Interest Rate

Points to remember:

1. Interest: It is the money paid by the borrower to the lender for using the borrowed money.

2. Principal: The total amount of money borrowed by the borrower is called principal.

3. Amount: It is the sum of the interest and principal i.e. the total money paid back to the lender which includes principal and interest.

4. Simple Interest: It is the interest which is payable only on the principal e.g. Simple interest on Rs. 100 at the rate of 5% per annum will be Rs. 5 each year; after one year the amount will be 105, and after two year the amount will be Rs. 110 and so on.

Simple Interest is given by:

$$I = \frac{P*r*t}{100}$$

Where, I = simple interest
     P = principal
     R = rate of interest
     T = number of years

5. Therefore, Principal = $\dfrac{I*100}{r*t}$

6. Similarly, Rate of Interest = $\dfrac{I*100}{P*t}$

7. And, **Number of years or time** = $\dfrac{I*100}{P*r}$

8. Amount = Principal + Simple Interest

$$= Principal + \frac{Principal * rate * time}{100}$$

$$= Principal \left(1 + \frac{rate * time}{100}\right)$$

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

1) **Compound Interest:** The addition of interest to the principal sum each year or some fixed time period is known as compounding. So, the compound interest is the interest on interest. The interest of each year or some fixed time period is added to the principal sum and the new amount becomes the principal for the next year and interest is calculated on the increased amount for the next year.

2) In case of compound interest, when interest is compounded annually, the amount is given by:

Amount (A) $\quad = P\left(1 + \dfrac{r}{100}\right)^t$

Where, P = Principal

r = Rate of interest

t = time/number of years

And, Compound Interest = Amount (A) - Principal (P)

Compound Interest (C.I) $= P\left(1 + \dfrac{r}{100}\right)^t - P$

$= P\left[\left(1 + \dfrac{r}{100}\right)^t - 1\right]$

And, Rate of interest (r) $= \left[\left(\dfrac{A}{P}\right)^{1/t} - 1\right]$ % p.a.

3) Compound interest can be compounded half-yearly and quarterly, etc. Accordingly, the formula varies;

- When interest is compounded half-yearly:

Amount (A) $= P\left(1 + \dfrac{r/2}{100}\right)^{2t}$

Compound Interest (C.I.) $= P\left[\left(1 + \dfrac{r/2}{100}\right)^{2t} - 1\right]$

And, Rate of interest (r) $= 2 * 100\left[\left(\dfrac{A}{P}\right)^{\frac{1}{t} * 2} - 1\right]$ % p.a.

4) When interest is compounded quarterly:

Amount (A) $= P\left(1 + \dfrac{r/4}{100}\right)^{4t}$

Compound Interest (C.I.) $= P\left[\left(1 + \dfrac{r/4}{100}\right)^{4t} - 1\right]$

And, Rate of interest (r) $= 4 * 100\left[\left(\dfrac{A}{P}\right)^{\frac{1}{t} * 4} - 1\right]$ % p.a.

5) When interest is compounded annually but time is in fraction i.e. $3\frac{2}{3}$ years, then;

Amount $= P\left(1 + \dfrac{r}{100}\right)^3 * \left(1 + \dfrac{\left(\frac{2}{3}\right)r}{100}\right)$

So, in general, if the interest is compounded n times a year;

Amount (A) $= P\left(1 + \dfrac{r/n}{100}\right)^{n*t}$

Compound interest (CI): $P\left[\left(1 + \dfrac{r/n}{100}\right)^{n*t} - 1\right]$

And, Rate of interest (r) $= n * 100\left[\left(\dfrac{A}{P}\right)^{\frac{1}{t} * n} - 1\right]$ % p.a.

6) When there are different rates of interest for different years e.g. r1%, r2%, r3% for 1st, 2nd and 3rd year respectively, then;

Amount $= P\left(1 + \dfrac{r1}{100}\right)\left(1 + \dfrac{r2}{100}\right)\left(1 + \dfrac{r3}{100}\right)$