

FINANCIAL MATHS

Present Value is the value on a given date of a payment or series of payments made in the future. They are discounted to reflect the **time value of money** and other **factors** such as **investment risk**.



For example, €100 invested for one year, earning 5% interest, will be worth €105 after one year; therefore, €100 paid now *and* €105 paid exactly one year later *both* have the same value to a recipient who expects 5% interest. This notion dates back at least to **Martín de Azpilcueta** (1491–1586) of the **School of Salamanca**.



Formula:
$$P = \frac{F}{(1+i)^t}$$

Where

F = Final Value (amount borrowed/invested + interest)

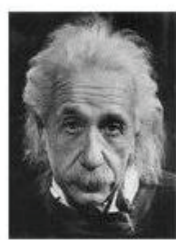
P = Present Value (amount borrowed/invested)

i = Interest Rate per annum (written in decimal form)

t = Time (in years)

APR: The annual percentage rate is the annual interest rate (expressed as a percentage to at least one decimal place) that makes the present value of all future payments equal to the present value of the loan.

"The most powerful force in the universe is compound interest."
Albert Einstein



Compound Interest Formula

$$F = P(1 + i)^t$$

Year	Loan at Start	Interest	Loan at End
0 (Now)	€1,000.00	€1,000.00 × 10% = €100.00	€1,100.00
1	€1,100.00	€1,100.00 × 10% = €110.00	€1,210.00
2	€1,210.00	€1,210.00 × 10% = €121.00	€1,331.00
3	€1,331.00	€1,331.00 × 10% = €133.10	€1,464.10
4	€1,464.10	€1,464.10 × 10% = €146.41	€1,610.51
5	€1,610.51		

AER, EAR, CAR

In the case of investments, the rate of interest that is used to calculate the amount to be paid to the investor is called the **annual equivalent rate (AER)**. This is, the same as the **equivalent annual rate (EAR)** and **Compound Annual Rate (CAR)**.

An **annuity** is a regular stream of fixed payments over a specified period of time, taking into account the time value of money.

Pension funds involve making contributions **to an annuity** before retirement and receiving payments **from an annuity** after retirement

A **bond** is a cash payment made to the government or to a private company for an agreed number of years. In return, the investor is paid a fixed sum at the end of each year; in addition the government or company repays the original value of the bond to the investor with the final payment.



Depreciation is calculated in order to write off the value of an asset over its useful economic life.

$$F = P(1 - i)^t$$

Reducing-balance method: Rather than charging a fixed amount every year, a (fixed) percentage of the remaining value of the asset is charged every year.

Amortisation is the process of accounting for a sum of money by making it equivalent to a series of payments over time. An amortised loan is a loan that involves paying back a fixed amount at regular intervals over a fixed period of time, e.g. term loans and mortgages.

$$A = P \frac{i(1+i)^t}{(1+i)^t - 1}$$

A = Annual Payment Amount;

P = Principal;

i = Interest Rate (as decimal);

t = Time (in years)



Irish Mathematics Teachers' Association

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