SIMPLE & COMPOUND INTEREST: ANNUITIES & PERPETUITIES

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SIMPLE INTEREST

Simple interest is a type of interest calculation where the interest is calculated as a percentage of the principal amount only. This contrasts with compound interest, which calculates interest on both the principal and accrued interest.

A deposit in a bank or a loan from a co-operative would result in an **interest (I)**. The **principal (P)** is the sum of money being deposited or borrowed. The **amount (A)** is addition of the principal and the interest. The interest is calculated based on interest rates (**r%**) given as percentages of the principal over a period.

The formula of simple interest:

$$I = \frac{Prt}{100}$$

The formula of amount:

$$A = P + I$$
$$= P\left(1 + \frac{r}{100}t\right)$$

t is the number of years; $r\%$ is the interest rate per annum.

☑ EXAMPLE 12.1

Trump borrowed \$25,000 at 12.5% per annum simple interest. Find the amount that he should return after 1 year.

SOLUTION tips

$P = \$25,000, r = 12.5\%, t = 1$ year.
$$I = \frac{Prt}{100} = \frac{25000 \times 12.5 \times 1}{100} = 3125$$
Amount, $A = P + I = 25000 + 3125 = \$28,125$
Alternatively:

$$A = P\left(1 + \frac{r}{100}t\right) = 25000\left(1 + \frac{12.5}{100} \cdot 1\right) = \$28,125$$

So, Trump should return \$28,125 after 1 year with simple interest.

☑ EXAMPLE 12.2

If \$120,000 is invested for 9 months at 10% per annum, calculate (a) the amount of simple interest earned, and (b) the total amount at the end of the term.

SOLUTION tips

a) $P = \$120,000, r = 10\%, t = 9$ months $= 9/12$ year

$$I = \frac{Prt}{100} = \frac{120000 \times 10 \times \frac{9}{12}}{100} = \$9,000$$

b) Total amount $A = P + I = 120,000 + 9,000 = \$129,000$

☑ **EXAMPLE 12.3**

Banana Island Plc invested $8,500 at 4.25% per annum. How long will it take the company to earn $500 simple interest?

SOLUTION tips

$I = \$500, P = \$8,500, r = 4.25\%$

$$I = \frac{Prt}{100} \quad \rightarrow \quad 500 = \frac{8500 \times 4.25 \times t}{100}$$

Rearrange and simplify

$$t = \frac{100 \times 500}{8500 \times 4.25} = 1.38 \text{ years}$$

Therefore, it will take Banana Island Plc approximately 1.38 years to earn $500 in simple interest.

COMPOUND INTEREST

Compound interest is a method of calculating interest where interest is not only earned on the initial principal amount (the original sum of money invested or borrowed), but also on the interest that accumulates over time. In other words, it is interest calculated on both the initial principal and the accumulated interest from previous periods. Compound interest is widely used in various financial products, including savings accounts, investment accounts, mortgages, and loans.

The formula of compound amount:

$$A = P\left(1 + \frac{r}{100n}\right)^{nt}$$

The formula of compound interest:

$$I = A - P$$

n is the number of compounding periods per year.

Compound interest can be compounded at different intervals, such as annually, semi-annually, quarterly, monthly, or even daily. The more frequently interest is compounded, the more interest you earn over time.

The **effective rate of interest** (also called the effective interest rate, the effective rate or the annual equivalent rate) is more precise in financial terms because it takes into consideration the effects of compounding. The effective annual rate of interest is the interest rate that is actually earned (or paid) on an investment, loan or other financial product because of compounding over a given period.

$$r_{eff} = \left(1 + \frac{r}{100n}\right)^{nt} - 1$$

r is the nominal interest.

☑ **EXAMPLE 12.4**

Prof. Amerika borrowed $10,000 at 6% per annum. Compare the amount that he should return after 3 years based on simple versus compound interest.

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