

# Interest

## 1 Preface

For the remainder of this paper, the following variables will be as set forth, unless specified otherwise.

$A$ : Accumulated Amount (*Future Value*)

$P$ : Principal (*Present Value*)

$r$ : Nominal Interest Rate Per Year

$m$ : Yearly Number of Conversion Periods

$t$ : Term (Number of Years)

As well as...

$i$ : Interest Rate Per Period

$$\frac{r}{m} \quad (1)$$

$n$ : Total Number of Conversion Periods

$$m * t \quad (2)$$

## 2 Simple Interest

The value of an investment after a given period of time with a given rate of interest (non-compounding).

$$A = P(1 + rt) \quad (3)$$

## 3 Compound Interest

Like simple interest, but you earn interest on your interest.

- Interest that is periodically added to the principal
- Earns interest on itself

$$A = P(1 + i)^n \quad (4)$$

## 4 Continuous Compounding Interest

Compound Interest that is compounding constantly.

$$A = Pe^{rt} \quad (5)$$

## 5 Effective Rate of Interest

The yearly interest rate that would be the same as compounding  $m$  times a year at rate  $r$ .

The **effective rate of interest** is the **annual rate** which would yield the **same accumulated amount** as the **nominal rate** ( $r$ ) compounded  $m$  times over the term ( $t$ ). It can also be called the **annual percentage yield**.

$$r_{eff} = (1 + i)^m - 1 \quad (6)$$

where:

$r_{eff}$ : Effective Rate of Interest

## 6 Present Value

The amount of money you would have to put in now to get  $A$  out.

### 6.1 Compound Interest

$$P = A(1 + i)^{-n} \quad (7)$$

### 6.2 Continuous Interest

$$P = Ae^{-rt} \quad (8)$$