MF*Transparency* Interest Rate Formulas

Both the Annual Percentage Rate (APR) and the Effective Interest Rate (EIR) are defined as the interest rate that would make the present value of the loan received by the client ("A") equal to the present value of the installments paid by the client ("P").

This is shown in the following formula, called the Discount Rate Method:

CALCULATING ONE PERIOD INTEREST RATE

$$\sum_{k=1}^{n} \frac{A_k}{(1+i)^k} = \sum_{k=1}^{n} \frac{P_k}{(1+i)^k}$$

Where:

A_k: amount of advance in k[th] period
k: period number
n: number of periods
P_j : amount of payment in k[th] period
i : percentage rate of finance charge per period, expressed as a decimal equivalent

CALCULATING APR

$$r_{APR} = i * n$$

Where:

r_{APR}: Annual Percentage Rate
n: number of periods per year
i : percentage rate of finance charge per unit-period, expressed as a decimal equivalent

The APR represents the nominal annual rate, which is the annual interest rate without taking into account the effects of compounding. It is simply the period interest rate times the number of periods in a year:

Example: 1.0% per month
Nominal rate: 1.0% * 12 = 12.0%

In other words, if the lender tells you the interest rate is 1%, calculated monthly on a declining balance, then the APR of that loan is 12.0%.

CALCULATING EIR

$$r_{EIR} = (1 + i)^n - 1$$

Where:
r_{EIR}: Effective Interest Rate
n: number of periods per year
i : percentage rate of finance charge per unit-period, expressed as a decimal equivalent

The EIR represents the effective annual rate which considers compounding factors. It is therefore calculated as:

Effective rate: $(1.01)^{12}$ - 1 = 12.68%

The EIR for this loan would legally be stated as 12.68%. By experimentation, one will find that if a loan is quoted with an EIR of 12.0%, with interest calculated monthly, the monthly interest rate charged must be not 1.0%, but 0.95%. The effective rate formula shows that:

Effective rate: $(1.0095)^{12}$-1 = 12.00%

XIRR CALCULATION, WHICH ALLOWS FOR PERIODS OF DIFFERING LENGTH

$$0 = \sum_{k=1}^{n} \frac{P_k}{(1 + r_{EIR})^{\frac{(d_k - d_0)}{365}}}$$

Where:

P_k:	The kth payment (with disbursements being positive, repayments negative)
r_{EIR}:	Effective Interest Rate
$d_k - d_0$:	The number of calendar days between the date of the kth payment and the date of the first payment

If you have any questions or would like more information please write to us at data@mftransparency.org.