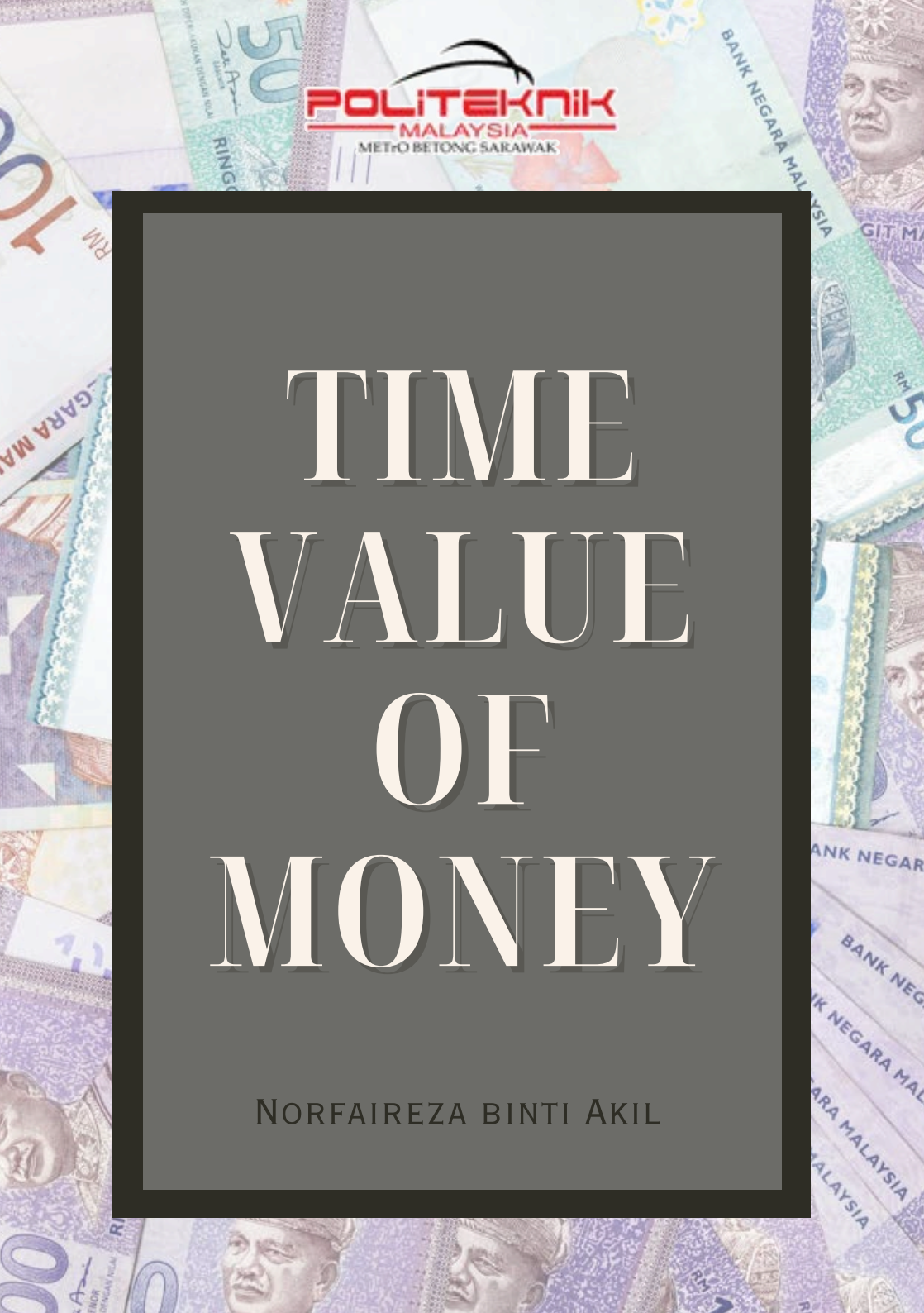

TIME VALUE OF MONEY

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May this humble effort bring benefit to readers and encourage further pursuit of knowledge.

Norfaireza binti Akil

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INTRODUCTION TIME VALUE OF MONEY

01.

SCAN ME

The Time Value of Money (TVM) is one of the most important concepts in the field of finance and economics. It refers to the idea that the value of money is dependent on the time at which it is received or paid.

A sum of money available today is considered more valuable than the same sum at a future date because of its potential earning capacity.
This principle establishes the foundation for investment analysis, corporate finance, capital budgeting, and personal financial planning.

TIME VALUE OF MONEY

The Time Value of Money is not merely a financial calculation but a theoretical framework that underpins the valuation of cash flows occurring at different points in time. It highlights the relationship between time, money, interest rates, and risk.

TIME VALUE OF MONEY

The theoretical basis of TVM is that money can generate income over time through investment or interest. For example, RM1,000 today, if invested at 5% per annum, will grow to RM1,050 in one year.

Conversely, if an individual is promised RM1,050 one year from now, its present value is less than RM1,050, because the money could have been received and invested earlier. Thus, TVM provides the mechanism to compare cash flows that occur at different points in time.

