 10 × B)
```

Where: N = number of separate qualifying holders (the donor plus each non-grantor trust).

▸ *Each non-grantor trust is a separate taxpayer with its own exclusion. "Stacking" multiplies the benefit — aggressive, legitimate, and exactly the kind of planning a wealth adviser is paid to know exists.*

Economic net worth

```
ENW = FC + PV(HC) − PV(Liabilities) − PV(Consumption)
```

Where: The full personal balance sheet.

▸ *What remains after funding the client's own life is what can be given away. This ties directly back to core capital — do not recommend a gifting strategy without establishing it first.*

EXAM TIPS — ADVISING THE WEALTHY

- Concentrated single-stock positions: the toolkit is outright sale (immediate tax), collar or prepaid variable forward (defers tax, caps upside), exchange fund (defers tax, requires a long lock-up), and charitable remainder trust (deduction plus deferral). Name the tax consequence of each — that is where the marks are.

- Cross-border clients: establish residence, domicile and citizenship separately. They are three different concepts and they drive three different taxes.

TRANSFERRING THE WEALTH · 7 formulas

Estate planning vehicles. The most technical section in the pathway, and the most reliably examined.

Estate tax

```
Tax = (Estate value − Exemption) × t_e
```

Where: Taxable estate = gross estate − debts − marital deduction − charitable deduction.

▸ *The marital deduction defers, it does not eliminate — the assets are simply taxed in the second spouse's estate. That deferral-versus-elimination distinction is the point of the whole section.*

Relative value of gifting vs bequest

```
RV = [(1 + r_g)^n(1 − T_e)] / [(1 + r_e)^n(1 − T_g) + T_g − T_e]
```

Where: r_g = after-tax return in the recipient's hands, r_e = in the estate's.

▸ *RV > 1 ⇒ gift now. Gifting wins when the recipient's tax rate is lower, when the asset is expected to appreciate (you move the future growth out of the estate), and when the gift tax is tax-exclusive rather than tax-inclusive.*

Generation-skipping transfer tax

```
GST tax = Transfer amount × t_GST
```

Where: Applies to transfers that skip a generation (grandparent to grandchild).

▸ *GST exists to stop families avoiding a whole layer of estate tax. Dynasty trusts, in jurisdictions that permit them, use the GST exemption to shelter assets across multiple generations.*

CRT charitable deduction

```
D = C × f_rem
```

Where: C = contribution fair market value, f_rem = IRS remainder factor at the 7520 rate.

▸ *A charitable remainder trust gives the donor an income stream, an immediate deduction, and defers the capital gain on the contributed asset. It is the standard answer for a low-basis concentrated position held by a charitably inclined client.*

Zeroed-out CLAT annuity payment

```
A = C / a(n, r)
```

Where: a(n, r) = the PV annuity factor at the 7520 rate.

▸ *"Zeroed out" means the annuity is sized so the PV of the charity's stream equals the contribution — producing a taxable gift of zero. Everything the assets earn above the 7520 rate passes to the family free of transfer tax.*

CLAT family remainder when assets outperform

```
R = C(1 + g)^n − A × s(n, g)
```

Where: g = the actual return achieved, s = the FV annuity factor.

▸ *This is where the strategy earns its keep. In a low-7520-rate environment, a CLAT holding a high-growth asset transfers substantial value to the family for zero gift tax. State the rate environment in your answer.*

529 plan five-year forward-averaging

