ENGINEERING ECONOMY

Dr. Ayman Youssef

MONEY-TIME[1] RELATIONSHIPS AND EQUIVALENCE

MONEY-TIME RELATIONSHIPS
مفاهيم المال - زمن

واسطة للتبادل

مصطلح للدفع من أجل المنتجات والخدمات بين البائع والشاري

خزان للقيمة وطريقة لنقل قوة الشراء من فترة زمنية إلى أخرى

وحدة محاسبة

مقياس دقيق للثروة و للقيمة ويسمح بجدولة القروض الديون

MONEY

Medium of Exchange --

    Means of payment for goods or services;

    What sellers accept and buyers pay ;

Store of Value --

    A way to transport buying power from one time period to another;

Unit of Account --

    A precise measurement of value or worth;

    Allows for tabulating debits and credits;

رأس المال

الثروة على شكل نقود أو ممتلكات يمكن تسخيرها لإنتاج المزيد من الثروة

CAPITAL

Wealth in the form of money or property that can be used to produce more wealth.

●أنواع رأس المال ●

رأس مال الأسهم : هو ذاك الذي يمتلكه أفراد استثمروا أموالهم أو ممتلكاتهم في مشروع على أمل جني أرباح ●

رأس المال المقترض : او ما يطلق عليه رأس المال المقترض ،
يتم الحصول عليه غالباً من خلال بيع السندات (لاستثمار المقرضين)

KINDS OF CAPITAL

Equity capital is that owned by individuals who have

invested their money or property in a business project or

venture in the hope of receiving a profit.

Debt capital, often called borrowed capital, is obtained from lenders

(e.g., through the sale of bonds) for investment.

Financing	Definition	Instrument	Description
• Debt financing	• Borrow money	• Bond	• Promise to pay principle & interest;
• Equity financing	• Sell partial ownership of company;	• Stock	• Exchange shares of stock for ownership of company;

INTEREST

The fee that a borrower pays to a lender for the use of his or her money.