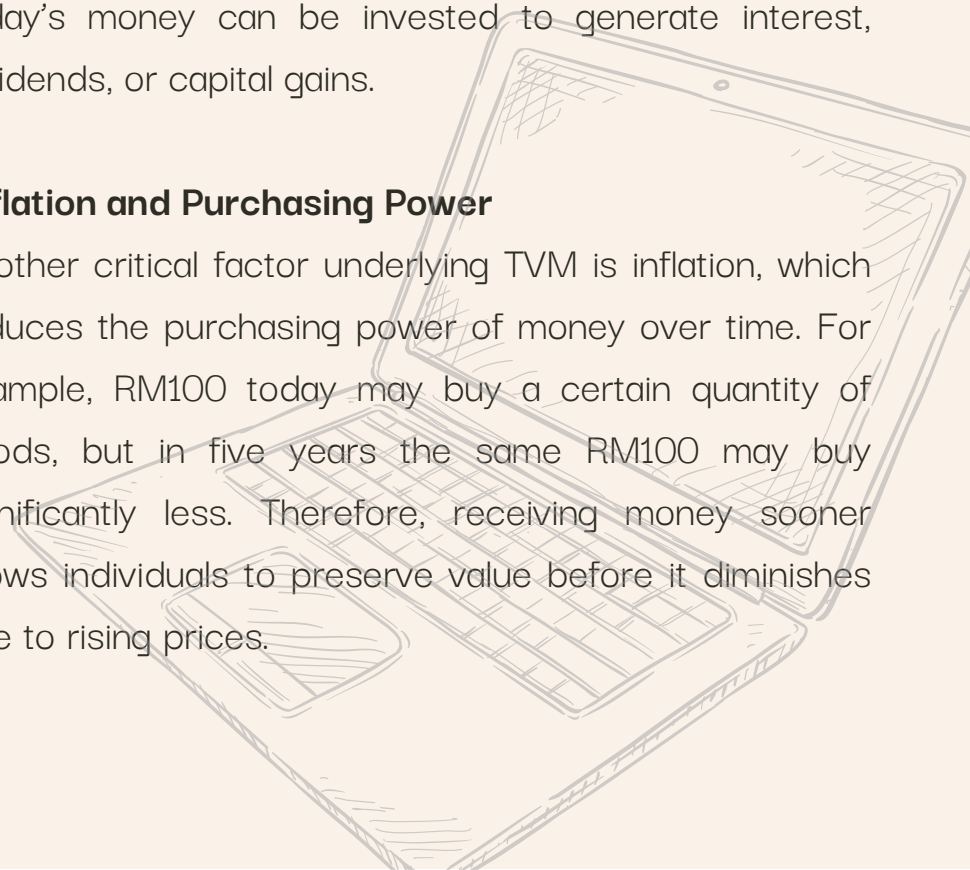
CONCEPT TIME VALUE OF MONEY

Opportunity Cost of Capital

Every financial decision involves a trade-off. Choosing to spend or delay money today means sacrificing the opportunity to earn returns. This is known as the opportunity cost of capital. Rational investors prefer to receive money today rather than in the future, since today's money can be invested to generate interest, dividends, or capital gains.

Inflation and Purchasing Power

Another critical factor underlying TVM is inflation, which reduces the purchasing power of money over time. For example, RM100 today may buy a certain quantity of goods, but in five years the same RM100 may buy significantly less. Therefore, receiving money sooner allows individuals to preserve value before it diminishes due to rising prices.



CONCEPT TIME VALUE OF MONEY

Risk and Uncertainty

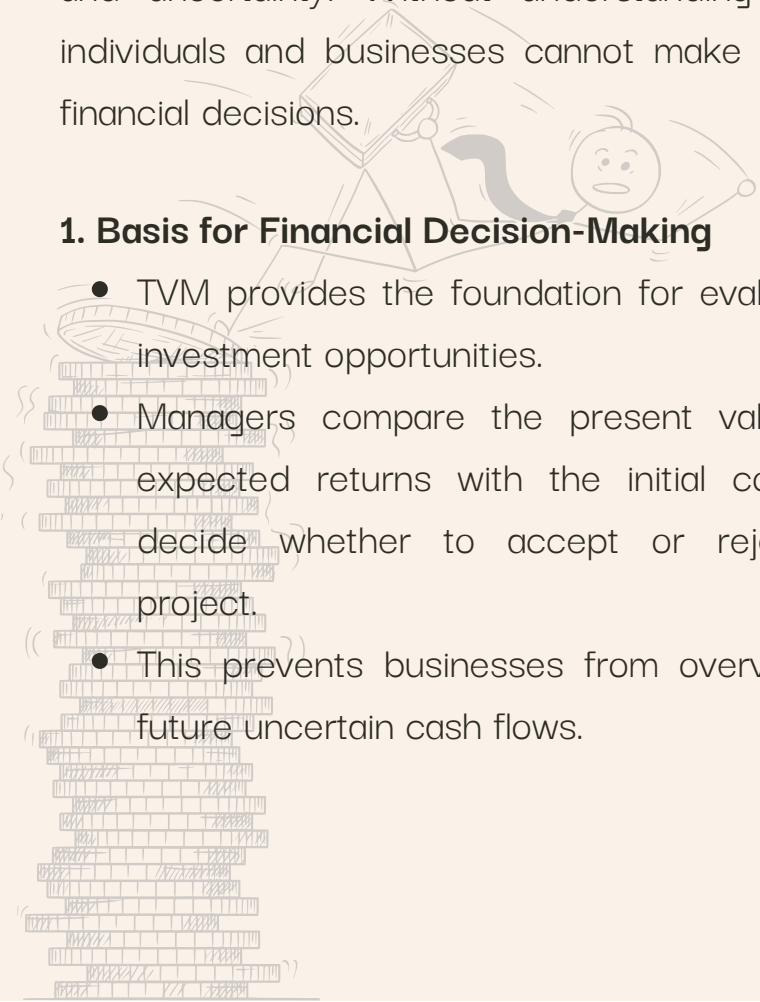
Future cash flows are uncertain due to market volatility, default risk, and other economic factors. Receiving cash today eliminates the risk of non-receipt in the future. Hence, money in hand today carries less uncertainty compared to money expected later, making it more valuable.

AR

SCAN ME!

IMPORTANCE OF TIME VALUE OF MONEY

The Time Value of Money (TVM) is one of the most important concepts in finance. It recognizes that the value of money changes over time due to its earning potential, inflation, and uncertainty. Without understanding TVM, individuals and businesses cannot make sound financial decisions.



1. Basis for Financial Decision-Making

- TVM provides the foundation for evaluating investment opportunities.
- Managers compare the present value of expected returns with the initial cost to decide whether to accept or reject a project.
- This prevents businesses from overvaluing future uncertain cash flows.

