

# Annuities

## 1 Preface

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

$R$ : Periodic Payment

$P$ : Present Value

$S$ : Future Value

$r$ : Nominal Interest Rate Per Year

$t$ : Term (*Number of Years*)

$m$ : Yearly Payment Periods (*Same as number of times compounded per year*)

As well as...

$n$ : Total Payment Periods

$$m * t \quad (1)$$

$i$ : Interest Rate Per Period

$$\frac{r}{m} \quad (2)$$

## 2 Future Value "S"

How much you will have total.

$$S = R \left[ \frac{(1+i)^n - 1}{i} \right] \quad (3)$$

## 3 Present Value "P"

How much you would have to invest now to match a given annuities final value.

$$P = R \left[ \frac{1 - (1+i)^{-n}}{i} \right] \quad (4)$$

## 4 Amortization Formula

Paying off a loan with period payments, interest will be working against you.

The periodic payment  $R$  on a loan of  $P$  dollars to be amortized over  $n$  periods with interest charged at the rate of  $i$  per period.

$$R = \frac{Pi}{1 - (1+i)^{-n}} \quad (5)$$

## 5 Calculate R when saving up to a value (not paying off)

$$R = \frac{Pi}{(1+i)^n - 1} \quad (6)$$

## 6 Equity

- Find payment per period for loan using the amortization formula (5)
- Plug that  $R$  into present value formula (4) with  $n$  = number of periods remaining, save result as *current*.
- Solve for Total – current