```
G_max = 5 × E_annual
```

Where: E_annual = the per-donee annual exclusion ($19,000 in 2026), giving $95,000 single or $190,000 per couple.

▸ *Front-load five years of annual exclusions into one contribution to get the money compounding sooner. The donor cannot then make further exclusion gifts to that beneficiary for five years — mention the trade-off.*

EXAM TIPS — TRANSFERRING THE WEALTH

- The whole logic of estate planning is: freeze the value in the estate, and move the future appreciation out of it. GRATs, CLATs, IDGTs and simple gifts are all variations on that one idea.

- The 7520 rate is the hurdle. Low rate ⇒ CLATs and GRATs are attractive (easy to beat). High rate ⇒ charitable remainder trusts and QPRTs look better. Always locate the strategy in its rate environment.
- Never recommend a transfer strategy before establishing core capital. Giving away money the client will later need is the one unforgivable error in this pathway.

CORE 1 — CAPITAL MARKET EXPECTATIONS & ASSET ALLOCATION · 23 formulas

Forecasting inputs, then turning them into a policy portfolio. Sat by every Level III candidate regardless of pathway.

Mean-variance optimal portfolio weights

$$w^* = (1/\lambda) \times \Sigma^{-1} (\mu - r_f \cdot 1)$$

Where: λ = risk aversion, Σ = covariance matrix, μ = expected returns.

▸ *MVO is famously input-sensitive: small changes in μ produce wild swings in weights, which is exactly why Black-Litterman and resampling exist.*

Corner portfolio blending

$$w_A = [E(R_P) - E(R_B)] / [E(R_A) - E(R_B)]$$
$$w_B = 1 - w_A$$

Where: A and B = the two adjacent corner portfolios bracketing the target return.

▸ *Any blend of two adjacent corner portfolios sits on the efficient frontier. Blending non-adjacent ones does not.*

Black-Litterman expected returns

$$\text{Equilibrium:}\quad \Pi = \delta \cdot \Sigma \cdot w_{mkt}$$
$$\text{Blended:}\quad E(R) = [(\tau\Sigma)^{-1} + P^T\Omega^{-1}P]^{-1} [(\tau\Sigma)^{-1}\Pi + P^T\Omega^{-1}Q]$$

Where: δ = risk aversion, w_mkt = market-cap weights, Q = your views, Ω = confidence in them.

▸ *You will not compute the matrix algebra in the exam. You will be asked why it beats raw MVO: it anchors on market equilibrium and tilts only where you have a view.*

Rebalancing trigger (range-based)

$$\text{Rebalance when } |w_i - w^*_i| > \Delta_i$$

Where: w^*_i = target weight, Δ_i = tolerance band.

▸ *Wider bands mean lower transaction costs but more drift from policy. Bands widen with higher transaction costs and with higher correlation to the rest of the portfolio.*

Grinold-Kroner expected equity return

$$E(R) = D/P - \Delta S + g + \Delta(P/E)$$

Where: D/P = dividend yield, ΔS = net share issuance, g = nominal earnings growth, Δ(P/E) = repricing.

▸ *Note the sign on ΔS: net buybacks (negative issuance) add to return. Income + growth + repricing — that is the whole model in three words.*

Taylor rule policy rate

$$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5(y_t - y^*)$$

Where: r* = neutral real rate, π* = inflation target, (y − y*) = output gap.

▸ *A rate above the Taylor-implied level suggests restrictive policy. It is a benchmark for judging central banks, not a prediction of them.*

Covered interest rate parity

$$F / S = (1 + i_d) / (1 + i_f)$$

Where: F, S quoted as domestic per foreign.

▸ *The high-yield currency always trades at a forward discount. If it did not, you could arbitrage it — which is why CIP holds tightly in practice.*

Fixed-income expected return building blocks

$$E(R) = r_f + \pi^e + TP + CP + LP$$

Where: TP = term premium, CP = credit premium, LP = liquidity premium.

▸ *Build the required return by stacking compensations for each risk you are actually bearing. Strip out the ones you are not.*