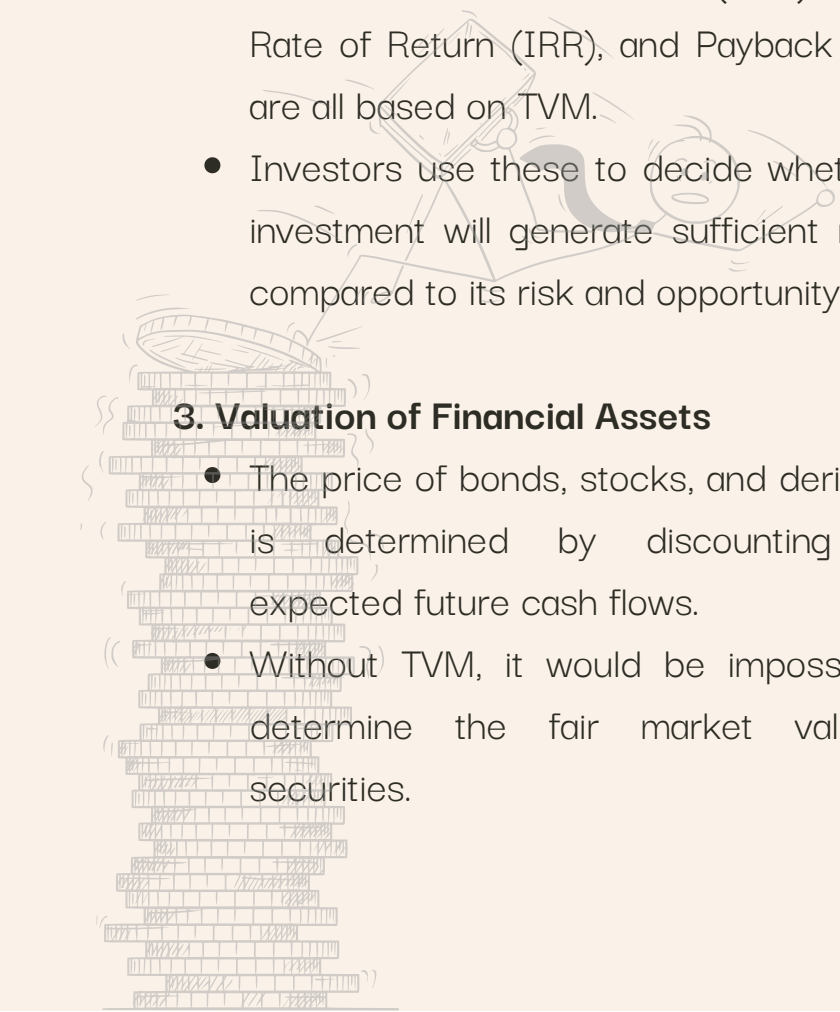
IMPORTANCE OF TIME VALUE OF MONEY

2. Investment Appraisal

- Tools like Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period are all based on TVM.
- Investors use these to decide whether an investment will generate sufficient returns compared to its risk and opportunity cost.

3. Valuation of Financial Assets

- The price of bonds, stocks, and derivatives is determined by discounting their expected future cash flows.
- Without TVM, it would be impossible to determine the fair market value of securities.



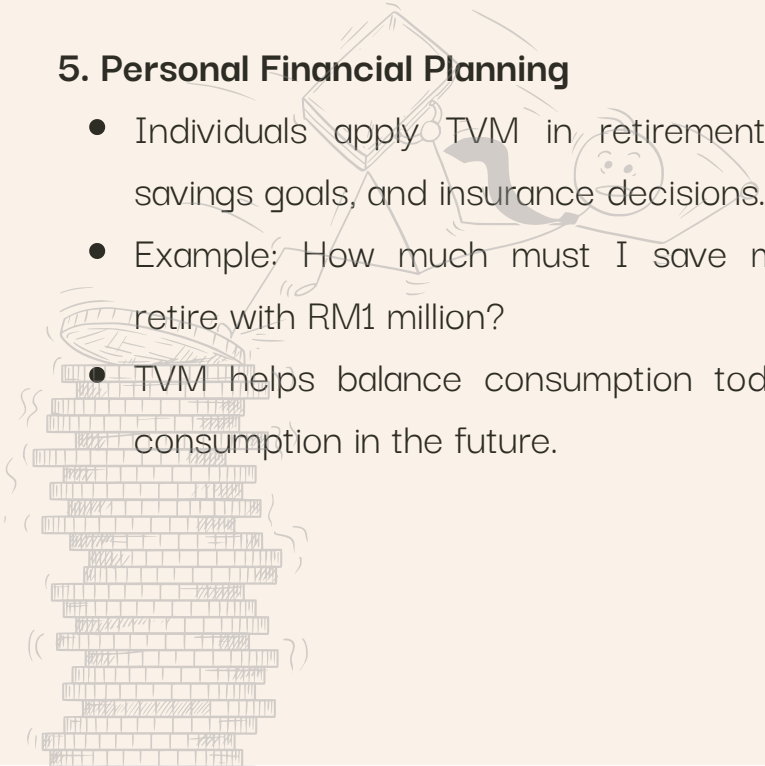
IMPORTANCE OF TIME VALUE OF MONEY

4. Loan and Credit Decisions

- Banks and financial institutions use TVM to structure loan repayments and calculate interest.
- Borrowers need TVM to compare financing options (e.g., lump sum repayment vs. installments).
- It ensures fairness between lenders and borrowers.

5. Personal Financial Planning

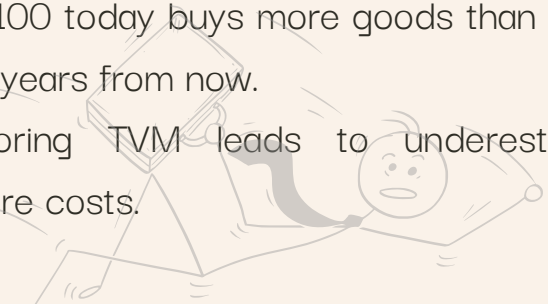
- Individuals apply TVM in retirement planning, savings goals, and insurance decisions.
- Example: How much must I save monthly to retire with RM1 million?
- TVM helps balance consumption today versus consumption in the future.



IMPORTANCE OF TIME VALUE OF MONEY

6. Inflation and Purchasing Power

- TVM accounts for the fact that inflation reduces the value of money over time.
- RM100 today buys more goods than RM100 ten years from now.
- Ignoring TVM leads to underestimating future costs.



7. Risk Assessment

- TVM incorporates uncertainty in future cash flows.
- Higher risk requires a higher discount rate, reducing the PV of uncertain projects.
- This principle ensures investors demand adequate compensation for risk.

PRESENT VALUE

02.