INTEREST RATE

The percentage of money being borrowed that is paid to the lender on some time basis.
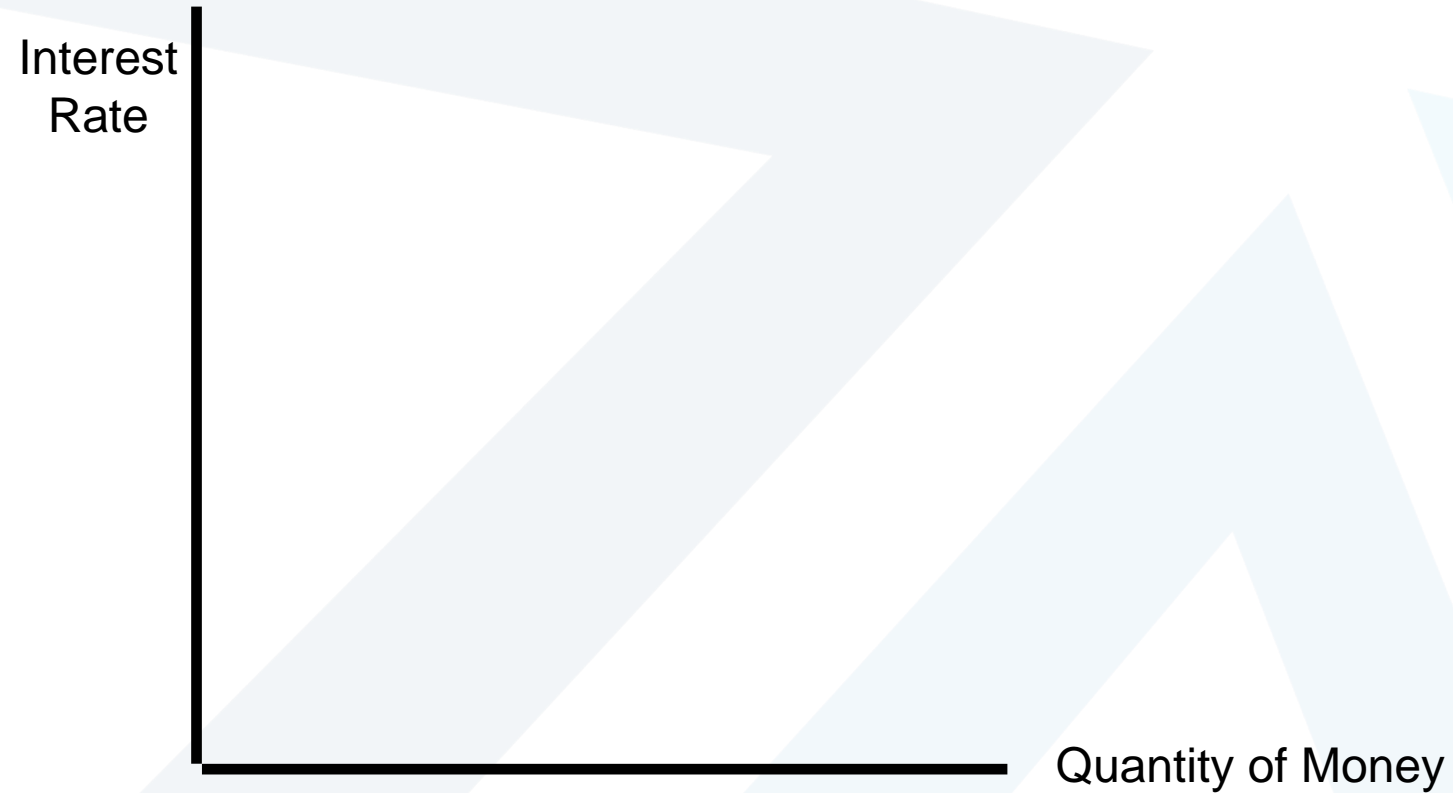
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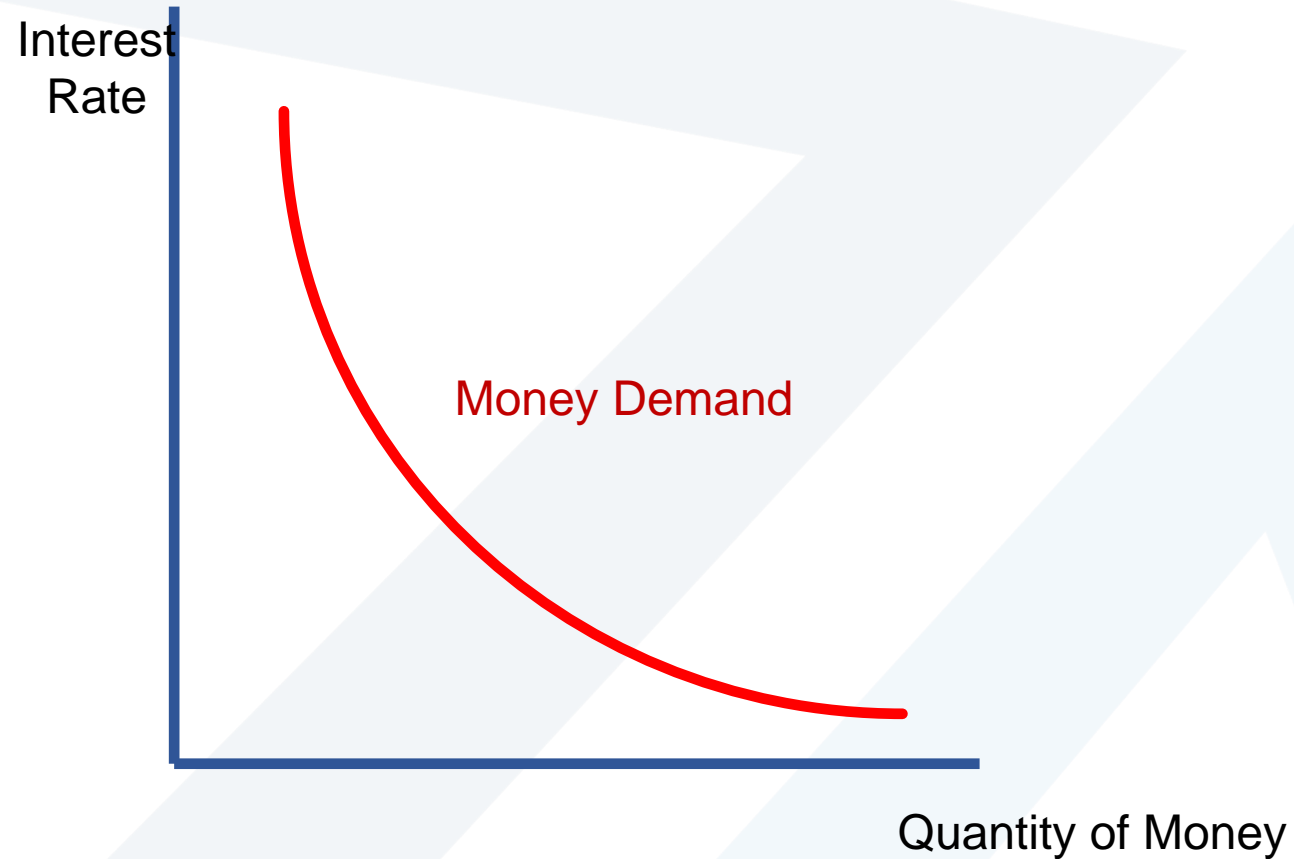الفائدة

