

Annuity Symbols

Type of Coverage	Payable Continuously	Payable at Beginning of Year	Payable at Beginning of mth
whole life annuity	$\bar{a}_x = \frac{1 - \bar{A}_x}{\delta}$	$\ddot{a}_x = \frac{1 - A_x}{d}$	$\dot{a}_x^{(m)} = \frac{1 - A_x^{(m)}}{d^{(m)}}$
n-year temporary life annuity	$\bar{a}_{x:n} = \frac{1 - \bar{A}_{x:n}}{\delta}$	$\ddot{a}_{x:n} = \frac{1 - A_{x:n}}{d}$	$\dot{a}_{x:n}^{(m)} = \frac{1 - A_{x:n}^{(m)}}{d^{(m)}}$
n-year deferred life annuity	${}_n \bar{a}_x = {}_nE_x \cdot \bar{a}_{x+n} = \bar{a}_x - \bar{a}_{x:n}$	${}_n \ddot{a}_x = {}_nE_x \cdot \ddot{a}_{x+n} = \ddot{a}_x - \ddot{a}_{x:n}$	${}_n \dot{a}_x^{(m)} = {}_nE_x \cdot \dot{a}_{x+n}^{(m)} = \dot{a}_x^{(m)} - \dot{a}_{x:n}^{(m)}$
n-year certain and life annuity	$\bar{a}_{x:n} = \bar{a}_n + {}_n \bar{a}_x$	$\ddot{a}_{x:n} = \ddot{a}_n + {}_n \ddot{a}_x$	$\dot{a}_{x:n}^{(m)} = \dot{a}_n^{(m)} + {}_n \dot{a}_x^{(m)}$

Annuity Formulas

Type of Coverage	Payable Continuously	Payable at Beginning of Year	Payable at Beginning of mth
General Formula	$\int_a^b v^t {}_t p_x dt$	$\sum_{k=a}^b v^k {}_k p_x$	$\sum_{k=a}^b \frac{1}{m} v^{k/m} {}_{\frac{k}{m}} p_x$
whole life annuity	$a = 0; b = \infty$ or end of table	$a = 0; b = \infty$ or end of table	$a = 0; b = \infty$ or end of table
n-year temporary life annuity	$a = 0; b = n$	$a = 0; b = n - 1$	$a = 0; b = nm - 1$
n-year deferred life annuity	$a = n; b = \infty$ or end of table	$a = n; b = \infty$ or end of table	$a = nm; b = \infty$ or end of table

Variances

Type of Coverage	Payable Continuously	Payable at Beginning of Year	Payable at Beginning of mth
whole life annuity	$\frac{{}^2\bar{A}_x - (\bar{A}_x)^2}{\delta^2}$	$\frac{{}^2A_x - (A_x)^2}{d^2}$	$\frac{{}^2A_x^{(m)} - (A_x^{(m)})^2}{[d^{(m)}]^2}$
n-year life annuity	$\frac{{}^2\bar{A}_{x:n} - (\bar{A}_{x:n})^2}{\delta^2}$	$\frac{{}^2A_{x:n} - (A_{x:n})^2}{d^2}$	$\frac{{}^2A_{x:n}^{(m)} - (A_{x:n}^{(m)})^2}{[d^{(m)}]^2}$

Relationships

$\ddot{a}_{x:\overline{n} } = \ddot{a}_x - {}_n E_x \cdot \ddot{a}_{x+n}$	$\bar{a}_{x:\overline{n} } = \bar{a}_x - {}_n E_x \cdot \bar{a}_{x+n}$	$\ddot{a}_{x:\overline{n} }^{(m)} = \ddot{a}_x^{(m)} - {}_n E_x \cdot \ddot{a}_{x+n}^{(m)}$	$\ddot{a}_x = 1 + vp_x \cdot \ddot{a}_{x+1}$	$\ddot{a}_x^{(m)} = \frac{1}{m} + v^m \cdot \frac{1}{m} p_x \cdot \ddot{a}_{x+1/m}^{(m)}$	$\ddot{a}_{x:\overline{n} } = 1 + vp_x \cdot \ddot{a}_{x+1:\overline{n-1} }$
$\bar{A}_x = 1 - \delta \bar{a}_x$	$\bar{A}_{x:\overline{n} } = 1 - \delta \bar{a}_{x:\overline{n} }$	$A_x = 1 - d \ddot{a}_x$	$A_{x:\overline{n} } = 1 - d \ddot{a}_{x:\overline{n} }$	$A_x^{(m)} = 1 - d^{(m)} \ddot{a}_x^{(m)}$	$A_{x:\overline{n} }^{(m)} = 1 - d^{(m)} \ddot{a}_{x:\overline{n} }^{(m)}$
$a_x = \ddot{a}_x - 1$	$a_{x:\overline{n} } = \ddot{a}_{x:\overline{n} } - 1$	$a_{x:\overline{n} } = \ddot{a}_{x:\overline{n} } - 1 + {}_n E_x$	$a_x^{(m)} = \ddot{a}_x^{(m)} - \frac{1}{m}$	$a_{x:\overline{n} } = \ddot{a}_{x:\overline{n} }^{(m)} - \frac{1}{m} + \frac{1}{m} \cdot {}_n E_x$	
${}_n a_x = {}_{n+1} \ddot{a}_x$	$a_{x:\overline{n} } = a_{\overline{n} } + {}_{n+1} \ddot{a}_x$		$(I\ddot{a})_x = \sum_{t=0}^{\infty} v^t (t+1) {}_t p_x$	$(I\ddot{a})_{x:\overline{n} } = \sum_{t=0}^{n-1} v^t (t+1) {}_t p_x$	$(\bar{I}\bar{a})_{x:\overline{n} } = \int_0^n t \cdot v^t \cdot {}_t p_x \cdot dt$

$$\ddot{a}_x^{(m)} = \alpha(m)\ddot{a}_x - \beta(m)$$

$$\ddot{a}_x^{(m)} = \ddot{a}_x - \frac{m-1}{2m}$$

$$\ddot{a}_x^{(m)} = \ddot{a}_x - \frac{m-1}{2m} - \frac{m^2-1}{12m^2}(\delta + \mu_x) \quad \text{where } \mu_x \approx -0.5\{\ln(p_{x-1}) + \ln(p_x)\}$$

$$\bar{a}_x = \alpha(\infty)\ddot{a}_x - \beta(\infty)$$

$$\bar{a}_x = \ddot{a}_x - \frac{1}{2}$$

$$\bar{a}_x = \ddot{a}_x - \frac{1}{2} - \frac{1}{12}(\delta + \mu_x) \quad \text{where } \mu_x \approx -0.5\{\ln(p_{x-1}) + \ln(p_x)\}$$