Introduction

SCAN HERE

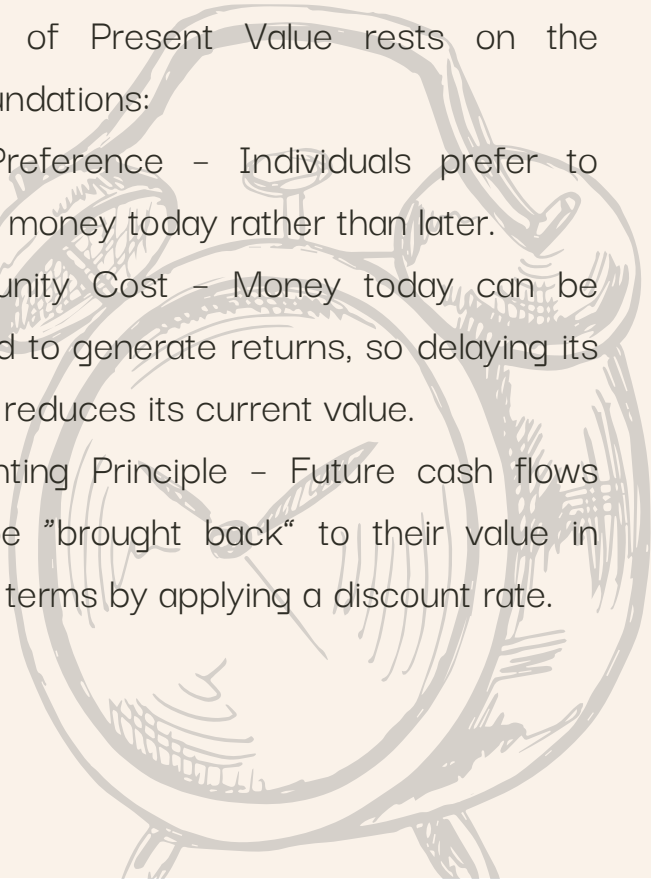
Present Value (PV) is a core concept within the theory of the Time Value of Money (TVM). It represents the current worth of a future sum of money or stream of cash flows, discounted at a specific interest rate. The concept recognizes that money available in the future is less valuable than the same amount today because of opportunity cost, inflation, and uncertainty.

APPLICATIONS OF PRESENT VALUE

In practice, PV provides a common basis for comparing cash flows that occur at different points in time. It is widely used in investment appraisal, loan analysis, and financial decision-making.

The theory of Present Value rests on the following foundations:

- Time Preference – Individuals prefer to receive money today rather than later.
- Opportunity Cost – Money today can be invested to generate returns, so delaying its receipt reduces its current value.
- Discounting Principle – Future cash flows must be "brought back" to their value in today's terms by applying a discount rate.



APPLICATIONS OF PRESENT VALUE

The Present Value concept is central to financial decision-making because it allows comparison of cash flows that occur at different times. By discounting future cash flows to their current worth, investors, managers, and policymakers can evaluate alternatives and make rational choices. The following are the key applications of PV in finance:

1. Investment Appraisal

In capital budgeting, companies must decide whether a project is worth undertaking. The Net Present Value (NPV) method discounts all expected future cash inflows and compares them with the initial investment. If the present value of inflows exceeds the outflows, the project is considered profitable.

- Example: A project requires an investment of RM100,000 and is expected to generate RM30,000 annually for 5 years. By discounting these inflows, managers can determine whether the project adds value to the firm.

2. Bond Valuation

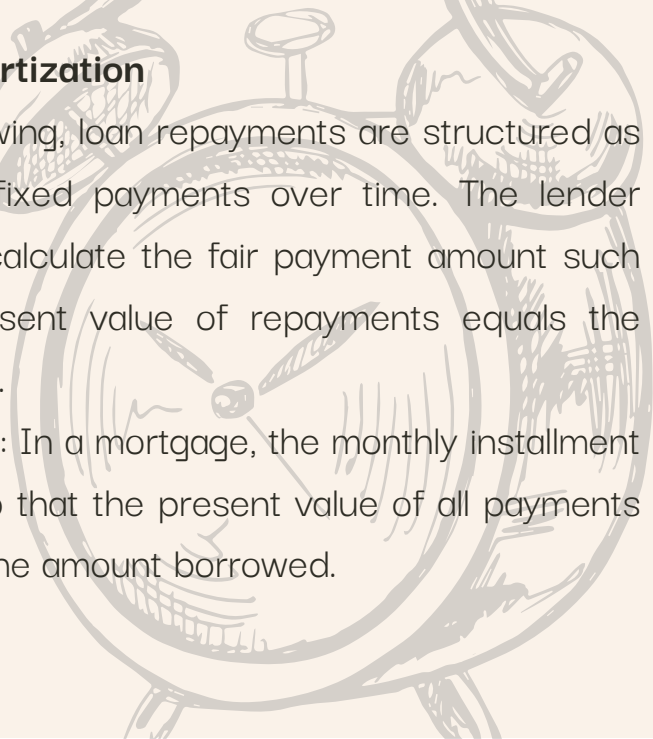
The value of a bond is the present value of all future coupon payments plus the face value (principal) at maturity. Investors use PV to determine how much they should pay today for a bond that generates fixed payments in the future.

- Example: A 10-year bond paying RM1,000 annually in coupons and RM10,000 at maturity will be priced by discounting all these future cash flows at the required rate of return.

3. Loan Amortization

When borrowing, loan repayments are structured as a series of fixed payments over time. The lender uses PV to calculate the fair payment amount such that the present value of repayments equals the loan principal.

- Example: In a mortgage, the monthly installment is set so that the present value of all payments equals the amount borrowed.



4. Retirement Planning

Individuals use PV to determine how much they must save today to achieve a desired retirement fund. By estimating future needs and discounting them back to the present, one can calculate the required savings contributions.

- Example: If a retiree wishes to withdraw RM50,000 annually for 20 years, PV helps determine the lump sum that must be set aside now to fund this stream of payments.

5. Business Valuation

Firms are often valued using the Discounted Cash Flow (DCF) method, which calculates the present value of all expected future cash flows generated by the company. This method provides a more accurate measure of intrinsic value than relying solely on accounting numbers.

- Example: A startup projecting cash flows of RM200,000, RM300,000, and RM400,000 over the next three years will be valued by discounting these inflows at an appropriate discount rate.

VALUATION FOR PV

The general formula for calculating the Present Value (PV) of a single future sum is:

$$PV = \frac{FV}{(1+r)^n}$$

Where:

- **PV = Present Value (the amount of money today)**
- **FV = Future Value (the amount of money in the future)**
- **r = Interest (or discount) rate per period**
- **n = Number of periods**

This formula expresses the principle of discounting: the value of money decreases as time passes if it is not invested. In other words, the higher the interest rate (r) or the longer the time horizon (n), the lower the present value of a future sum will be.

VALUATION FOR PV

Example 1: Simple Future Cash Flow

You expect to receive RM5,000 three years from now, and the discount rate is 6% per year.

$$PV = \frac{5,000}{(1+0.06)^3} = RM4,198.63$$

This means RM5,000 in 3 years is worth RM4,198.63 today.

Example 2: Bond Valuation (Single Payment)

A bond promises to pay RM1,000 face value after 10 years. The required rate of return is 5%.

$$PV = \frac{1,000}{(1+0.05)^{10}} = RM613.91$$

The bond's current fair value is RM613.91.