الرسوم التي يدفعها المقترض للمقرض مقابل استخدام ماله

معدل الفائدة

معدل الفائدة النسبة المئوية من المال المقترض التي تدفع للمانح في فترة زمنية أساسية

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HOW INTEREST RATE IS DETERMINED

Interest
Rate

Quantity of Money

HOW INTEREST RATE IS DETERMINED

Interest
Rate

Money Demand

Quantity of Money

HOW INTEREST RATE IS DETERMINED

Interest
Rate

MS$_1$

Money Supply
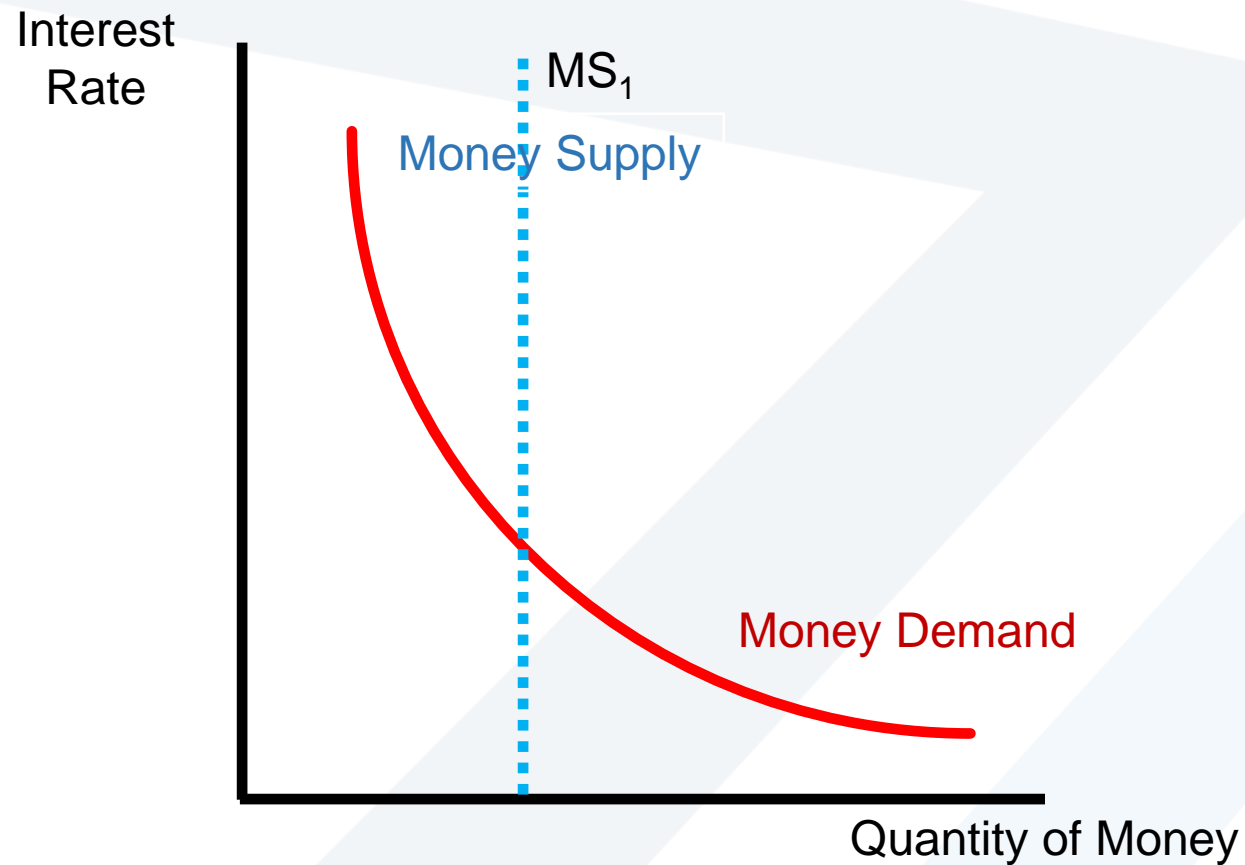
Money Demand

Quantity of Money

HOW INTEREST RATE IS DETERMINED

HOW INTEREST RATE IS DETERMINED

