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FREE CERTIFICATION PREP

FORMULA SHEET

CFA Level II

Chartered Financial Analyst · Core formula reference

35 formulas **9** subject areas

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HOW TO USE THIS SHEET

Level II is not Level I with harder numbers. It is a vignette exam: the formula is rarely the hard part, and finding the right three inputs buried in a page of narrative usually is.

So use this sheet differently. Do not just memorise the formulas — memorise what each formula NEEDS. When you read a vignette, you should be scanning for inputs, not for topics.

Fewer formulas than Level I, but each one sits inside a longer chain of reasoning. A single wrong input propagates through the whole item set, which is why one careless read can cost you four marks instead of one.

The ► notes flag the judgement calls: which version of the formula, which assumption, which distractor the vignette is setting up.

QUANTITATIVE METHODS · 4 formulas

Regression output. You will be handed an ANOVA table and asked to interpret it — know what every cell means.

F-statistic (overall regression)

$$F = (RSS / k) / (SSE / (n - k - 1)) = MSR / MSE$$

Where: k = number of predictors, n = number of observations.

► Tests H_0 : all slope coefficients equal zero, jointly. It is always a one-tailed, right-tail test — a common misstep is halving the significance level.

Coefficient of determination

$$R^2 = RSS / SST = 1 - SSE / SST$$

Where: RSS = explained, SSE = unexplained, SST = total sum of squares.

► R^2 never falls when you add a variable, even a useless one. That property alone is why adjusted R^2 exists.

Adjusted R^2

$$\bar{R}^2 = 1 - [(n - 1)/(n - k - 1)] \times (1 - R^2)$$

Where: Penalises the model for extra regressors.

► Adjusted R^2 CAN fall when you add a variable — if the new variable's t-statistic is below about 1, it will. That is the signal that the variable is not earning its place.

Standard error of the estimate

$$SEE = \sqrt{(SSE / (n - k - 1))} = \sqrt{MSE}$$

Where: The typical size of a prediction error, in the units of Y.

► Lower SEE = tighter fit. It is the square root of MSE — the same MSE that sits in the denominator of the F-stat.

EXAM TIPS — QUANTITATIVE METHODS

- Every regression vignette gives you an ANOVA table. Learn the layout so you can pull RSS, SSE, SST, k and n out of it in five seconds.
- Know the three violations and their consequences cold: heteroskedasticity and serial correlation break the STANDARD ERRORS (so t-stats lie); multicollinearity inflates them (so nothing looks significant even though R^2 is high).
- A high R^2 combined with insignificant individual t-statistics is the textbook fingerprint of multicollinearity.

ECONOMICS · 4 formulas

Currency parity conditions. Four relationships, and they interlock — learn them as a system.

Relative purchasing power parity

$$E(\% \Delta S_{d/f}) \approx \pi_d - \pi_f$$

Where: The higher-inflation currency depreciates.

► PPP is a long-run anchor and a terrible short-run predictor. The exam will make that distinction explicitly.

Covered interest rate parity

$$F / S = (1 + r_d) / (1 + r_f)$$

Where: F, S quoted as domestic per foreign.

► Covered = enforced by arbitrage, so it holds. Uncovered parity relies on expectations, so it does not — and the failure of uncovered parity is what the carry trade profits from.

International Fisher effect

$$r_{nom,d} - r_{nom,f} \approx E(\pi_d) - E(\pi_f)$$

Where: Combines the Fisher effect with PPP.

► Assumes real rates are equal across countries. That assumption is doing a lot of work — and it is exactly what the exam probes.

Unhedged foreign asset return

$$(1 + R_{DC}) = (1 + R_{FC})(1 + R_{FX})$$

$$\text{Approx: } R_{DC} \approx R_{FC} + R_{FX}$$

Where: R_{FX} = appreciation of the foreign currency against the domestic.

► Use the exact multiplicative form. The cross-product term is small only when both returns are small, and Level II vignettes rarely make them small.

EXAM TIPS — ECONOMICS

- Write the quote convention at the top of the page before you touch a number. Almost every FX mistake is an inverted quote, not a broken concept.
- The parity conditions form one system: PPP relates inflation to spot, IFE relates inflation to nominal rates, CIP relates nominal rates to forwards. Draw it once and it stops being four separate things.

FINANCIAL STATEMENT ANALYSIS · 2 formulas

Pensions and cash flow. Small formula count, disproportionate exam weight.