VALUATION OF PV

Example 3: Education Savings

A parent wants to set aside money now to pay RM50,000 tuition in 8 years. If the interest rate is 7%, how much must be deposited today?

$$PV = \frac{50,000}{(1+0.07)^8} = RM29,048.06$$

The parent needs to invest RM29,048.06 today.

PVIF Calculator

PRINCIPLES OF PV

The concept of Present Value (PV) is one of the most fundamental principles in finance. It is based on the idea that a sum of money received today is more valuable than the same sum received in the future. This is due to the time value of money (TVM) – money today can be invested to earn interest, generate returns, or be used to consume immediately.

Key Principles of Present Value

Discounting Future Cash Flows

- The process of finding PV is called discounting.
- Discounting is the reverse of compounding: while compounding grows present money into a future sum, discounting reduces future money to its present equivalent.

Effect of Time

- The longer the waiting period for the cash flow, the smaller the present value.
- For example, RM1,000 to be received in 10 years is worth much less than RM1,000 to be received tomorrow.

Key Principles of Present Value

Effect of Interest (Discount) Rate

- A higher discount rate decreases the present value.
- This reflects risk and opportunity cost: if better investment opportunities exist, the value of waiting for a future cash flow decreases.

Risk and Uncertainty

- PV also incorporates risk, since uncertain future cash flows must be adjusted with a higher discount rate.
- Investors demand compensation for waiting and for bearing uncertainty.

FUTURE VALUE

03.

Definition

SCAN HERE

Future Value (FV) is the amount to which a present sum of money will grow after a certain period of time, when invested at a specific interest rate. It represents the compounded value of today's money in the future.

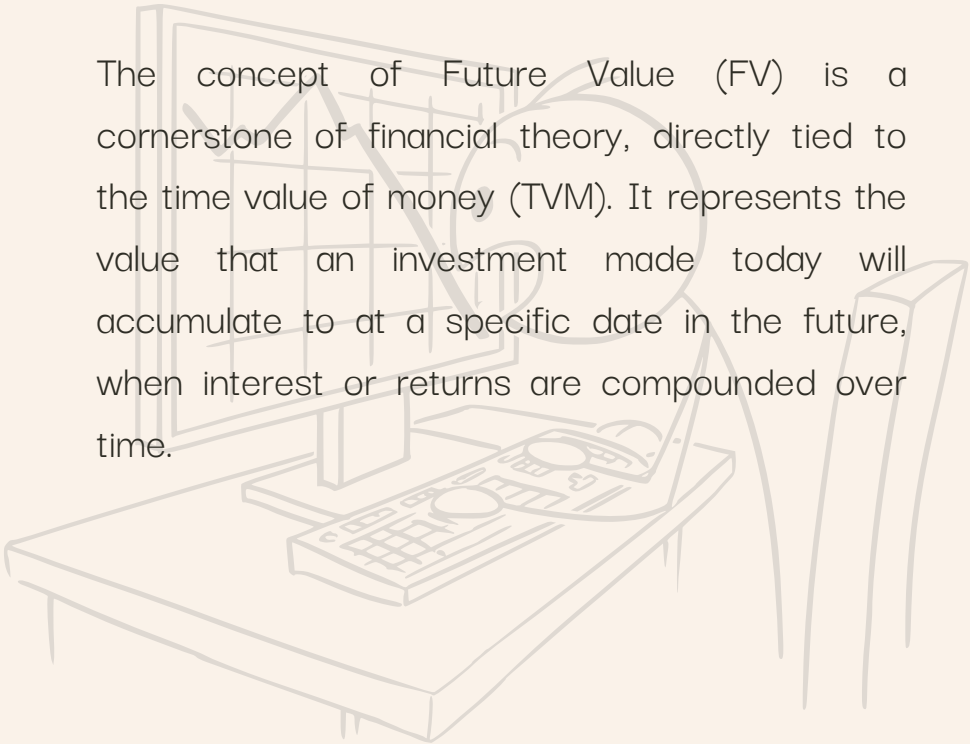
In other words, FV answers the question:

If I invest a certain amount today, how much will it be worth in the future?

CONCEPT OF FUTURE VALUE

Future Value emphasizes the growth potential of money through compounding. It highlights the importance of time, interest rate, and reinvestment in building wealth and is an essential tool in investment analysis, savings, and financial decision-making.

The concept of Future Value (FV) is a cornerstone of financial theory, directly tied to the time value of money (TVM). It represents the value that an investment made today will accumulate to at a specific date in the future, when interest or returns are compounded over time.



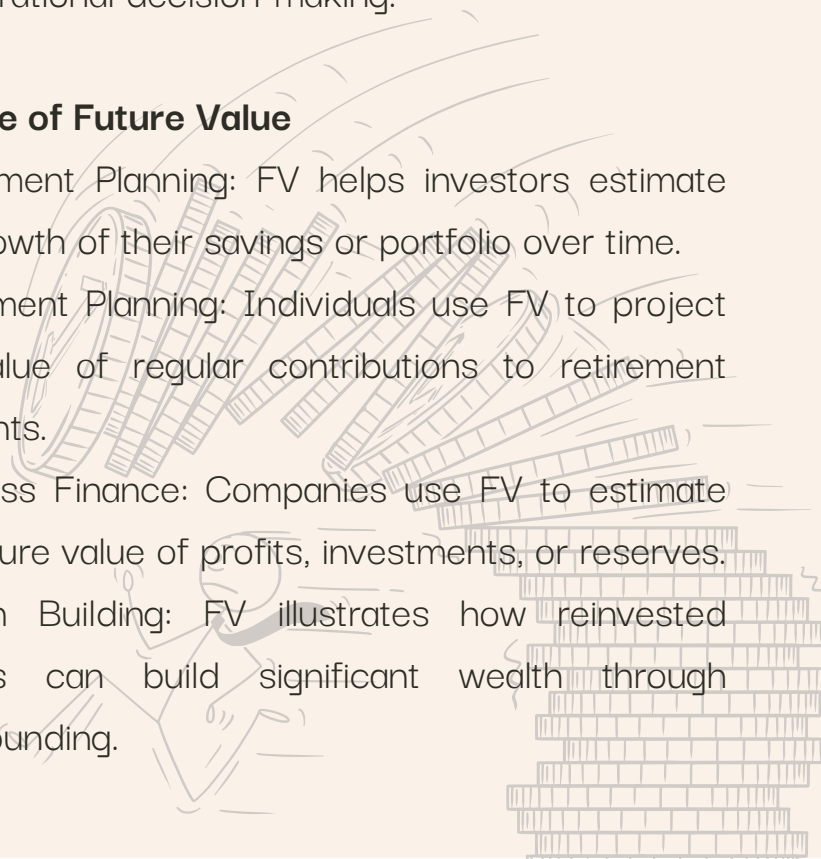
Conceptual Foundation

Future Value represents the principle that money has earning potential over time. By investing or depositing funds today, those funds will grow due to interest, dividends, or reinvested profits. Thus, FV captures the forward-looking growth of wealth.