HOW INTEREST RATE IS DETERMINED

Money Supply

Interest Rate

MS$_3$ MS$_1$ MS$_2$

i$_3$

i$_e$

i$_2$

Money Demand

Quantity of Money
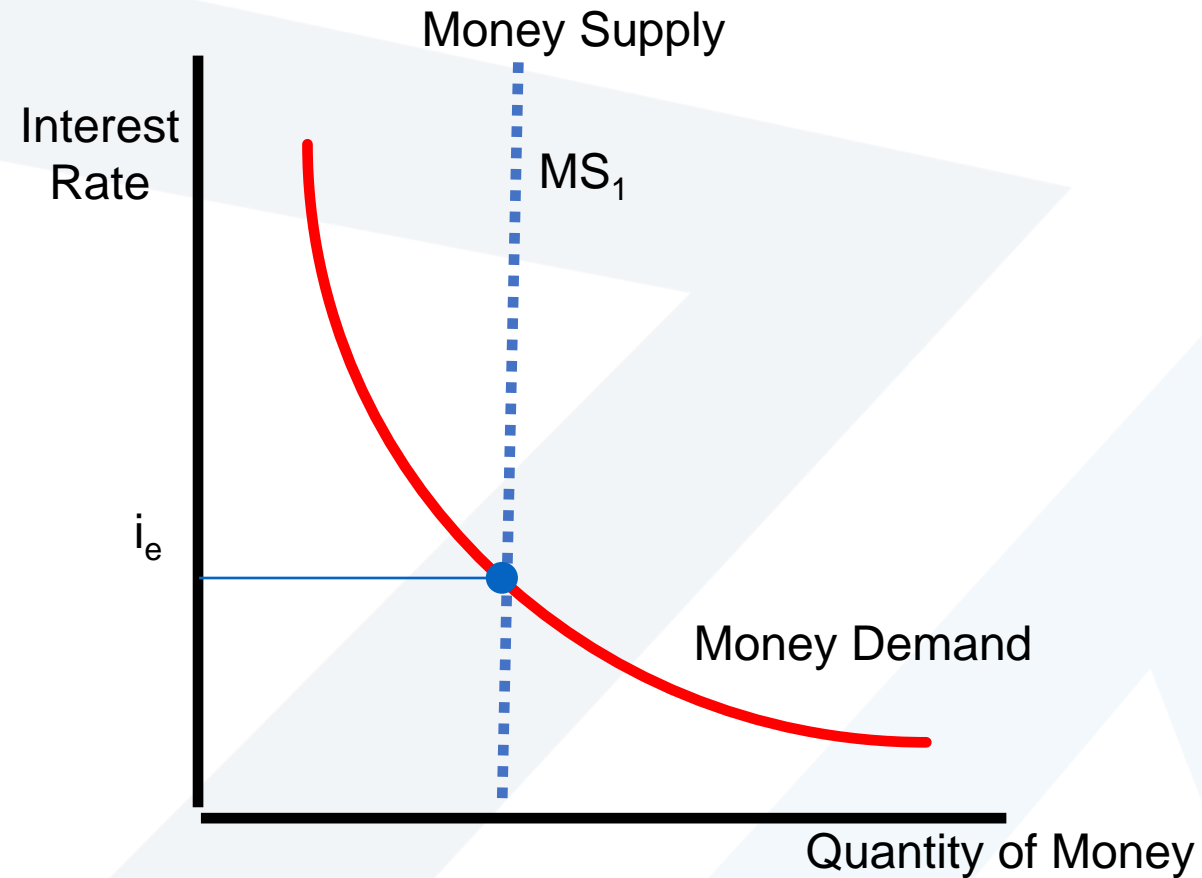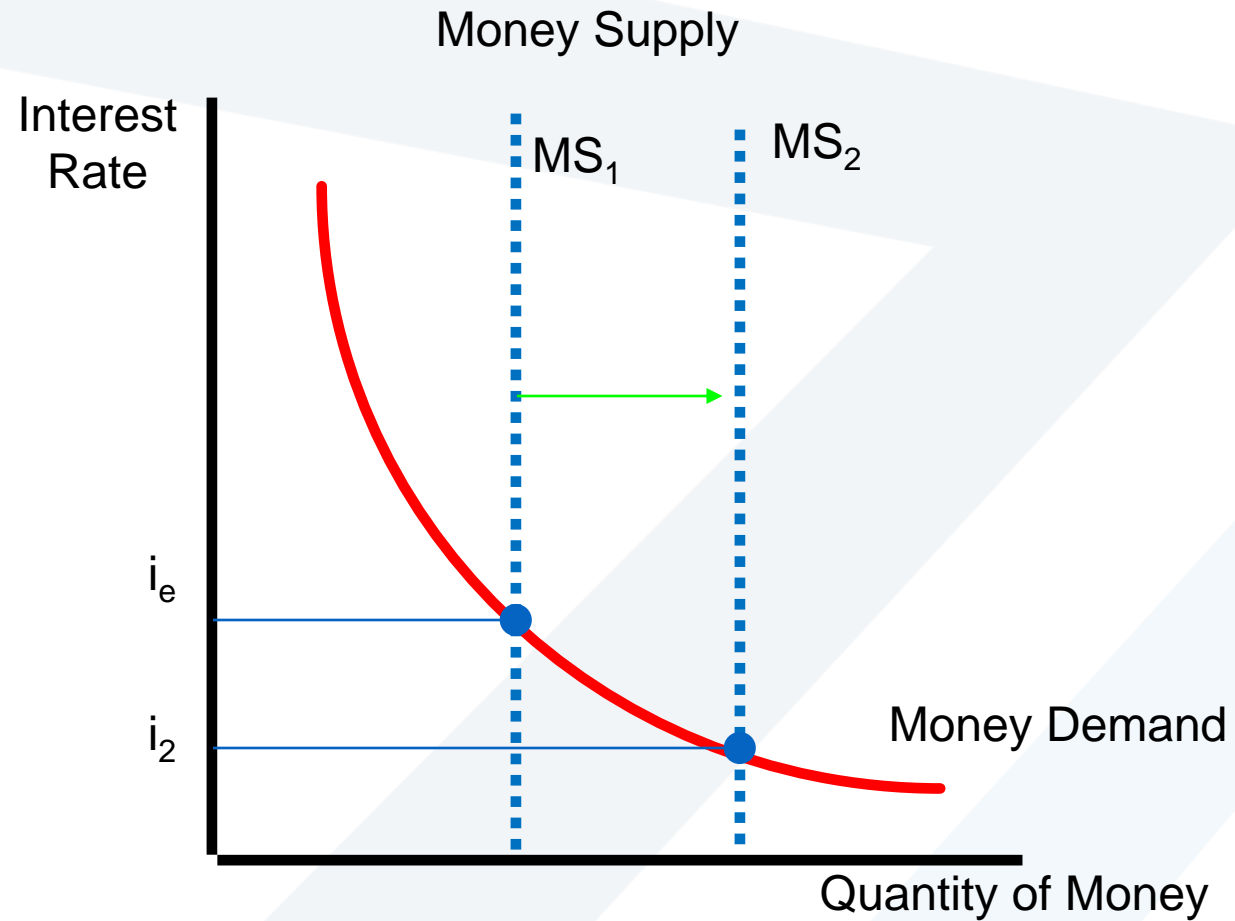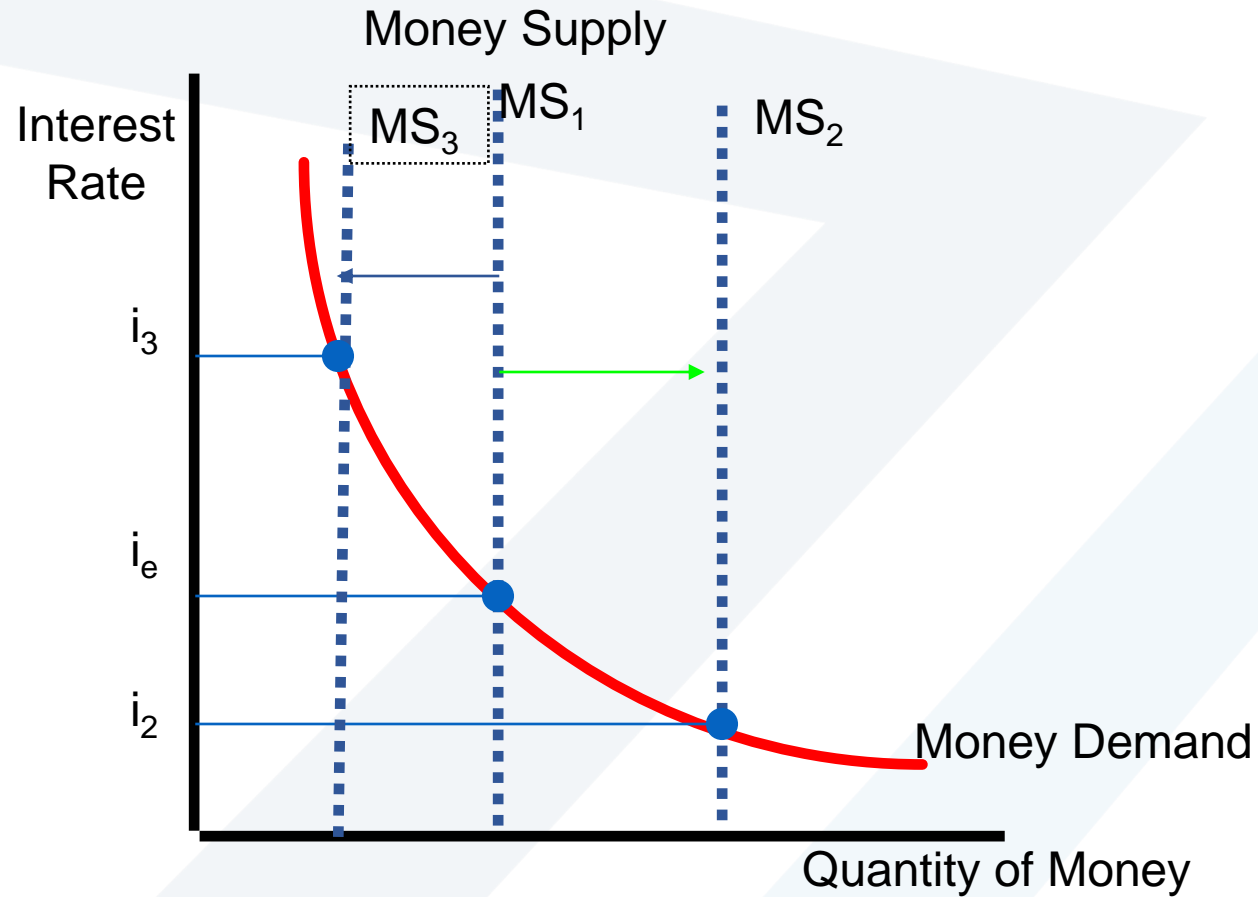
SIMPLE INTEREST

