Financial Formulas and Financial Equations

Financial math has as its foundation many basic finance formulas related to the time value of money. In addition, particulars related to certain financial instruments (bonds for example) are calculated using derivatives of these basic formulas. Other formulas used in financial math are related to probability, randomness and statistical analysis.

The financial equations below are helpful as they are. However, using the financial formulas provided here, one may also generalize and calculate answers for even more complex financial problems.

Symbols and Variables in Financial Formulas

One important key to understanding formulas for financial math is knowledge of what financial symbols and variables represent.

The chart of symbols (located at the right) offers an explanation of the financial variables used in the formulas provided below.

Where N = Number of Periods

g = Rate of Growth

m = Compounding Frequency

r = Interest Rate

PMT = Periodic Payment

FV = Future Value

PV = Present Value

CF = Cash Flow

j = the jth Period

Calculate the Number of Payments

$$\mathrm{N} = \frac{-\log\left(1 - r\,\mathrm{FV}/\mathrm{PMT}\right)}{\log\left(1 + r\right)}$$

Convert Interest Rate Compounding Bases

Where r_1 = Original Interest Rate with Compounding Frequency n_1

and r_2 is the stated interest rate with compounding frequency n_2

$$r_2 = \left[\left(1 + \frac{r_1}{n_2}\right)^{\frac{n_1}{n_2}} - 1\right] \cdot n_2$$

Calculate Sinking Fund

$$\text{PMT} = \text{Goal} \cdot \frac{r/m}{\left(1+\frac{r}{m}\right)^{(n \cdot m)} - 1}$$

Future Value Formulas

Calculate the Future Value of a Single Sum

$$\text{FV} = \text{PV}\,(1+r)^n$$

Calculate the Future Value with Compounding

$$\text{FV} = \text{PV}\left(1+\frac{r}{m}\right)^{(n \cdot m)}$$

Calculate the Future Value of a Cash Flow Series

$$\text{FV} = \sum_{j-1}^{n} \text{CF}_j\,(1+r)^j$$

Calculate the Future Value of an Annuity

$$\text{FV}_a = \text{PMT}\left[\frac{(1+r)^n - 1}{r}\right]$$

Calculate the Future Value of an Annuity Due

$$\text{FV}_{\text{ad}} = \text{PMT}\left[\frac{(1+r)^n - 1}{r}\right](1+r)$$

Calculate the Future Value of an Annuity with Compounding

$$\text{FV}_a = \text{PMT} \cdot \frac{\left(1+\frac{r}{m}\right)^{(m \cdot n)} - 1}{r/m}$$

Payment Calculations

Calculate Monthly Payment

$$\text{PMT} = P \cdot \frac{r(1+r)^n}{(1+r)^n - 1}$$

Present Value Formulas

Calculate the Present Value of a Single Sum

$$\text{PV} = \frac{\text{FV}}{(1+r)^n}$$

Calculate the Present Value with Compounding

$$\text{PV} = \frac{\text{FV}}{\left(1 + \frac{r}{m}\right)^{(n \cdot m)}}$$

Calculate the Present Value of a Cash Flow Series

$$\text{PV} = \sum_{j=1}^{n} \left[\frac{\text{FV}_j}{\left(1 + \frac{r}{m}\right)^j} \right]$$

Calculate the Present Value of an Annuity with Continuous Compounding

$$\text{PV}_{acp} = \frac{1 - e^{(-rt)}}{r}$$

Calculate the Present Value of a Growing Annuity with Continuous Compounding

$$\text{PV}_{ga} = \frac{\text{PMT}\left(1 - e^{-(r-g)t}\right)}{e^{(r-g)} - 1}$$

Calculate the Net Present Value of a Cash Flow Series

$$\mathrm{NPV} = \sum_{j-1}^{n} \frac{\mathrm{CF}_j}{(1+r)^j} = 0$$

Cash Flow Series Calculations

Calculate the Present Worth Cost of a Cash Flow Series

$$\mathrm{PWC} = \sum_{j-1}^{n} \frac{\mathrm{CF}_j}{(1+r)^j} \text{ where } \mathrm{CF}_j < 0$$

Calculate the Present Worth Revenue of a Cash Flow Series

$$\mathrm{PWR} = \sum_{j-1}^{n} \frac{\mathrm{CF}_j}{(1+r)^j} \text{ where } \mathrm{CF}_j > 0$$