Expected fixed-income return decomposition

$$E(R_{FI}) = YTM + Roll\text{-}down + \Delta P_{yield} - L_{credit} - L_{FX}$$

Where: ΔP = price change from your yield-curve view, L = expected losses.

▸ *Roll-down is free return on an upward-sloping curve as the bond ages into a lower yield. It disappears on a flat curve.*

GARCH(1,1) variance forecast

$$\sigma^2_t = \omega + \alpha \cdot \varepsilon^2_{t-1} + \beta \cdot \sigma^2_{t-1}$$

Where: ω = long-run anchor, α = weight on the last shock, β = weight on the prior variance.

▸ *This is why volatility clusters. α + β close to 1 means shocks decay slowly and today's turbulence persists.*

Singer-Terhaar blended risk premium

$$RP = w(\sigma \cdot \rho \cdot SR_g) + (1 - w)(\sigma \cdot SR_g)$$

Where: w = degree of global market integration, ρ = correlation with the global portfolio.

▸ *A fully integrated market only earns compensation for its correlated (systematic) risk. A fully segmented one earns compensation for all its risk — hence the higher premium.*

TAA band around the strategic allocation

$$w_{TAA} \in [w_{SAA} - b,\ w_{SAA} + b]$$

Where: b = the tactical band set in the IPS (often ±5%).

▸ *Tactical deviations must live inside the IPS bands. A recommendation that breaches them is wrong no matter how good the market view is.*

Net after-cost tactical premium

$$\alpha_{net} = \alpha_{gross} - TC - T$$

Where: TC = transaction costs, T = realised tax cost.

▸ *Tactical calls are gross-alpha ideas that die on net-alpha arithmetic. Always net down before recommending the trade — this is a standard essay point.*

Stress liquidity coverage ratio

$$LCR_{stress} = \text{Accessible liquid assets (stress)} \,/\, \text{Cash demands (stress)}$$

Where: Both measured under a stressed scenario, not a normal one.

▸ *For illiquid-heavy portfolios, a prudent floor is around 2×. Capital calls arrive precisely when markets are down — the denominator and numerator move together, against you.*

Endowment spending rate

$$s = \text{Annual spending} \,/\, \text{Portfolio value}$$

Where: e.g. 5% of $800M = $40M.

▸ *The spending rate is the anchor for the required return. Raise spending and you must raise required return, which means raising risk.*

Correlation inputs required for MVO

$$N_\rho = n(n - 1) / 2$$

Where: n = number of asset classes.

▸ *Ten asset classes need 45 correlations. This combinatorial explosion is the practical argument against very granular MVO.*

Total MVO inputs required

$$N = 2n + n(n - 1)/2$$

Where: n expected returns + n standard deviations + n(n−1)/2 correlations.

▸ *Every extra input is an extra estimation error you feed into an optimiser that will happily maximise it.*

Pension funded ratio

$$FR = A \,/\, L$$

Where: A = market value of plan assets, L = PV of liabilities (e.g. PBO).

▸ *A well-funded plan should de-risk — it has already won. Under-funded plans face pressure to take more risk, which is exactly when they can least afford it.*

Pension surplus

$$S = A - L$$

Where: Surplus optimisation maximises the return on S, not on A.

▸ *Focusing on asset return alone ignores that the liability is also a moving, rate-sensitive position. Surplus is the real risk being managed.*

Dollar duration

$$DD = MV \times D$$

Where: MV = market value (or PV of liabilities), D = modified/effective duration.

▸ *The unit of account for LDI hedging. You match dollar duration of assets to dollar duration of liabilities — not durations, dollar durations.*

Mean-variance utility

$$U = E(R_p) - 0.5 \times \lambda \times \sigma^2_p$$

Where: λ = risk aversion (typically 1–10).