The total interest earned or charged is linearly proportional to the initial amount of the loan (principal), the interest rate and the number of interest periods for which the principal is committed.

When applied, total interest "I" may be found by

$I = (P) (N) (i)$, where

P = principal amount lent or borrowed

N = number of interest periods (e.g., years)

i = interest rate per interest period

COMPOUND INTEREST

Whenever the interest charge for any interest period is based on the remaining principal amount plus any accumulated interest charges up to the *beginning* of that period.

Period	Amount Owed Beginning of period	Interest Amount for Period (@ 10%)	Amount Owed at end of period
1	$1,000	$100	$1,100
2	$1,100	$110	$1,210
3	$1,210	$121	$1,331

ECONOMIC EQUIVALENCE

Established when we are <u>indifferent</u> between a future payment, or a series of future payments, and a present sum of money .

Considers the comparison of alternative options, or proposals, by reducing them to an equivalent basis, depending on:

- **interest rate;**
- **amounts of money involved;**
- **timing of the affected monetary receipts and/or expenditures;**
- **manner in which the interest , or profit on invested capital is paid and the initial capital is recovered.**

ECONOMIC EQUIVALENCE FOR FOUR REPAYMENT PLANS OF AN $8,000 LOAN

Plan #2:
$0 of loan principal paid until end of fourth year; $800 interest paid at the end of each year

Year	Amount Owed	Interest Accrued	Total Money	Principal Payment	Total end of Year
1	8000	800	8800	0	800
2	8000	800	8800	0	800
3	8000	800	8800	0	800
4	8000	800	8800	8000	8800

Total interest paid ($3,200) is 10% of total

ECONOMIC EQUIVALENCE FOR FOUR REPAYMENT PLANS OF AN $8,000 LOAN

Plan #3: $2,524 paid at the end of each year; interest paid at the end of each year is 10% of amount owed at the beginning of the year.

Year	Amount Owed at beginning of year	Interest Accrued for year	Total Money owed at end of year	Principal payment	Total end of year payment
1	8000	800	8800	1724	2524
2	6276	628	6904	1896	2524
3	4380	438	4818	2086	2524
4	2294	230	2524	2294	2524

Total interest paid ($2,096) is 10

CASH FLOW DIAGRAMS / TABLE NOTATION

- i = effective interest rate per interest period

- N = number of compounding periods (e.g., years)

- P = present sum of money; the equivalent value of one or more cash flows at the present time reference point

- F = future sum of money; the equivalent value of one or more cash flows at a future time reference point

- A = end-of-period cash flows (or equivalent end-of-period values) in a uniform series continuing for a specified number of periods, starting at the end of the first period and continuing through the last period