FCFF from EBIT

$$FCFF = EBIT(1 - t) + D\&A - \Delta WC - CapEx$$

Where: t = tax rate, ΔWC = increase in working capital.

► Starting from EBIT, interest never appears — it was never deducted. Starting from net income, you must add back after-tax interest. Know which starting point you are on.

Net periodic pension cost (US GAAP)

$$NPPC = \text{Service cost} + \text{Interest cost} - \text{Expected return on assets} + \text{Amortisation of prior service cost} \pm \text{Amortisation of gains/losses}$$

Where: ASC 715 reporting.

► Under IFRS (IAS 19), net interest on the net pension liability replaces the expected-return line — so management cannot flatter earnings by assuming a heroic return on plan assets. That difference is a favourite comparison question.

EXAM TIPS — FINANCIAL STATEMENT ANALYSIS

- Pension questions are about where the cost lands: P&L or OCI. Under IFRS remeasurements go to OCI and stay there; under US GAAP, actuarial gains and losses can be amortised back into P&L.

- A high assumed discount rate shrinks the reported liability. A high assumed return on assets flatters US GAAP earnings. Both are management levers — expect an earnings-quality question about them.

CORPORATE ISSUERS · 4 formulas

Free cash flow and capital structure. The FCFF-to-FCFE bridge is tested almost every year.

FCFE from FCFF

$$\text{FCFE} = \text{FCFF} - \text{Int}(1 - t) + \Delta\text{Debt}$$

Where: ΔDebt = net new borrowing.

- Subtract what lenders take (after tax), add what they lend. Net repayment makes ΔDebt negative — read the cash flow statement, do not assume.

FCFE from net income

$$\text{FCFE} = \text{NI} + \text{NCC} - \Delta\text{WC} - \text{CapEx} + \Delta\text{Debt}$$

Where: NCC = non-cash charges (D&A, deferred tax).

- No interest adjustment here — net income is already after interest. Adding interest back is the classic double-count.

FCFE constant-growth valuation

$$V_0 = \text{FCFE}_1 / (r_e - g)$$

Where: r_e = cost of equity; requires $r_e > g$.

- Discount FCFE at the cost of equity and you get equity value directly. Discount FCFF at WACC and you get firm value, from which you must subtract debt.

MM Propositions I & II (with taxes)

$$\text{Prop I: } V_L = V_U + tD$$

$$\text{Prop II: } r_e = r_o + (r_o - r_d)(1 - t)(D/E)$$

Where: The debt tax shield adds value; cost of equity rises with leverage.

- Taken literally, MM with taxes implies 100% debt is optimal. The exam wants you to name what MM leaves out: financial distress costs, agency costs, and asymmetric information.

EXAM TIPS — CORPORATE ISSUERS

- FCFF pairs with WACC and gives firm value. FCFE pairs with cost of equity and gives equity value. Crossing the pair is an instant wrong answer, and the vignette will offer it as a distractor.
- For MM, learn the progression: no taxes $\Rightarrow$ capital structure is irrelevant; with taxes $\Rightarrow$ all debt; with taxes and distress costs $\Rightarrow$ an interior optimum. The exam usually asks which world you are in.

EQUITY VALUATION · 4 formulas

Multi-stage models and residual income. Residual income is the topic candidates most often under-prepare.

Build-up method for cost of equity

$$r_e = r_f + \text{ERP} + \text{Size premium} + \text{Specific-company premium} \pm \text{Industry premium}$$

Where: Used for private and illiquid firms where CAPM beta is unobservable.

- No beta — that is the point. There is no public price series to regress, so you stack observable premia instead.

Sustainable growth rate

$$g = \text{ROE} \times b$$

Where: b = retention ratio = $1 - \text{payout ratio}$.

- The growth a firm can fund without new equity or more leverage. If forecast growth exceeds g , the model implicitly requires external financing — say so.

Two-stage dividend discount model

$$V_0 = \sum D_0(1 + g_S)^t / (1 + r)^t + V_n / (1 + r)^n$$

$$V_n = D_{n+1} / (r - g_L)$$

Where: g_S = high growth, g_L = long-run growth.

► V_n is a value AS AT time n , so it is discounted n periods. Discounting it $n + 1$ periods is the most common Level II valuation error.

Residual income model

$$V_0 = B_0 + \sum [(ROE_t - r_e) \times B_{t-1}] / (1 + r_e)^t$$

Where: B_0 = current book value of equity.

► Most of the value arrives immediately as book value, so it depends far less on the terminal value than a DDM does. That robustness is precisely why it is preferred for firms with no dividends and negative near-term cash flow.