▸ *Higher λ means variance is penalised harder, so the optimal portfolio sits further left on the frontier. Set λ = 0 and you get the maximum-return corner.*

Geometric mean approximation

$$G \approx A - 0.5\sigma^2$$

Where: A = arithmetic mean, σ^2 = variance of returns.

▸ *The volatility drag. Two portfolios with the same arithmetic mean but different volatility do not compound the same — the volatile one ends up poorer.*

Roy's safety-first ratio

$$SF = [E(R_p) - R\_L] / \sigma_p$$

Where: R_L = minimum acceptable (threshold) return.

▸ *Maximise SF and, under normality, you minimise the probability of falling below R_L. Set R_L = R_f and it collapses into the Sharpe ratio.*

EXAM TIPS — CORE 1 — CAPITAL MARKET EXPECTATIONS & ASSET ALLOCATION

- Asset allocation essays are graded on justification, not arithmetic. State the constraint, state the number, state the conclusion — in that order.
- Whenever a question describes an investor, extract five things before you compute anything: return requirement, risk tolerance, time horizon, liquidity needs, and legal/tax/unique constraints.
- Volatility drag ($G \approx A - 0.5\sigma^2$) is the quiet reason risk control creates return. Expect it to be tested indirectly, through a comparison of two portfolios.

CORE 2 — RISK BUDGETING, TRADING & INVESTOR TYPES · 28 formulas

Decomposing portfolio risk, measuring execution cost, and the return requirements of each institutional and private investor type.

Marginal contribution to risk

$$MCTR_i = \beta_i \times \sigma_p$$
$$\beta_i = Cov(R_i, R_p) / \sigma^2_p$$

Where: Risk added by a marginal increase in asset i's weight.

▸ *Note the beta is to the portfolio, not to the market. This is the derivative of portfolio risk with respect to weight.*

Absolute contribution to risk

$$ACTR_i = w_i \times MCTR_i$$
$$\Sigma\ ACTR_i = \sigma_p$$

Where: The individual contributions sum exactly to total portfolio risk.

▸ *Risk budgeting means setting target ACTRs. An asset with a small weight can dominate the risk budget if its volatility and correlation are high.*

Tracking error (active risk)

$$TE = \sigma(R_p - R_B)$$
$$TE_{annual} = TE_{monthly} \times \sqrt{12}$$

Where: Standard deviation of the active return series.

▸ *Scale by √12 from monthly, √252 from daily. Scaling the mean uses 12; scaling the standard deviation uses √12 — do not mix them.*

Implementation shortfall

$$IS = Explicit + Delay + Impact + Opportunity$$

Where: Explicit = commissions and fees; delay = decision-to-desk drift; impact = the price move you cause; opportunity = the return on shares you never filled.

▸ *This is the complete cost of a trade, including the cost of not trading. Trading urgently kills you on impact; trading slowly kills you on opportunity cost.*

Effective spread

$$\text{Effective spread} = 2 \times |P_{exec} - P_{mid}|$$

Where: P_mid = quote midpoint at the time of execution.

▸ *The factor of 2 makes it round-trip comparable to the quoted spread. Effective spread below quoted spread means you got price improvement.*

Square-root market impact

$$\text{Impact} \propto \sqrt{(\text{shares} / ADV)}$$

Where: ADV = average daily volume.

▸ *Doubling order size raises impact by about 41%, not 100%. This concavity is why breaking large orders into pieces helps — but only up to a point.*

VWAP transaction cost

$$\text{Buy:}\quad cost = P_{exec} - VWAP$$
$$\text{Sell:}\quad cost = VWAP - P_{exec}$$

Where: Positive means unfavourable in both cases.

▸ *VWAP flatters a patient trader and is easy to game. It is meaningless for an order that is itself a large share of the day's volume.*

Effective equity beta including private equity

$$\beta_{eff} = w_{eq} + w_{PE} \times \beta_{PE}$$

