A primer on financial maths

Compounding a cash flow	**Current cash flows moved to the future using the appropriate discount rate** $$FV = PV\ (1+r)^N$$
Discounting	The process by which a future cash flow is adjusted to reflect the above= discounting and the magnitude of these factors is reflected by the discount rate. $$PV = \frac{FV}{(1+r)^N}$$ **Discount factor:** $$\mathrm{DF}_n = \frac{1}{(1+r_n)^n}$$
Effective annual interest rate	**Converts compounding intervals to a rate p.a.** $$\mathrm{EAR} = \left[1+\left(\frac{r}{m}\right)\right]^{\frac{m}{k}} - 1$$ *Where:* *m= "compounded semi-annually"* *k=number of payment periods (Kaching! How often payments are made)* *remember: N=N x k* *note: 12=monthly; 2= semi-annual; 4=quarterly; 52= weekly; 365=daily*
NPV rule	**Accept investments that have a positive NPV** NPV= PV (benefits)- PV(costs)
Rate of return rule	**Accept if return > opportunity cost of capital** $$\mathrm{Return} = \frac{\mathrm{Profit}}{\mathrm{Investment}}$$ *Note:* Higher risk = requires higher return = causes a lower PV
Perpetuities	**A perpetuity** is a constant cash flow at regular intervals forever. The future value of a perpetuity is infinite $$PV = \frac{C}{r}$$
Growing perpetuities	A **growing perpetuity** is a cash flow that is expected to grow at a constant rate forever.

	$$\text{PV} = \frac{C_1}{(r-g)}; r > g$$ *Where C1 is the expected cash flow for next year.* The fact that a growing perpetuity lasts forever **constrains the growth rate. The discount rate MUST be greater than g for the formula to work.**
FV end-of – period annuity	In some cases an individual may plan to set aside a fixed annuity each period for a number of periods and will want to know how much he will have at the end of the period. $$\text{FV of annuity} = \text{C} \times \left[\frac{(1+r)^N - 1}{r}\right]$$
PV of end-of-period annuity	Cash flow is a fixed sum (C) for a specified number of years (N). $$\textbf{PV annuity} = C \times \left[\frac{1-(1+r)^{-N}}{r}\right]$$ PV annuity factor (PVAF) $= \left[\frac{1}{r} - \frac{1}{r(1+r)^N}\right]$
Amortization of annuities given PV	In some cases, the PV of cash flows is known and the annuity needs to be estimated. This is often the case with loans where a borrower receives a loan today and pays it back in equal monthly instalments over an extended period of time. $$\text{C} = \text{PV}\left[\frac{r}{1 - \frac{1}{(1+r)^n}}\right]$$
Beginning-of period annuity	**Annuity due:** $$\text{PV annuity due} = \text{C} + \text{C}\left[\frac{1-(1+r)^{-(N-1)}}{r}\right]$$
Growing annuities	$$\text{PV} = \frac{C}{(r-g)}\left[1 - \frac{(1+g)^N}{(1+r)^N}\right]; r > g$$ ^^CAN ONLY USE THE GROWTH FORMULA WHEN r>g!!!!!!!!! when r=g then the PV is equal to the nominal sums of the annuities over the period, without the growth effect. *This formula also works when g>r :* **PV of growing annuity for n years (when r=g)= nC**