

### 7.4.3. Advanced: Calculation Details

In order to discuss the mathematical formulas used by the Financial Calculator, we first must define some variables.

- ◆n◆==◆number◆of◆payment◆periods
- ◆%i◆==◆nominal◆interest◆rate,◆NAR,◆charged
- ◆PV◆==◆Present◆Value
- ◆PMT◆==◆Periodic◆Payment
- ◆FV◆==◆Future◆Value
- ◆CF◆==◆Compounding◆Frequency◆per◆year
- ◆PF◆==◆Payment◆Frequency◆per◆year

Normal◆values◆for◆CF◆and◆PF◆are:

- ◆◆◆1◆◆◆==◆annual
- ◆◆◆2◆◆◆==◆semi-annual
- ◆◆◆3◆◆◆==◆tri-annual
- ◆◆◆4◆◆◆==◆quarterly
- ◆◆◆6◆◆◆==◆bi-monthly
- ◆◆◆12◆◆◆==◆monthly
- ◆◆◆24◆◆◆==◆semi-monthly
- ◆◆◆26◆◆◆==◆bi-weekly
- ◆◆◆52◆◆◆==◆weekly
- ◆◆◆360◆◆◆==◆daily
- ◆◆◆365◆◆◆==◆daily

#### 7.4.3.1. Converting between nominal and effective interest rate

When a solution for n, PV, PMT or FV is required, the nominal interest rate (i) must first be converted to the effective interest rate per payment period (ieff). This rate, ieff, is then used to compute the selected variable. When a solution for i is required, the computation produces the effective interest rate (ieff). Thus, we need functions which convert from i to ieff, and from ieff to i.

To◆convert◆from◆i◆to◆ieff,◆the◆following◆expressions◆are◆used:

Discrete◆Interest:◆◆◆◆◆ieff◆=◆(1◆+◆i/CF)^(CF/PF)◆-◆1

Continuous◆Interest:◆◆◆◆◆ieff◆=◆e^(i/PF)◆-◆1◆=◆exp(i/PF)◆-◆1

To◆convert◆from◆ieff◆to◆i,◆the◆following◆expressions◆are◆used:

Discrete◆Interst:◆◆◆◆◆i◆=◆CF\*[(1+ieff)^(PF/CF)◆-◆1]

Continuous◆Interest:◆◆◆◆◆i◆=◆ln[(1+ieff)^PF]

#### Note

NOTE: in the equations below for the financial transaction, all interest rates are the effective interest rate, ieff. For the sake of brevity, the symbol will be shortened to just 'i'.

#### 7.4.3.2. The basic financial equation

One equation fundamentally links all the 5 variables. This is known as the fundamental financial equation:

$$PV*(1+i)^n + PMT*(1+i)^X * [(1+i)^n - 1] / i + FV = 0$$

◆◆Where:◆X◆=◆0◆for◆end◆of◆period◆payments,◆and  
◆◆◆◆◆◆◆◆◆◆◆X◆=◆1◆for◆beginning◆of◆period◆payments