★★★★★

Three formulas for ${}_{t|u}q_x$ in terms of non-deferred p's and q's

22F

$$ {}_{t|u}q_x = {}_tp_x \, {}_uq_{x+t} $$

$$ {}_{t|u}q_x = {}_tp_x - {}_{t+u}p_x $$

$$ {}_{t|u}q_x = {}_{t+u}q_x - {}_tq_x $$

★★★★★

${}_{k}p_{x}$ *in terms of l's*

$$ {}_{k}p_{x} = \frac{l_{x+k}}{l_{x}} $$

★★★★★

$_kq_x$ in terms of l's and d's

$$ {}_kq_x = \frac{{}_kd_x}{l_x} = \frac{l_x - l_{x+k}}{l_x} $$

★★★

$_{t|u}q_x$ *in terms of l's and d's*

25F

$$ {}_{t|u}q_x = \frac{{}_u d_{x+t}}{l_x} = \frac{l_{x+t} - l_{x+t+u}}{l_x} $$

★★★★

Definition of $_tq_x$ in terms of probabilities of X, the random variable for age at death.

$$ {}_tq_x = \Pr(x < X \leq x + t \mid X > x) $$

★★★★

Definition of $_tp_x$ in terms of probabilities of X, the random variable for age at death.

$$ {}_tp_x = \Pr(X > x + t \mid X > x) $$

★★★★

Definition of $_{t|u}q_x$ in terms of probabilities of X, the random variable for age at death.

$$ {}_{t|u}q_x = \Pr(x + t < X \leq x + t + u \mid X > x) $$

★★★★★

General formula for A_x

$$A_x = \sum_{k=0}^{\infty} v^{k+1}\, {}_kp_x\, q_{x+k}$$

★★★★

General formula for $\mathbf{E}[Z_x^2]$

$$\mathbf{E}[Z_x^2] = \sum_{k=0}^{\infty} {}_{k|}q_x v^{2(k+1)} = \sum_{k=0}^{\infty} {}_kp_x\, q_{x+k}\, v^{2(k+1)}$$

★★★★

General formula for $A^{1}_{x:\overline{n}|}$

130F

$$A^{1}_{x:\overline{n}|} = \sum_{k=0}^{n-1} v^{k+1}\,{}_{k}p_{x}\,q_{x+k}$$

★★★★

General formula for $A_{x:\overline{n}|}$

131F

$$A_{x:\overline{n}|} = \sum_{k=0}^{n-1} v^{k+1}\,{}_kp_x\,q_{x+k} + v^n\,{}_np_x$$

★★★★

General formula for ${}_{n|}A_x$

$$ {}_{n|}A_x = \sum_{k=n}^{\infty} v^{k+1} \, {}_kp_x \, q_{x+k} $$

★★★★

General formula for ${}_{n|m}A_x$

133F

$$ {}_{n|m}A_x = \sum_{k=n}^{n+m-1} v^{k+1} \, {}_kp_x \, q_{x+k} $$

★★★

Formula for EPV of benefit premium annuity-due when health costs by age increase geometrically with $B(x+1,t)/B(x,t) = c$ and health cost inflation is constant at rate j.

$$\ddot{a}_B(x,t) = \sum_{k=0}^{\infty} v^k\,{}_kp_x\,c^k(1+j)^k$$

★★★

When health costs by age increase geometrically with $B(x+1,t)/B(x,t) = c$ and health cost inflation is constant at rate j, benefit premium annuity-due can be valued at whole life annuity at adjusted interest rate i^*. What is i^*?

563F

$$i^* = \frac{1+i}{c(1+j)} - 1$$

★★

Actuarial value of total health benefits assuming all retirements at beginning of year and no later than age 65

$$\text{AVTHB} = \sum_{i=0}^{65-x} \frac{r_{x+t}}{l_x} v^t B(x+t,t)\ddot{a}_B(x+t,t)$$