Where: $\beta_{PE} \approx 1.3$ (PE has levered equity beta).

▸ *Reported PE returns are smoothed by appraisal-based NAVs, which understates true beta. A portfolio that looks defensive may be levered equity in a slow-reporting wrapper.*

Effective PE allocation including unfunded commitments

$$w_{PE(eff)} = (NAV + UC) / (P + UC)$$

Where: UC = unfunded commitments, P = total portfolio value.

▸ *Ignoring unfunded commitments systematically understates PE exposure. The capital is committed — you just have not written the cheque yet.*

Total PE economic exposure

$$E_{PE} = NAV + UC$$

Where: What you are really on the hook for.

▸ *The denominator changes but the message does not: commitments are exposure. This is what caught endowments out in 2008.*

Liquidity coverage for an alternatives programme

$$LCR = L / CF_{12m}$$

Where: L = liquid assets, CF_{12m} = committed cash outflows over the next 12 months (capital calls + benefit payments).

▸ *The denominator includes both. An endowment paying a spending distribution and facing capital calls in the same drawdown is the classic liquidity failure.*

Endowment nominal return requirement

$$R_{nom} = s + c + \pi$$

Where: s = spending rate, c = management costs, π = expected inflation.

▸ *Additive approximation. Purists multiply: (1 + s)(1 + c)(1 + π) − 1. The exam accepts the additive form unless it says otherwise.*

Endowment real return requirement

$$R_{real} = s + c$$

Where: Inflation stripped out.

▸ *This is what "preserving intergenerational equity" actually requires: earn the spend plus the costs, in real terms, forever.*

Foundation minimum return

$$R \geq 0.05 + c + \pi$$

Where: 5% = the US IRS minimum annual distribution requirement.

▸ *The 5% is a legal floor, not a policy choice. It is the key structural difference between a private foundation and an endowment.*

Insurer duration-matched immunisation

$$D_A \times A = D_L \times L$$

Where: Match dollar duration of assets to dollar duration of liabilities.

▸ *Duration matching only immunises against small, parallel shifts. Convexity matching and periodic rebalancing are what make it hold.*

DV01 (price value of a basis point)

$$DV01 = D_{mod} \times MV \times 0.0001$$

Where: Dollar change in value per 1 bp yield move.

▸ *The hedging currency of LDI. Number of futures = ΔDV01 required ÷ DV01 per contract.*

Active share

$$AS = \tfrac{1}{2} \Sigma \, |w_{p,i} - w_{b,i}|$$

Where: Summed across the combined portfolio-plus-benchmark universe.

▸ *Active share and tracking error are different things. A well-diversified stock-picker can have high active share and low tracking error; a sector bet has the reverse.*

Required pre-tax return for a private client

$$r = [(S - I)/V + \pi] / (1 - t) + f$$

Where: S = spending, I = other income, V = portfolio value, t = tax rate, f = advisory fees.

▸ *Order of operations is the whole question: net the spending against income, express as a rate, add inflation, gross up for tax, then add fees. Grossing up in the wrong place is the standard error.*

Leveraged portfolio return on equity

$$r_p = r_i + (V_B / V_E)(r_i - r_B)$$

Where: V_B = borrowed value, V_E = equity, r_B = borrowing cost.

▸ *Leverage multiplies the spread between asset return and borrowing cost — in both directions. If $r_i < r_B$, leverage accelerates the loss.*

Human capital

$$HC = \Sigma \, E[w_t] / (1 + r)^t$$

Where: w_t = expected labour income, r = risk-adjusted discount rate.

▸ *A tenured professor has bond-like human capital and can hold more equities. A commission-based trader has equity-like human capital and should hold fewer. This is the entire life-cycle argument.*

Real after-tax return

