生命保険数学 問題1 (平成20年 ~~9~~ 10 月 ~~29~~ 1 日) (制限時間: 30分)

1. 次の空欄に当てはまる適切な式、記号又は数値を書け。

(1) $i^{(k)} = k \cdot \left(\left[\,(1+i)^{\frac{1}{k}} - 1\,\right]\right)$

(2) $d^{(k)} = \left[\,k\left(1-(1-d)^{\frac{1}{k}}\right)\right]$ (dの式で表せ)

(3) $\ddot{a}_{\overline{n}|} = 1 + \left[\,a_{\overline{n-1}|}\,\right]$

(4) $s_{\overline{n}|} = 1 + \left[\,\ddot{s}_{\overline{n-1}|}\,\right]$

(5) $\ddot{a}_{\overline{n}|} = \left[\,v^{n}\,\right]\ddot{s}_{\overline{n}|}$

(6) $(Ia)_{\overline{n}|} = \dfrac{\left[\,1-(n+1)v^{n}+nv^{n+1}\,\right]}{id}$

(7) $\bar{a}_{\overline{n}|} = \dfrac{1-v^{n}}{[\,\delta\,]}$

(8) ${}_{f|}\ddot{a}_{\overline{n}|} = \left[\,v^{f}\,\right]\cdot \ddot{a}_{\overline{n}|}$

(9) ${}_{f|}\ddot{a}_{\overline{n}|} = \ddot{a}_{\overline{n+f}|} - \left[\,\ddot{a}_{\overline{f}|}\,\right]$

(10) $\ddot{s}^{(k)}_{\overline{n}|} = \dfrac{\left[\,(1+i)^{\frac{1}{k}}\{(1+i)^{n}-1\}\,\right]}{i^{(k)}}$

(11) $a^{(k)}_{\overline{n}|} = \left[\,a^{(k)}_{\overline{1}|}\,\right]\cdot \ddot{a}_{\overline{n}|}$

(12) $\ddot{a}^{(k)}_{\overline{n}|} = \left[\,\ddot{s}^{(k)}_{\overline{1}|}\,\right]\cdot a_{\overline{n}|}$

(13) 年始資産をA, 年末資産をB, 期中の利息収入をIとするとき、

ハーディーの公式は$\left[\,\dfrac{2I}{A+B-I}\,\right]$である。

(14) ${}_{n}q_x = \dfrac{l_x - [\,l_{x+n}\,]}{l_x}$

(15) ${}_{f|}q_x = \dfrac{[\,d_{x+f}\,]}{l_x}$

(16) ${}_{f|}q_x = {}_{f}p_x \cdot [\,q_{x+f}\,]$

(17) ${}_{n}q_x = q_x + {}_{1|}q_x + \cdots + {}_{[\,n-1\,]|}q_x$

(18) $\dfrac{d}{dx}l_x = [\,-l_x\mu_x\,]$

(19) $\displaystyle\int_0^1 l_{x+t}\mu_{x+t}\,dt = [\,d_x\,]$

(20) ${}_{t}p_x = \exp\left(-\left[\,\int_0^t \mu_{x+s}\,ds\,\right]\right)$

(21) ${}_{n|}\mathring{e}_x = [\,{}_{n}p_x\,]\cdot \mathring{e}_{x+n}$

(22) $\dfrac{d}{dt}{}_{t}p_x = [\,-{}_{t}p_x\,\mu_{x+t}\,]$

(23) $\dfrac{d}{dx}{}_{t}p_x = [\,{}_{t}p_x(\mu_x - \mu_{x+t})\,]$

2. $l_x = k(100-x)$ $(0 \le x \le 100)$ のとき、次を求めよ。$k>0$は定数とする。

(24) ${}_{t}p_x = \dfrac{100-x-t}{100-x}$

(25) ${}_{f|}q_x = \dfrac{1}{100-x}$

(26) $\mu_x = \dfrac{1}{100-x}$

(27) ${}_{f|n}q_x = {}_{f}p_x\,{}_{n}q_{x+f} = \dfrac{n}{100-x}$

(28) $\mathring{e}_x = \dfrac{100-x}{2}$

(29) ${}_{n}\mathring{e}_x = \displaystyle\int_0^n {}_{t}p_x\,dx = n - \dfrac{n^2}{2(100-x)}$

(30) $e_x = \displaystyle\sum_{k=1}^{100-x} {}_{k}p_x = \dfrac{99-x}{2}$

(31) ${}_{n|}e_x = {}_{n}p_x\, e_{x+n}$

$= \dfrac{100-x-n}{100-x}\cdot\dfrac{99-x-n}{2}$