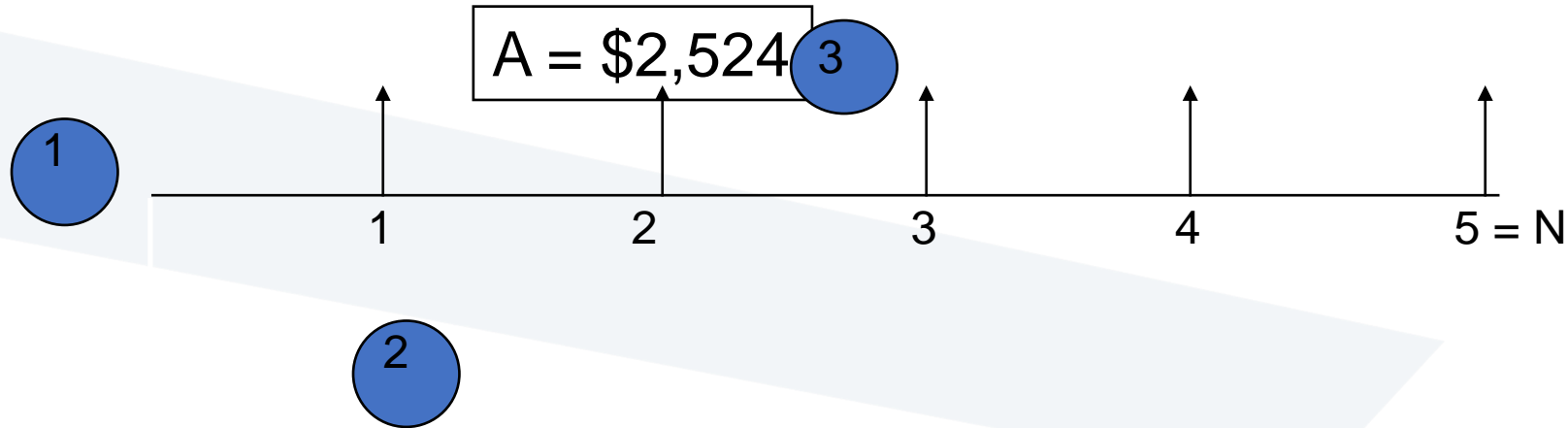- G = uniform gradient amounts -- used if cash flows increase by a constant amount in each period

1   2   3   4   5 = N

1   Time scale with progression of time moving from left to right; the numbers represent time periods (e.g., years, months, quarters, etc...) and may be presented within a time interval or at the end of a time interval.

