

Time Value of Money

Formula sheet — a quick-reference companion to the TVM calculators (PV/FV, NPV/IRR, Loan Repayment, Annuity) and to the Income Capitalisation and DCF methods.

1 Notation

PV — Present Value — a future amount expressed in today's terms

FV — Future Value — an amount today projected forward

r — Discount / interest rate per period, as a decimal (10% = 0.10)

n — Number of periods (usually years)

PMT — Level periodic payment or receipt (an annuity)

CF_t — Cash flow arising in period t

g — Growth rate per period, as a decimal

m — Number of compounding periods per year

2 Single Sum — the PV / FV calculator

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

Grows a present amount forward — projecting a future rental, cost, or capital value.

$$PV = FV \div (1 + r)^n$$

Discounts a future amount back to today — converting a known future sale price or cash flow into a present value.

3 Annuities — the Annuity calculator

$$PV = PMT \times [1 - (1 + r)^{-n}] \div r$$

Present value of a level periodic amount — e.g. a stable rental income stream over n periods, discounted at r.

$$FV = PMT \times [(1 + r)^n - 1] \div r$$

Future value of a level periodic contribution — e.g. a sinking fund building up at rate r.

$$\text{Annuity due} = \text{ordinary annuity} \times (1 + r)$$

Use when each payment falls at the start of the period rather than the end (e.g. rent payable in advance).

4 Loan Repayment — the Loan Repayment calculator

$$PMT = PV \times r \div [1 - (1 + r)^{-n}]$$

The level instalment that fully amortises a loan of PV over n periods at rate r per period — e.g. a bond repayment on acquisition finance.

$$\text{Balance}_k = PMT \times [1 - (1 + r)^{-(n-k)}] \div r$$

Capital still outstanding after k instalments have been paid.

Continued overleaf — NPV / IRR, perpetuities, the income-capitalisation bridge, effective rates, and a worked example.

5 NPV & IRR — the NPV / IRR calculator

$$\text{NPV} = \sum \text{CF}_t \div (1 + r)^t \quad (t = 0 \dots n)$$

Sum of all discounted cash flows, including the initial outlay at $t = 0$ (entered as a negative). $\text{NPV} > 0$ at your required return means the investment adds value.

$$\text{IRR: the rate } r \text{ at which NPV} = 0$$

Solved iteratively (no closed-form formula). An investment clears the bar when IRR exceeds your required return.

6 Perpetuities & the Income-Capitalisation Bridge

$$\text{PV} = \text{CF} \div r$$

Level perpetuity — the present value of a constant cash flow received indefinitely.

$$\text{PV} = \text{CF}_1 \div (r - g)$$

Growing perpetuity (Gordon growth) — the cash flow grows at a constant rate g forever.

$$\text{Value} = \text{NOI} \div \text{Cap Rate}$$

Direct capitalisation, as used throughout the Income Capitalisation Method — mechanically a level perpetuity, treating NOI as a constant, indefinite income stream.

Why the cap rate and the DCF discount rate are not the same number

Rearranging the growing-perpetuity formula gives $\text{Cap Rate} \approx \text{Discount Rate} - \text{Growth Rate}$. The cap rate already has expected income growth “baked in”, which is why it normally sits below the discount rate used in a DCF, and why the two should never be used interchangeably (see Capitalisation Rate, §7 of the Income Capitalisation workbook).

7 Effective vs Nominal Rates

$$\text{EAR} = (1 + i \div m)^m - 1$$

Converts a nominal annual rate i , compounded m times a year, into the true effective annual rate.

$$\text{Periodic } r = (1 + \text{annual } r)^{1/m} - 1$$

Converts an effective annual rate into an equivalent compounding-period rate — this is not simply the annual rate divided by m .

8 Terminal (Exit) Value — DCF Method

$$\text{Terminal Value} = \text{NOI}_{n+1} \div \text{Exit Cap Rate}$$

The resale value assumed at the end of the DCF projection period, based on the income of the year immediately following exit.

$$\text{PV of Terminal Value} = \text{Terminal Value} \div (1 + r)^n$$

Discounted back to today at the DCF discount rate to combine with the PV of the interim cash flows for the total DCF value.

9 Worked Micro-Example

Single sum & direct capitalisation

Future value — 500,000 invested for 5 years at 9% p.a. compound:

$$\text{FV} = 500,000 \times (1.09)^5 = \mathbf{769,312}$$

Direct capitalisation — a property with a stabilised NOI of 1,000,000 p.a., supported by a market cap rate of 10%:

$$\text{Value} = \text{NOI} \div \text{Cap Rate} = 1,000,000 \div 0.10 = \mathbf{10,000,000}$$

Educational tool only. This formula sheet is provided for illustrative and learning purposes as a companion to the Time Value of Money calculators on Valuation Discussion Hour, and does not constitute financial, investment, or valuation advice. Always verify calculations independently and apply professional judgement before relying on them in practice.

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