EXAM TIPS — EQUITY VALUATION

- Model selection is itself an exam question. No dividends and negative FCF $\Rightarrow$ residual income. Stable dividend payer $\Rightarrow$ DDM. Control perspective $\Rightarrow$ FCFF.
- Residual income creates value only when $ROE > r_e$. If ROE equals the cost of equity, the firm is worth exactly book value — a fine one-line answer.

FIXED INCOME · 4 formulas

Spreads and duration with embedded options. Get the OAS direction right and half the topic falls into place.

Credit spread decomposition

$$\text{Observed spread} = \text{Expected loss} + \text{Credit risk premium} + \text{Liquidity premium}$$

$$\text{Expected loss} = PD \times LGD$$

Where: PD = probability of default, LGD = loss given default.

► The observed spread is much wider than expected loss alone. The gap — risk premium plus liquidity — is why long-run credit returns have exceeded default losses.

Option-adjusted spread

$$OAS = Z\text{-spread} - \text{Option value (bps)}$$

Where: Option value from a lattice or Monte Carlo model.

► Callable $\Rightarrow$ the option belongs to the ISSUER, so its value is subtracted: $OAS < Z\text{-spread}$. Puttable $\Rightarrow$ the option belongs to YOU, so $OAS > Z\text{-spread}$. Reason it from who owns the option and you will never get it wrong.

Effective duration

$$D_{\text{eff}} = (P_- - P_+) / (2 \times P_0 \times \Delta y)$$

Where: P_- = price if yields fall, P_+ = price if yields rise.

► Mandatory for anything with an embedded option — callables, putables, MBS — because the cash flows themselves change with yields.

Portfolio effective duration

$$D_{\text{eff, port}} = \sum w_i \times D_{\text{eff, i}}$$

Where: w_i = market-value weight.

► Assumes a parallel shift. When the vignette describes a steepening or flattening curve, it is telling you to use key rate durations instead.

EXAM TIPS — FIXED INCOME

- Callable bond behaviour is the whole game: as yields fall, price compression sets in, effective duration shrinks and convexity turns negative. Learn the shape of the price-yield curve, not just the numbers.

- Higher assumed interest-rate volatility raises the value of BOTH embedded options — so the callable's price falls and the puttable's price rises. Expect exactly this comparison.

DERIVATIVES · 5 formulas

The Greeks and binomial pricing. Level II is where derivatives stop being definitional.

Put-call parity

$$c + X/(1 + r)^T = p + S_0$$

$$\text{Continuous: } c + X \cdot e^{(-rT)} = p + S_0$$

Where: Same strike and expiry, European options.

► Every synthetic and every arbitrage question at Level II starts here. If a question feels intractable, rearrange parity and see what falls out.

Binomial option pricing (one period)

$$c = (\pi_u \cdot c_u + \pi_d \cdot c_d) / (1 + r)$$

$$\pi_u = ((1 + r) - d) / (u - d), \quad \pi_d = 1 - \pi_u$$

Where: u, d = up and down factors; π = risk-neutral probabilities.

► Risk-neutral probabilities are NOT real-world probabilities and have nothing to do with anyone's forecast. The investor's actual expected return never enters the model — a favourite conceptual trap.

Option gamma

$$\Gamma = \partial^2 V / \partial S^2 = \partial \Delta / \partial S$$

Where: The rate of change of delta.

► Highest at the money and close to expiry — that is where delta hedging becomes expensive and unstable. Long options are positive gamma; short options are negative gamma and quietly dangerous.

Option vega

$$v = \partial V / \partial \sigma$$

Where: Price change per one percentage-point move in volatility.

► Long calls AND long puts are both positive vega — buying an option is buying volatility, whichever direction you think the underlying is going. Vega is highest at the money with longer expiry.

Option theta

$$\theta = \partial V / \partial t$$

Where: Change in value per unit of calendar time.

► Usually negative for long options: value bleeds away toward expiry. Decay is fastest for at-the-money options in the final weeks — the reason long straddles are expensive to hold.

EXAM TIPS — DERIVATIVES

- The Greeks are just partial derivatives. Delta $\Rightarrow$ price. Gamma $\Rightarrow$ delta. Vega $\Rightarrow$ volatility. Theta $\Rightarrow$ time. Rho $\Rightarrow$ rates. Naming the variable tells you the Greek.
- Long options: positive gamma, positive vega, negative theta. You pay time decay to own convexity. Short options are the exact mirror — and that is what blows up option sellers.

