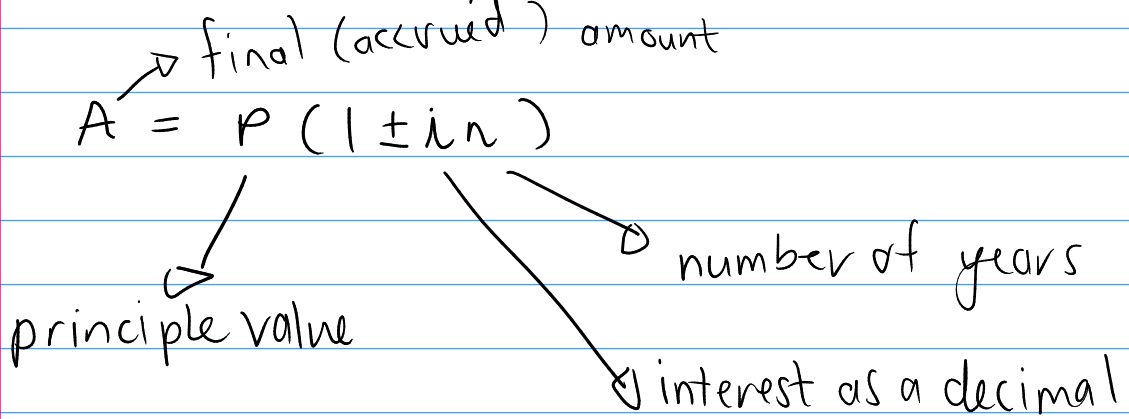
FINANCIAL MATH

Including the following

SIMPLE GROWTH / DECAY



(straight line method)

COMPOUND GROWTH / DECAY

$$A = P(1 \pm i)^n$$

- A: final amount
- P: Principle amount
- i: interest in decimal
- n: number of years

COMPOUND GROWTH / DECAY → COMPOUNDED QUARTERLY / MONTHLY

$$A = P\left(1 \pm \frac{i}{m}\right)^{n \times m}$$

- A: accrued amount (end)
- P: start (principle) amount
- i: interest as a decimal over the number of months / compounding periods
- $n \times m$: number of years times number of months / compounding periods

* When find P for a known A (going back in time) use:

$$A = P(1+i)^{-n}$$

FUTURE VALUE (SAVING FOR THE FUTURE)

$$f_V = x \left[\frac{(1+\frac{i}{m})^n - 1}{\frac{i}{m}} \right]$$

- f_V: total future value
- x: fixed/monthly payments
- n: number of payments made
- $\frac{i}{m}$: interest in decimal divided by amount of months

PRESENT VALUE (LOANS)

$$P_v = x\left[\frac{1-\left(1+\frac{i}{m}\right)^{-n}}{\frac{i}{m}}\right]$$

- P_v: Present value available
- x: fixed regular/monthly payments
- i: rate of interest in decimals divided by the number of months/compounding period
- n: number of payments made

EFFECTIVE INTEREST

$$i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m - 1$$

i_{nom}: starting (nominal) interest rate compounded m times a year

m: compounding times

i_{eff}: effective interest (Actual rate of interest that is obtained)

TO CONVERT FROM ONE COMPOUNDING PERIOD TO ANOTHER:

Use: $i_{eff(1)} = i_{eff(2)}$

$$\therefore \left(1 + \frac{i^{(m)}}{m}\right)^m = \left(1 + \frac{i^{(n)}}{n}\right)^n$$

OTHER NOTES:

* **Once off investments:** use compound growth formula

$$A = P(1+i)^n$$

* **Annuity:** Future value | Present value with regular payments(x)

FV vs PV

FV → What amount will I have in the future?

PV → What amount do I have right now (loans)

* **'One month after'**: that is how questions are typically asked. It does not change the formula

* **'Rate of depreciation'** means $i = ?$

* **Reducing balance method:**

use compound depreciation

$$A = P(1-i)^n$$

* **Population:** compound interest formula

$$A = P(1 \pm i)^n$$

* **Sinking fund:** Saving up for needing something paid for in the future

ie: Fv

* **Quarterly rate:** $\frac{\text{percentage } i}{\text{compounding periods}}$

* **How many withdrawals | deposits?**

this means 'what is n?'

* Fv: 'one month after purchase' → normal way of asking

'immediately' → + one month

* **Fv:** On the time line, change all years to months

Eg 3 yrs

T_0 T_1 ..... T_{36} → 12×3

x_1 x_n

* **If payments end early:** use compound interest for the remaining months

BALANCE OUTSTANDING

* Pv - full loan

* What is the balance ?

compound interest - fv

- compound interest → of the full loan for the years already paid
- fv → monthly payments already paid

= loan amount still to pay.

DELAYED START QUESTIONS (PV)

$$P = x\left[\frac{1-(1+i)^{-n}}{i}\right]$$

but

P has compound interest for the first missed months due to the delay

$$\therefore P(1+i)^{n} = x\left[\frac{1-(1-i)^{-n}}{i}\right]$$

↓

Principal amount with it's interest for the months of the delay