The FV concept is crucial in finance because it allows individuals, businesses, and governments to estimate how much current resources will be worth in the future, supporting rational decision-making.

Importance of Future Value

- Investment Planning: FV helps investors estimate the growth of their savings or portfolio over time.
- Retirement Planning: Individuals use FV to project the value of regular contributions to retirement accounts.
- Business Finance: Companies use FV to estimate the future value of profits, investments, or reserves.
- Wealth Building: FV illustrates how reinvested returns can build significant wealth through compounding.

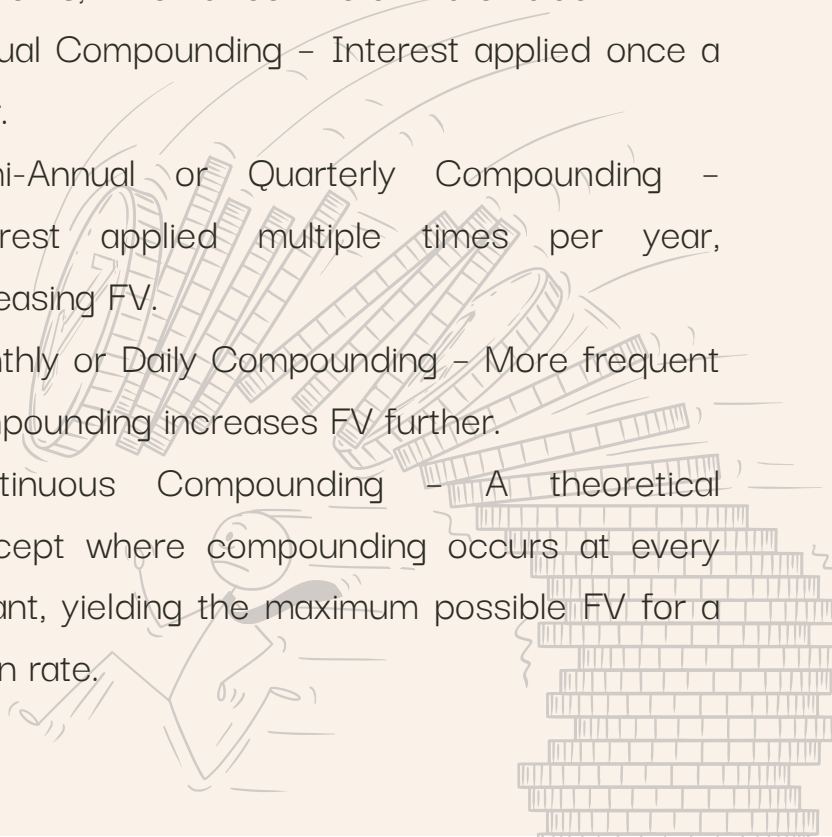


Types of Compounding

Future Value is determined through compounding, which means earning "interest on interest." Unlike simple interest, where only the principal earns returns, compound interest allows both the principal and accumulated interest to generate future earnings. The longer the compounding period, the more dramatic the growth effect.

FV can be calculated under different compounding arrangements, which affect the ultimate value:

- Annual Compounding – Interest applied once a year.
- Semi-Annual or Quarterly Compounding – Interest applied multiple times per year, increasing FV.
- Monthly or Daily Compounding – More frequent compounding increases FV further.
- Continuous Compounding – A theoretical concept where compounding occurs at every instant, yielding the maximum possible FV for a given rate.



FUTURE VALUE GROWTH

Time Horizon (n)

Longer investment horizons allow more compounding cycles. Wealth accumulation is exponential rather than linear, meaning that the "early start" effect is powerful.

Interest Rate (r)

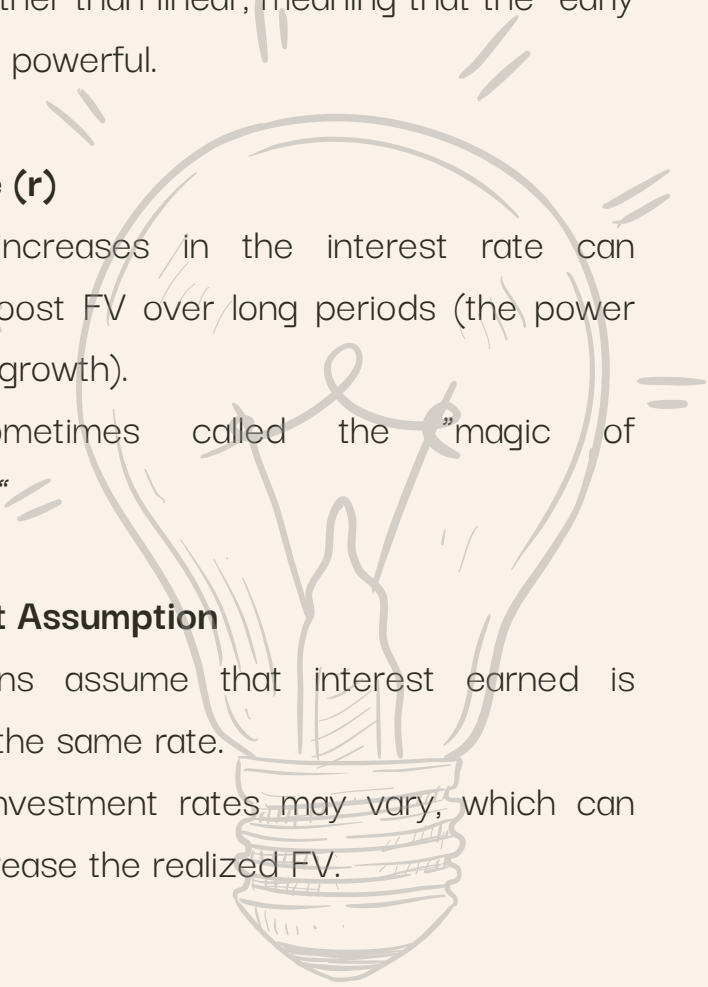
Even small increases in the interest rate can significantly boost FV over long periods (the power of compound growth).