ALTERNATIVE INVESTMENTS · 4 formulas

Real estate and private equity valuation. Formulas are simple; the definitions are where marks are lost.

Direct capitalisation (real estate)

$$V = \text{NOI}_1 / \text{Cap rate}$$

Where: NOI_1 = stabilised first-year net operating income, after opex but before debt service and tax.

- Implicitly, $\text{cap rate} = r - g$. So a low cap rate means the market expects growth, not that the property is cheap.

Total value to paid-in (TVPI)

$$\text{TVPI} = (\text{Distributions} + \text{Residual NAV}) / \text{Paid-in capital} = \text{DPI} + \text{RVPI}$$

Where: DPI = realised, RVPI = unrealised.

- TVPI counts unrealised NAV, which the GP marks themselves. DPI is cash actually returned — it is the only multiple that cannot be flattered by a generous mark.

Pre-money and post-money valuation

$$\text{Post-money} = \text{Pre-money} + \text{New investment}$$

$$\text{Investor share} = \text{Investment} / \text{Post-money}$$

Where: Price per share = pre-money value / pre-money shares.

- Ownership is always computed on the POST-money figure. Dividing by pre-money overstates the investor's stake — and that is the distractor.

Equity REIT NAV per share

$$\text{NAV/share} = (\text{Property value} + \text{Other assets} - \text{Total liabilities}) / \text{Shares outstanding}$$

Where: Property value usually from cap-rate or DCF on stabilised NOI.

- Price-to-NAV reveals whether the market is paying a premium or a discount to the bricks. A persistent discount is a signal about management, not about the buildings.

EXAM TIPS — ALTERNATIVE INVESTMENTS

- Every real estate valuation runs through NOI. Build NOI right — exclude debt service, income tax, depreciation — and the rest is arithmetic.
- For private equity, know the difference between gross and net returns (fees and carry) and between realised and unrealised value. Almost every PE question tests one of those two distinctions.

PORTFOLIO MANAGEMENT · 4 formulas

The performance ratios return, essentially unchanged from Level I. Free marks — take them.

Fundamental law of active management

$$\text{IR} = \text{IC} \times \sqrt{\text{BR}}$$

Where: IC = skill, BR = number of independent bets.

- Breadth is under a square root, so doubling your number of bets does not double your information ratio. And the bets must be genuinely independent.

Treynor ratio

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

Where: Excess return per unit of systematic risk.

- Appropriate when the portfolio is one holding among many. If it is the investor's whole portfolio, use Sharpe.

Jensen's alpha

$$\alpha_p = R_p - [R_f + \beta_p(R_m - R_f)]$$

Where: Return above the CAPM-required return.

- The only one of these measured in return units rather than as a ratio — which is why it cannot be compared across portfolios with different risk levels.

M-squared

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

Where: Portfolio return re-levered to the market's volatility.

- Ranks identically to Sharpe but reports in percent, so you can say "this manager beat the market by 1.4% on a risk-adjusted basis" — a sentence Sharpe cannot produce.

EXAM TIPS — PORTFOLIO MANAGEMENT

- These four came up at Level I and will come up again at Level III. Getting them wrong at Level II is giving away marks you have already paid for once.
- Match the risk measure to the context: total risk (Sharpe, M^2) for a standalone portfolio, systematic risk (Treyner, Jensen) for a component of a diversified whole.

HOW TO ACTUALLY PASS LEVEL II

Read the vignette like an analyst, not a student

- Read the questions FIRST, then the vignette. You will read half the narrative knowing it is irrelevant, and that is the point.
- Level II vignettes deliberately include unused data. An unused number is not evidence that you missed something.
- Exhibits carry more information than prose. Footnotes under exhibits carry more than the exhibits.

The five highest-leverage things to know cold

- The FCFE $\rightleftharpoons$ FCFE bridge, from both starting points (EBIT and net income).
- OAS direction: callable $\Rightarrow$ OAS < Z-spread; putable $\Rightarrow$ OAS > Z-spread.
- The regression violations and which statistic each one corrupts.
- Two-stage models, and where exactly the terminal value gets discounted to.
- Risk-neutral probabilities — what they are, and what they emphatically are not.

Practice discipline

- Practise in full item sets under time. Six questions in 18 minutes. Isolated questions do not build the skill Level II tests.
- When you get one wrong, classify it: wrong formula, wrong input, misread question, or ran out of time. Those four failures have four different cures.
- Ethics is the largest single topic and the cheapest to improve. Do not leave it to the final week.

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