Interest & Discount

**IMPORTANT FORMULA AND EQUATIONS**

**Principal:**

The money borrowed or lent out for a certain period is called the principal or the sum.

**Interest:**

Extra money paid for using other's money is called interest.

**Simple Interest (S.I.):**

If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called simple interest.

Let Principal = P, Rate = R% per annum (p. a.) and Time = T years. Then

(i). Simple Interest = \( \frac{P \times R \times T}{100} \)

(ii). \( P = \frac{100 \times S.I.}{R \times T} \), \( R = \frac{100 \times S.I.}{P \times T} \), and \( T = \frac{100 \times S.I.}{P \times R} \).

**Key notes on Simple interest**

- Definition of Amount: If two equal principals are deposited for \( t_1 \) and \( t_2 \) years at \( r_1\% \) and \( r_2\% \) per annum such that the difference between their interests is \( D \), then the principal can be obtained by \( P = \frac{Rs. \ D \times 100}{r_1 t_1 - r_2 t_2} \).
- \( SI = A \times R \times T / 100 + R \times T \)
- \( P = 100 \times A / 100 + R \times T \)
- If a principal \( P \) becomes 'a' times of itself in \( T_1 \) years at \( R_1\% \) rate per annum and 'b' times in \( T_2 \) years at \( R_2\% \),
  - then (i) \( a - 1 / T_1 = b - 1 / T_2 \)
  - (ii) \( a - 1 / R_1 = b - 1 / R_2 \)
- If a person deposits Rs.\( x_1 \) in a bank at \( r_1\% \) per annum and Rs.\( x_2 \) at \( r_2\% \) per annum, then the interest for the whole sum is \( \left[ \frac{x_1r_1 + x_2r_2}{x_1 + x_2} \right] \% \).
Is two equal principals are deposited for t1 and t2 years at r1% and r2% per annum such that the difference between their interests is D, then the principal can be obtained by \( P = \frac{D \times 100}{r1t1 - r2t2} \).

If some Principal of money at simple interest amounts to Rs. A1 in T1 years and Rs A2 in T2 years, then the sum and rate of interests are

\[
\text{Principal} = \frac{A_2T_1 - A_1T_2}{T_2 - T_1}
\]

\[
\text{Rate} = \frac{100(A_2 - A_1) \times 100}{A_2T_1 - A_1T_2}
\]

A sum of money becomes n times itself in T years at simple interest, then the rate of interest is

\[
\text{Rate} = \frac{100(n - 1)}{T}
\]

If a sum of money becomes n times in T years at S.I then it will be m times of itself in \( \frac{(m-1) \times T}{(n-1)} \) years.

If S.I on a sum of money is \( \frac{x}{n} \) th of the principal and the time T is equal to the rate percent R then

\[
\text{Rate} = \sqrt{\frac{100 \times \frac{1}{x}}{T}}
\]

A certain sum is at S.I at a certain rate for T years. And if it had been put at R 1% higher rate, then it would fetch Rs. x more. Then the Principal

\[
\text{Principal} = \frac{x \times 100}{T \times R}
\]

The annual payment that will discharge a debt of Rs. P due in T years at the rate of interest R% per annum is Annual payment

\[
\frac{100P}{100P + \frac{RT(T-1)}{2}}
\]

Let the rate of interest for first t1 years is r 1% per annum, for the next t2 years is r 2% per annum and for the period beyond that is r 3%.

Suppose all together the simple interest for t3 years is Rs. I. Then

\[
\text{Principal} = \frac{100 \times I}{\frac{t1}{r1} + \frac{t2}{r2}}
\]

The simple interest on a certain sum of money at r 1% per annum for t1 years is Rs. m. The interest on the same sum for t2 years at r 2% per annum is n

\[
\text{Then the sum} = \frac{(m-n) \times 100}{r1 - r2}
\]