```
r_real,at ≈ r_nom − π − t × r_nom
```

Where: Tax is levied on the nominal gain, including the inflation component.

▸ *Tax on inflation is a real loss of purchasing power. In high-inflation regimes a positive nominal after-tax return can still be a real loss.*

Modified duration from Macaulay

```
D_mod = D_Mac / (1 + y)
```

Where: y = periodic yield to maturity.

▸ *Carried straight over from Level I and still tested. Effective duration replaces it wherever cash flows are contingent.*

Taxable-equivalent yield

```
TEY = y_muni / (1 − t)
```

Where: t = investor's marginal tax rate.

▸ *The higher the client's bracket, the more attractive the muni. Compare TEY, never the raw muni yield, to a taxable bond.*

Economic net worth

```
ENW = HC + FC − PV(Liabilities)
```

Where: The holistic balance sheet.

▸ *Institutional thinking applied to an individual: assets include the PV of future earnings, liabilities include the PV of future consumption.*

SWF stabilisation fund sizing

```
AUM_stab = f × G × n
```

Where: f = fiscal dependence on the commodity, G = annual government spending, n = years of shortfall to cover.

▸ *A stabilisation fund is a short-horizon, low-volatility mandate — it may be called on next year. Do not let it hold illiquid growth assets.*

Norway-style fiscal transfer rule

```
T_annual = r_real × V_fund
```

Where: r_real ≈ 3% expected real return.

▸ *Spending only the expected real return preserves the principal in perpetuity. It is a savings fund, not a stabilisation fund — different horizon, different portfolio.*

Commodity SWF sector exposure cap

