

# Prior Art Reference: PA-1

## *Special Annuity Factor formula*

Document	Title – Author	Date	Publisher	Pages
Jordan	Life Contingencies by Chester Wallace Jordan	1967	Society of Actuaries	41
Kellison	The Theory of Interest by Stephen G. Kellison	1970	Richard D. Irwin, Inc. Homewood, IL 60430	49-50
Atkinson	Life Insurance Products and Finance by David B. Atkinson, FSA & James W. Dallas, FSA	2000	The Society of Actuaries	635-636

In Application # 09//804,667 the following formula is given for a *special annuity factor*:

$$\text{Special Annuity Factor} = \left[ \sum_{t=0}^{n-1} v^t \right] + \left[ v^n \times \sum_{s=0}^{\omega} v^s \times {}_s p_{x+n} \right] (1+L)$$

Where:

- $v$  =  $1/(1+AIR)$
- $AIR$  = assumed investment rate for variable annuities or guaranteed investment rate for fixed annuities
- $n$  = number of years in the liquidity period
- $\sum v^t$  = present value, discounting for interest only, of \$1 paid annually from  $t=0$  to  $t=n-1$
- $v^n$  = present value, discounting for interest only, of \$1 paid at  $t=n$
- $\sum v^s \times {}_s p_{x+n}$  = present value, discounting for interest and mortality, of \$1 paid annually from  $s=0$  to the end of the mortality table
- $L$  = expense load (positive or negative).

There are two parts of the *special annuity factor* as defined in the highlighted text. For simplicity<sup>1</sup> it is assumed that annual payouts are made even though payments from an annuity are typically made with a monthly frequency. Therefore these formulas are constructed with an annual payout assumption.

The expression of the special annuity factor is well known by actuaries in the insurance industry. Its two parts are:

<sup>1</sup> See 7,089,201 col. 7, line 22: “For simplicity, this formula assumes annual variable annuity benefit payments.”