This is sometimes called the "magic of compounding."

Reinvestment Assumption

FV calculations assume that interest earned is reinvested at the same rate.

In reality, reinvestment rates may vary, which can reduce or increase the realized FV.



VALUATIONS OF FUTURE VALUE

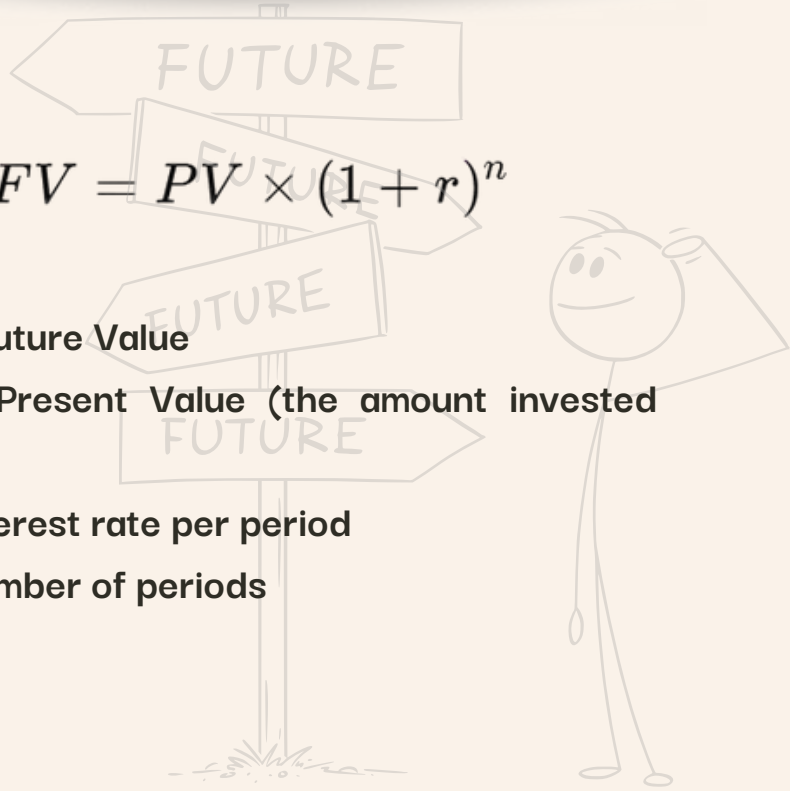
The Future Value of a Single Sum refers to the amount of money that a present lump sum (one-time investment or deposit) will accumulate to in the future, given a specific interest rate and time period. It illustrates the principle of compounding – earning interest not only on the original principal but also on accumulated interest.

FORMULA:

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

Where:

- **FV = Future Value**
- **PV = Present Value (the amount invested today)**
- **r = Interest rate per period**
- **n = Number of periods**



Example 1: Basic Investment

If RM2,000 is invested at 5% annually for 3 years:

$$FV = 2,000 \times (1 + 0.05)^3 = RM2,315.25$$

The investment grows to RM2,315.25 after 3 years.

Example 2: Effect of Time

RM10,000 is invested at 7%:

- After 5 years:

$$FV = 10,000 \times (1.07)^5 = RM14,025.52$$

- After 10 years:

$$FV = 10,000 \times (1.07)^{10} = RM19,671.51$$

The same investment grows faster the longer it is left to compound.

FVIF Calculator

SCAN ME!

ANNUITY

04.

Definition

SCAN HERE

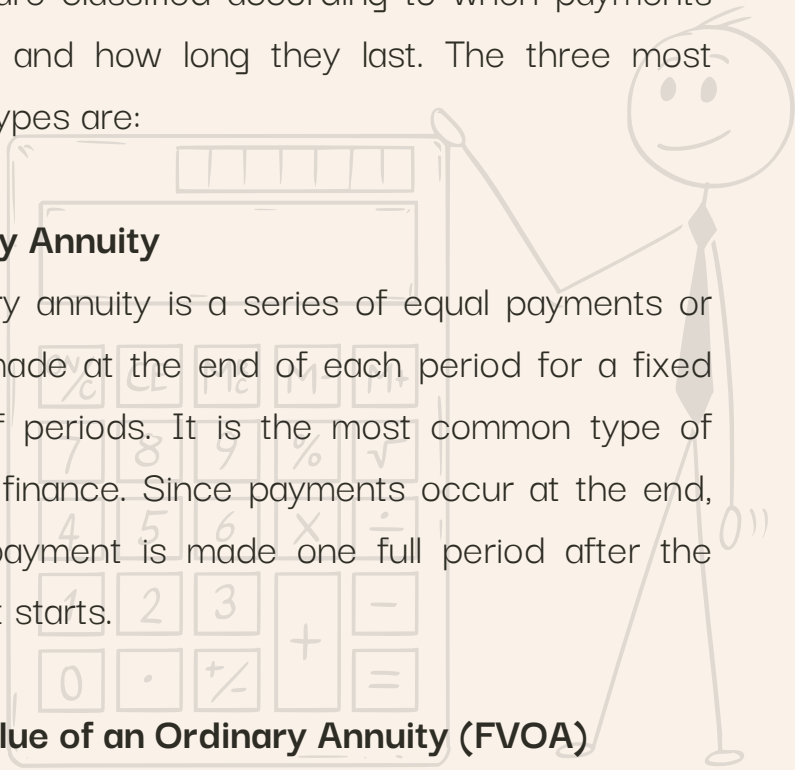
An annuity is a series of equal payments or receipts made at regular intervals over a specified period of time. Payments can be weekly, monthly, quarterly, or annually. Common in loans, mortgages, insurance policies, pensions, and retirement savings.

In simple terms:

An annuity is like a stream of cash flows spread evenly over time.

TYPES OF ANNUITY

Annuities are classified according to when payments are made and how long they last. The three most common types are:



1. Ordinary Annuity

An ordinary annuity is a series of equal payments or receipts made at the end of each period for a fixed number of periods. It is the most common type of annuity in finance. Since payments occur at the end, the first payment is made one full period after the agreement starts.

