***Compound interest - capitalization - creation***

We previously explained in the first axis the difference between simple interest and compound interest, so that we knew simple interest to be calculated and not added to the original amount (capital), but rather paid to the beneficiary at the end of the employment period (wholesale), and no other interest is calculated on the interest. The compound interest is calculated for each period of time, and added to the capital in order to calculate the total interest for the following year according to the interest rate prescribed for that, in other words, the compound interest for a certain period of time is calculated on the basis of the original amount plus the interest accrued from the previous periods.

- The concept of compound interest: Through the aforementioned, compound interest is based on the capitalization of interests, and this means that at the end of each unit of time we calculate its interest, and add it to the amount at the beginning of the period to form a new amount, which is the basis for calculating interest for the next period.

 Example: At the beginning of the year, an amount of 1,000 DZD was borrowed from a bank, at an interest rate of 10%.

Interest accruing from this amount at the end of the year:

i=1000×t=1000×0.1=100 DZD

At the beginning of the second year, the new amount is equal to the original amount plus the interest of the first year

 That is 1000 + 100 = 1100 DZD

At the beginning of the year, the new amount is equal to the original amount plus the first year's interest

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This amount is the basis for calculating the interest for the second year, as:

i=1100×t=1100×0,1=110 DZD

 At the beginning of the third year, the amount becomes equal to the amount employed at the beginning of the second year, plus the interest for that year:

That is: 1100 + 110 = 1210 DZD

- The law of compound interest: Before deducing the law of compound interest, reference must be made to the most important elements and determinants of compound interest, where the value of compound interest is determined by the same determinants of simple interest, which are:

C: the original amount, which is the principal of the debt and the amount employed, t: the interest rate, which is a percentage covered mostly on an annual basis, n: the number of time periods at the end of which the principal repays its interest.

Through the above explanations, we can deduce the law of compound interest, starting from calculating the interest for the first year, and the years that follow, up to year n, and the following table summarizes that:

The value collected (the total earned at the end of each year) the interest at the end of each year the capital at the beginning of each year the year

= C(1+t) C+i=c+c×t c×t C 1

= C(1+t)2 C(1+t)+C (1+t)×t C(1+t)×t C(1+t) 2

= C(1+t)3 C(1+t)2+C(1+t)2×t C(1+t)2×t C(1+t)2 3

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c(1+t)n-1 c (1+t)n-2+c(1+t)n-1×t c (1+t)n-2×t c (1+t)n-2 n-1

c(1+t)n C(1+t)n-1 + c(1+n-1×t C(1+t)n-1×t C(1+T)n-1 n

=c((1+t)^(n-2) )×(1+t),

=c(1+t)^(n-1) (1+t)

Through the table, we find that the earned (collected) “A” when hiring an amount “C” after a number of time periods “n” at a compound interest rate “t” at each unit of time, is calculated according to the following relationship:

A=〖C(1+t)〗^n

 Example: Calculate the total amount of 1500 DZD employed at an interest rate of 8% annually for five years.

A〖=C(1+t)〗^n=1500(1+0,O8)^5

= 2204 DZD

Example: Calculate the total amount of 2000 DZD employed at a semi-annual rate of 3% and a semi-annual capitalization for 4 years.

A〖=C(1+t)〗^n=2000(1+0,O3)^8

= 2000 (1,26677) = 2533,54 DZD

Important Notes:

- The previous relationship for calculating the sum total requires that the interest rate be matched with the capitalization period. If the annual periods are, the compound interest rate must be annual, and if it is agreed to capitalize the interests monthly or six months, the compound interest rate must be identical to the period.

- The table shows that the benefits of successive years, as well as the values collected at the end of successive years, form the c, !:; Base geometry (1+t).

- The law of compound interest does not provide us with the value of interest directly, unlike the law of simple interest. Therefore, to know the value of compound interest, we must subtract the principal of the loan as follows: i=C[((1+t)^n-1) ]

Example: Calculate the interest resulting from investing an amount of 1200 DZD for a period of three years at a compound interest rate of 6%.

i=C[((1+t)^n-1) ]=1200[(1,O6)^3-1]=229,21

Operations on the law of compound interest:

A- Calculating the original amount “C”: The original amount can be calculated in terms of the acquired sentence “A” as follows:

A=C(1+t)^n↔C=A/(1+t)^n =〖A(1+t)〗^(-n)

It is the same relationship as the present value relationship of a future amount at the present time. It can also be calculated in terms of the interest relationship as follows: C=i/((1+t)^n-1). The present value of an amount to be paid in the future, in other words, the present value is the amount that must be employed now with compound interest to obtain another amount after "n" period.

Example: A person borrowed an amount for a period of 5 years at a compound interest rate of 7%, and at the end of the loan period he paid interest of 724.59 DZD. Calculate the term of the loan?

c=i/((1+t)^n-1)=724,59/((1,07)^5-1)=724.59/0,40255=1800 DZD

Example: We invested $1 and the estimated annual cash flows are as follows:

Year 1 2 3 4 5

Estimated cash flows 50,000 100,000 200,000 400,000 500,000

At a rate of 9%, is the investment profitable or not?

Year 1 2 3 4 5

Estimated cash flow (DJ) 50,000 100,000 200,000 400,000 500,000

Creation coefficient or present value (1.09)-1 (1.09)-2 (1.09)-3 (1.09)-4 (1.09)-5

O.91744311 O.8416799 O.77218348 O.70842521 O.64993138

Present value (DZD) 45871.56 84167.99 154436.70 283370.08 324965.69

Accumulated Present Value (DJ) -- 130039.55 284476.25 567846.33 892812.O2

The return on this investment is insufficient, as at the end of the fifth year we get 892,812.02 DA for an investment of 1,000,000 DA.

- Calculation of the rate t: It can be calculated by adopting the following relations:

A=c(1+t)^n→A/C=(1+t)^n

 (1+t)=√(n&A/C), from which t=√(n&A/C)-1, and if we use the interest law, it is:

t=√(n&(c+i)/c)-1

Example: calculate