Case study: *

Jane, who is 45 years old and planning her retirement, wants a reliable income source upon retiring at 65. Her financial advisor has outlined two investment choices: an annuity and a perpetuity.

Annuity Option:

Jane can invest $200,000 in an annuity plan that will pay her $20,000 per year for 20 years, starting from her retirement at age 65. The annuity plan has an annual interest rate of 6%.

Perpetuity Option:

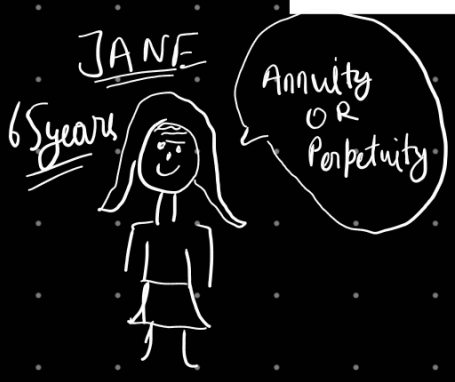
Alternatively, Jane can opt for a perpetuity that guarantees her $15,000 per year indefinitely, beginning from her retirement at age 65. The perpetuity plan also offers an annual interest rate of 5%.

Objective:

Jane wants to evaluate these two options to determine which investment plan would be more beneficial for her retirement income.
Now based on this, answer the following questions:

1)Calculate the present value of both the annuity and perpetuity options at the time of Jane's retirement (age 65). Use the appropriate formulas for the present value of an annuity and perpetuity given the provided interest rates and payment structures.**(2 marks)**

2)Examine the differences in the present worth between an annuity and a perpetuity. Analyze how these valuation variances could impact Jane's retirement income.**(2 marks)**
Answers without any steps/calculations won't fetch you any marks.



Annuity -> investment -> $200,000

Returns -> $20,000 / year for 20 years.

interest rate = 6%.

Perpetuity -> investment $200,000

Returns -> $15,000 / year ⟶ ∞

interest rate = 5%

1) $$PV_{annuity} = \frac{C \times (1 - (1+\gamma)^{-n}}{\gamma}$$

$$= \frac{20{,}000\,(1 - (1+0.06)^{-20})}{0.06}$$

$$= 20000\left(\frac{1 - 0.31180}{0.06}\right)$$

$$= 20000\left(\frac{0.688195}{0.06}\right)$$

$$= 20000 \times 11.4699 = \boxed{\$229{,}398.42}$$

$PV_{perpetuity} \hookrightarrow = \frac{C}{\gamma} = \frac{15{,}000}{0.05} = \boxed{\$300{,}000}$

2) **Annuity** — fixed number of payments over specific period of time

(∵ It will have a less present value than annuity if cash inflow and rate are same)

Perpetuity — infinite number of payments (till holder dies)

→ here in this case the annuity has higher cash flow and higher rate of interest (making it more attractive option)

→ It is important to consider
- → life expectancy
- → financial needs
- → risk tolerance

If life expectancy > 20 years → Perpetuity is better

If wants higher income in initial years of retirement → Annuity is better