```
w_energy ≤ w_bench − Δ
```

Where: Δ = a deliberate underweight (e.g. 30% of the benchmark weight).

▸ *The fund's inflows are already correlated with oil. Holding benchmark energy weight doubles down on the risk the country already carries — this is the concentration argument.*

SWF withdrawal cap

```
W_max = c × (3-year average AUM)
```

Where: c = charter cap (often 5%).

▸ *Averaging AUM over three years smooths withdrawals so a single bad market year does not force a spending collapse — the same logic as endowment smoothing.*

EXAM TIPS — CORE 2 — RISK BUDGETING, TRADING & INVESTOR TYPES

- Trading questions almost always resolve to the urgency trade-off: high urgency ⇒ market impact dominates; low urgency ⇒ opportunity cost and delay dominate. Match the algorithm to the motive for the trade.
- For any investor type, the exam wants: time horizon → liquidity need → risk tolerance → required return, in that causal order. Do not lead with the return number.
- Unfunded commitments are exposure. Any question featuring an endowment with a large PE programme is testing whether you know that.

CORE 3 — PERFORMANCE MEASUREMENT & ATTRIBUTION · 12 formulas

Risk-adjusted ratios and the Brinson decomposition. Reliably examined, and easy marks if you know which denominator to use.

Information ratio

$$IR = (\bar{R}_p - \bar{R}_B) / TE = \bar{\alpha} / TE$$

Where: $\bar{\alpha}$ = mean active return, TE = tracking error.

▸ *Active return per unit of active risk. Unlike Sharpe, IR is unaffected by adding cash or leverage to an unconstrained portfolio.*

Fundamental law of active management

$$IR = IC \times \sqrt{BR}$$
$$E(R_A) = IC \times \sqrt{BR} \times \sigma_A$$

Where: IC = information coefficient (skill), BR = breadth (independent bets per year).

▸ *Skill matters more than breadth because breadth is under a square root. Note that breadth must be independent — 500 correlated bets are not 500 bets.*

Sharpe ratio

$$SR_p = (R_p - R_f) / \sigma_p$$
$$SR^2_{combined} = SR^2_B + IR^2$$

Where: Total risk in the denominator.

▸ *The second identity is the beautiful one: adding an active overlay to a benchmark improves the combined Sharpe by exactly the manager's IR, squared.*

M-squared

$$M^2 = (R_p - R_f) \times (\sigma_m / \sigma_p) + R_f$$

Where: De-levers or levers the portfolio to the market's volatility.

▸ *Same ranking as Sharpe, but expressed in percent — so it can be compared directly against the market return.*

Treynor ratio

$$T = (R_p - R_f) / \beta_p$$

Where: Systematic risk in the denominator.

▸ *Correct when the portfolio is one sleeve of a diversified whole. Sharpe is correct when it is the client's entire wealth.*

Sortino ratio

$$Sortino = (R_p - MAR) / \sigma_d$$

Where: MAR = minimum acceptable return, σ_d = downside deviation below MAR.

▸ *Only penalises downside volatility. Preferred for strategies with deliberately asymmetric payoffs — option-selling, hedge funds, anything with a fat left tail.*

Brinson allocation effect

$$A_i = (w_{p,i} - w_{b,i})(R_{b,i} - R_b)$$

Where: Was the sector overweighted, and did that sector beat the total benchmark?

▸ *Allocation uses BENCHMARK sector returns. Being overweight a sector that outperformed the overall benchmark is a positive allocation effect — regardless of what you actually picked inside it.*

Brinson selection effect

$$S_i = w_{b,i} \times (R_{p,i} - R_{b,i})$$

Where: Did your picks beat the sector benchmark?

▸ *Selection uses BENCHMARK weights. Allocation ⇒ weight difference × benchmark return. Selection ⇒ benchmark weight × return difference. Getting these backwards is the most common attribution error there is.*

Upside capture ratio

$$UC = \bar{R}_{p,up} / \bar{R}_{b,up}$$

Where: Averaged over periods when the benchmark rose.

▸ *Above 100% means the manager amplifies up markets.*

Downside capture ratio

$$DC = \bar{R}_{p,down} / \bar{R}_{b,down}$$

Where: Averaged over periods when the benchmark fell.

▸ *Below 100% means the manager dampens losses — which is the more valuable of the two, because of compounding.*

Up/down capture ratio

$$\text{Up/Down} = \text{Upside capture} / \text{Downside capture}$$

Where: A single asymmetry number.

▸ *Above 1.0 is favourable convexity. A manager capturing 90% of the upside and 60% of the downside (ratio 1.5) beats one capturing 110% and 105%.*

Symmetric performance fee

$$\text{Fee} = \text{Base} + s \times (R_p - R_B)$$

Where: s = sharing rate.

▸ *Symmetric means the fee falls when the manager underperforms — genuine alignment. Asymmetric (upside-only) fees give the manager a free option on volatility, and the exam wants you to say so.*

EXAM TIPS — CORE 3 — PERFORMANCE MEASUREMENT & ATTRIBUTION

- Attribution: allocation is about WEIGHTS, selection is about PICKS. If you remember only one thing from this section, remember which return goes with which weight.
- Choosing the ratio is the question. Total risk ⇒ Sharpe or M². Systematic risk ⇒ Treynor or Jensen. Active risk ⇒ information ratio. Downside risk ⇒ Sortino.
- A high information ratio from a very low tracking error is fragile — it may just be a closet indexer with a lucky quarter. Look at active share alongside it.

CORE 4 — DERIVATIVES & CURRENCY RISK MANAGEMENT · 15 formulas

Hedging, overlays and option structures. The futures-contract formulas are near-guaranteed calculation marks.

Option delta

$$\text{Call:}\quad \Delta_c = N(d_1) \in (0, 1)$$
$$\text{Put:}\quad \Delta_p = N(d_1) - 1 \in (-1, 0)$$
$$\Delta_c - \Delta_p = 1$$

Where: Approximate change in option value per $1 move in the underlying.

▸ *Delta is also a rough probability of finishing in the money. ATM options sit near |0.5| and their delta moves fastest — that is gamma.*

Protective put

$$\text{Payoff} = S_T + \max(X - S_T, 0) = \max(S_T, X)$$
$$\text{Profit} = \text{Payoff} - (S_0 + p)$$

Where: Long stock + long put.

▸ *Insurance: floor the downside, keep the upside, pay a premium for the privilege. The put premium is the drag on a flat market.*

Covered call

$$\text{Payoff} = S_T - \max(S_T - X, 0) = \min(S_T, X)$$
$$\text{Profit} = \text{Payoff} - S_0 + c$$

Where: Long stock + short call.

▸ *Income in flat or mildly down markets, capped upside. You are selling the right tail to fund the present — fine until the stock gaps up.*

Collar

$$\text{Payoff} = S_T + \max(X_L - S_T, 0) - \max(S_T - X_H, 0)$$
$$= \min(\max(S_T, X_L), X_H)$$

Where: Long stock + long put (X_L) + short call (X_H).

▸ *A zero-cost collar funds the protective put by selling the call. Standard answer for a concentrated stock position the client cannot or will not sell.*

Put-call parity