Future Value of an Ordinary Annuity (FVOA)

$$FV = PMT \times \frac{(1+r)^n - 1}{r}$$

Present Value of an Ordinary Annuity (PVOA)

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

Where:

- **PMT = Payment per period**
- **r = Interest (discount) rate per period**
- **n = Number of periods**

Examples

Example 1: Future Value of an Ordinary Annuity

You deposit RM1,000 at the end of each year into a savings account earning 6% annually for 5 years.

$$FV = 1,000 \times \frac{(1.06)^5 - 1}{0.06} = RM5,637.09$$

At the end of 5 years, the savings accumulate to RM5,637.09.

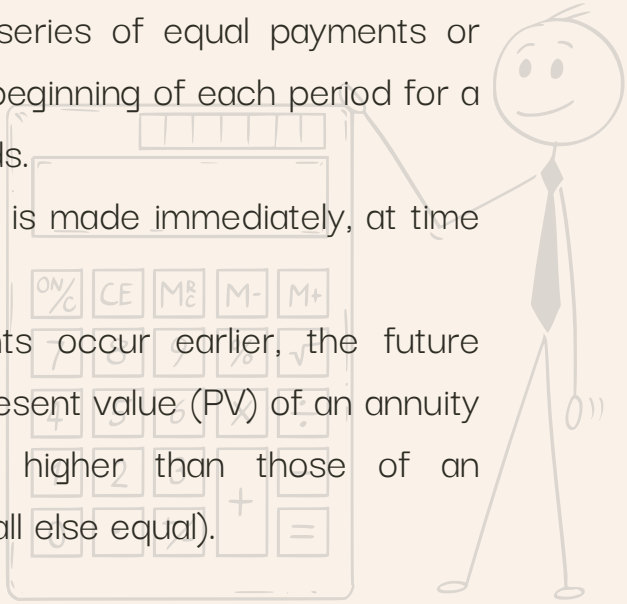
Example 2: Present Value of an Ordinary Annuity

You will receive RM2,000 at the end of each year for 4 years. If the discount rate is 10%:

$$PV = 2,000 \times \frac{1 - (1.10)^{-4}}{0.10} = RM6,355.26$$

The value of this annuity today is RM6,355.26.

2. Annuity Due



An annuity due is a series of equal payments or receipts made at the beginning of each period for a fixed number of periods.

- The first payment is made immediately, at time t= 0.
- Because payments occur earlier, the future value (FV) and present value (PV) of an annuity due are always higher than those of an ordinary annuity (all else equal).

Future Value of an Annuity Due (FVAD)

$$FV_{AD} = PMT \times \frac{(1+r)^n - 1}{r} \times (1+r)$$

Present Value of an Annuity Due (PVAD)

$$PV_{AD} = PMT \times \frac{1-(1+r)^{-n}}{r} \times (1+r)$$

Where:

- **PMT = Payment per period**
- **r = Interest (discount) rate per period**
- **n = Number of periods**

Examples

Example 1: Future Value of an Annuity Due

You deposit RM1,000 at the beginning of each year into a savings account earning 6% annually for 5 years.

$$FV = 1,000 \times \frac{(1.06)^5 - 1}{0.06} \times 1.06 = RM5,974.32$$

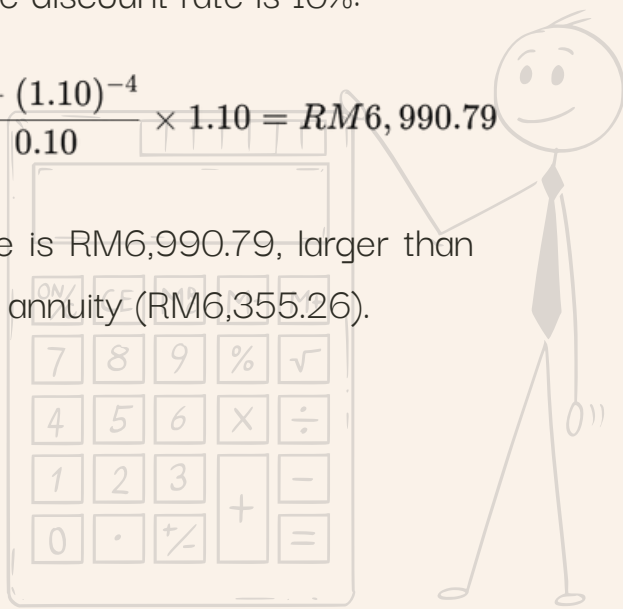
After 5 years, your savings grow to RM5,974.32, which is higher than the ordinary annuity case (RM5,637.09).

Example 2: Present Value of an Annuity Due

You will receive RM2,000 at the beginning of each year for 4 years. If the discount rate is 10%:

$$PV = 2,000 \times \frac{1 - (1.10)^{-4}}{0.10} \times 1.10 = RM6,990.79$$

The present value is RM6,990.79, larger than the PV of an ordinary annuity (RM6,355.26).



AMORTIZATION

05.

Definition

SCAN HERE

Amortization is the process of gradually paying off a loan (or debt) over time through regular, fixed payments that cover both:

- Interest on the outstanding balance
- Principal repayment

Each payment is the same, but the interest portion decreases over time, while the principal portion increases, until the loan is fully repaid.

AMORTIZATION

Amortization is essentially an application of annuities within the Time Value of Money:

- A loan is like receiving a present value (PV) today.
- Repayment is structured as a series of equal periodic payments (PMT) in the future.
- The relationship between PV, PMT, interest rate (r), and number of periods (n) is governed by the annuity formula.

Formula Derivation from TVM

The present value of an ordinary annuity is:

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

- **PV = Loan amount (the cash received today)**
- **PMT = Equal loan repayment each period**
- **r = Periodic interest rate**
- **n = Number of payments**

CONCLUSION

The Time Value of Money (TVM) is a fundamental concept in finance, recognizing that the value of money changes over time due to its earning potential. A ringgit today is worth more than a ringgit tomorrow because it can be invested to earn interest.

Through the study of Present Value (PV) and Future Value (FV), we understand how to compare cash flows across time. PV allows us to determine the value today of future cash inflows or outflows, while FV shows us the accumulated worth of current investments or payments.

The concept extends to annuities, where payments are made periodically over time. Ordinary annuities (payments at the end of each period) and annuities due (payments at the beginning of each period) help model real-life financial scenarios such as loan repayments, insurance premiums, and retirement savings. Perpetuities further illustrate cash flows that continue indefinitely.

Finally, amortization applies TVM principles in practice by structuring loan repayments into equal installments. These payments are an application of annuities, where each installment covers both interest (time value of money) and principal (loan balance).

Time Value Of Money

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