FLOW DIAGRAM NOTATION

A = $2,524 **3**

1

```
          1         2         3         4        5 = N
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2

1 Time scale with progression of time moving from left to right; the numbers represent time periods (e.g., years, months, quarters, etc...) and may be presented within a time interval or at the end of a time interval.
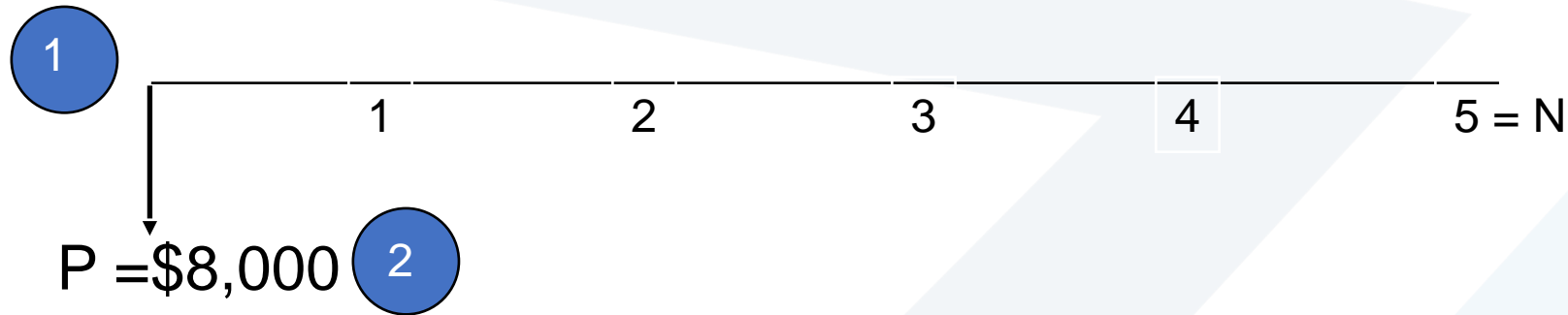
2 Present expense (cash outflow) of $8,000 for lender.

3   Annual income (cash inflow) of $2,524 for lender.

CASH FLOW DIAGRAM NOTATION

1

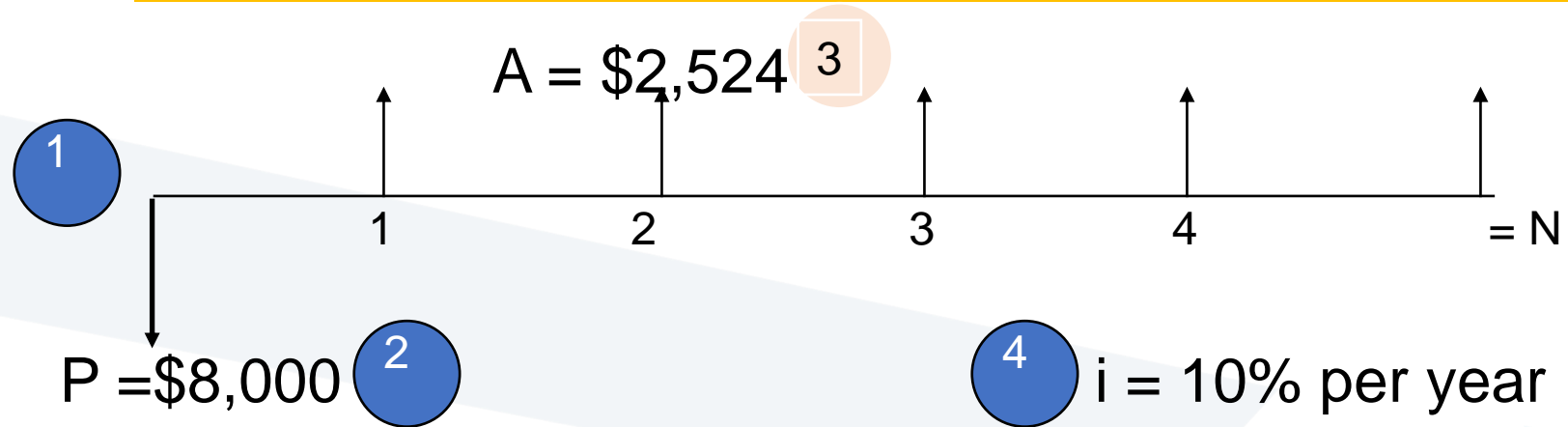|	1	2	3	4	5 = N

P =$8,000 **2**

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CASH FLOW DIAGRAM NOTATION

A = $2,524 **3**

1

$$1 \quad 2 \quad 3 \quad 4 \quad = N$$

P = $8,000 **2**

4 i = 10% per year

1 Time scale with progression of time moving from left to right; the numbers represent time periods (e.g., years, months, quarters, etc...) and may be presented within a time interval or at the end of a time interval.
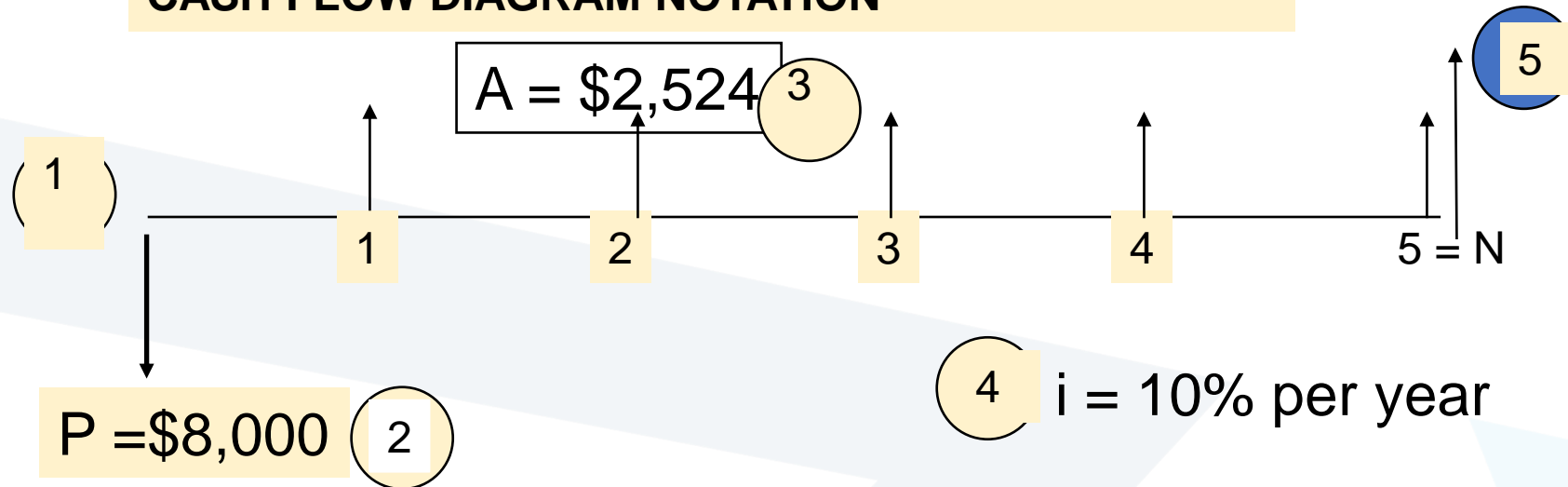
2 Present expense (cash outflow) of $8,000 for lender.

3 Annual income (cash inflow) of $2,524 for lender.

4 Interest rate of loan.

CASH FLOW DIAGRAM NOTATION

A = $2,524 ③

⑤

① ──────────────────────────────────

1   2   3   4   5 = N

P = $8,000 ②

④ i = 10% per year

① Time scale with progression of time moving from left to right; the numbers represent time periods (e.g., years, months, quarters, etc...) and may be presented within a time interval or at the end of a time interval.

② Present expense (cash outflow) of $8,000 for lender.

③ Annual income (cash inflow) of $2,524 for lender.

④ Interest rate of loan.

⑤ Dashed-arrow line indicate