```
S + P = C + PV(K)
```

Where: Same strike, same expiry, European.

▸ *Every synthetic in the Level III toolkit falls out of rearranging this. Long stock + long put = long call + cash.*

Long straddle breakevens

```
BE = K ± (C₀ + P₀)
```

Where: Long call + long put at the same strike.

▸ *A pure volatility bet — you need a big move in either direction. You lose if the underlying sits still, and time decay is working against you the whole way.*

Bull call spread maximum gain

```
Max gain = (K_H − K_L) − Net premium
```

Where: Buy the lower strike, sell the higher.

▸ *Max loss is simply the net premium paid. Capping the upside is what makes the position cheap.*

Maximum loss on short stock + long call

```
Max loss = K − S₀ + C₀
```

Where: A synthetic long put.

▸ *The call caps the unlimited loss on the short. Recognising the synthetic is usually faster than working the payoff from scratch.*

Number of bond futures to adjust duration

```
N = (DD_T − DD_P) / DD_f
```

Where: DD = dollar duration; DD_f is BPV-adjusted by the conversion factor.

▸ *Positive N means buy futures to extend duration; negative means sell to shorten. The conversion factor for the cheapest-to-deliver bond is not optional.*

Number of equity futures to adjust beta

```
N = [(β_T − β_P) / β_F] × [V / (P_f × m)]
```

Where: β_T = target beta, m = contract multiplier.

▸ *Set β_T = 0 to fully hedge equity exposure; set β_T = 1 to equitise a cash pile. Same formula, both directions.*

Roll yield on a currency forward hedge

```
Roll yield = (F − S) / S
```

Where: Approximately the domestic minus foreign interest rate differential.

▸ *Hedging a high-yielding foreign currency costs you money (negative roll). This is why the hedging decision is never free, and why the exam asks about it.*

Minimum-variance hedge ratio

```
h* = ρ_A,B × (σ_A / σ_B)
```

Where: A = the asset being hedged, B = the hedging instrument.

▸ *It is just the slope coefficient from regressing A on B. If ρ = 1 and volatilities match, h* = 1 and it is a perfect hedge — real cross-hedges never are.*

Domestic-currency return on a foreign asset

```
R_DC = (1 + R_FC)(1 + R_FX) − 1
```

Where: R_FX = % change in the foreign currency against the domestic.

▸ *It is multiplicative, not additive. The cross term matters when both moves are large — and the exam picks large numbers deliberately.*

Variance notional from vega notional

```
N_var = N_vega / (2 × σ_strike)
```

Where: σ_strike in whole-number percent (e.g. 20, not 0.20).

▸ *Vega notional is intuitive (dollars per vol point); variance notional is what the contract actually pays on. Convert before you compute the payoff.*

Variance swap payoff

```
Payoff = N_var × (σ²_realised − σ²_strike)
```

Where: Volatilities squared — it settles on variance, not volatility.

▸ *Because it pays on variance, the payoff is convex in volatility: the long side gains more from a vol spike than it loses from an equivalent vol fall.*

EXAM TIPS — CORE 4 — DERIVATIVES & CURRENCY RISK MANAGEMENT

- Futures overlay questions are formulaic marks. Write down current exposure, target exposure, and the exposure per contract — then divide. The only real difficulty is a sign error.
- Currency hedging: the roll yield tells you the cost, the correlation tells you the benefit. A currency that already hedges the underlying asset (negative correlation) may be best left unhedged.
- When a question describes a concentrated low-basis stock position, it wants a collar, an exchange fund, or a completion portfolio — and it wants you to discuss the tax consequence of each.

LEVEL III EXAM STRATEGY

The constructed-response session

- Answer in the box, in bullets, using the command word. "Recommend" needs a decision. "Justify" needs a reason drawn from the vignette. "Calculate" needs working.
- Cite the specific fact from the vignette that drives your answer. "Because the client is in the top marginal bracket" scores; "because of tax" does not.
- Show the formula, then the substitution, then the answer. Visible method earns partial credit even when the arithmetic slips.
- Allocate time by the printed minutes. Overrunning one question steals marks from an easier one you then never reach.

Private wealth specifics that carry weight

- Human capital ⇒ asset allocation. If human capital is bond-like, the financial portfolio can hold more equity. This idea recurs endlessly.
- After-tax, after-fee, real return. Always all three. A nominal pre-tax figure is never the answer to a private-client question.
- Core capital before estate planning. Establish what the client needs, then plan what they can give.
- Behavioural biases: name the bias, quote the evidence from the vignette, state the consequence, recommend moderate-or-adapt.

A note on the pathways

- The core (Topics labelled Core 1–4 here) is common to all three pathways and makes up the larger share of the exam.
- Candidates who fail Level III usually fail on asset allocation and performance evaluation — not on their chosen specialism. Budget your revision accordingly.