

Krzysztof Ostaszewski <http://www.krzysio.net>
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Practice Problem for April 21, 2007

November 2006 SOA Course M Examination, Problem No. 19

For a fully discrete whole life insurance of 25,000 on (25), you are given:

- (i) $P_{25} = 0.01128$.
- (ii) $P_{25:\overline{15}|}^1 = 0.05107$.
- (iii) $P_{25:\overline{15}|} = 0.05332$.

Calculate $25,000 \cdot {}_{15}V_{25}$.

- A. 4420
- B. 4460
- C. 4500
- D. 4540
- E. 4580

Solution.

Nothing prospective is given, so we must rely on retrospective formulas. Recall

$$\begin{aligned} {}_nV_x - 0 &= {}_nV_x - {}_nV_{x:\overline{n}|}^1 = \\ &= \left(P_x \cdot \ddot{s}_{x:\overline{n}|} - \frac{A_{x:\overline{n}|}^1}{n E_x} \right) - \left(P_{x:\overline{n}|}^1 \cdot \ddot{s}_{x:\overline{n}|} - \frac{A_{x:\overline{n}|}^1}{n E_x} \right) = (P_x - P_{x:\overline{n}|}^1) \ddot{s}_{x:\overline{n}|}. \end{aligned}$$

Or, you hopefully memorized this: ${}_nV_x = (P_x - P_{x:\overline{n}|}^1) \ddot{s}_{x:\overline{n}|}$. This formula is suggested by the presence of three premiums. Here

$${}_{15}V_{25} = (P_{25} - P_{25:\overline{15}|}^1) \cdot \ddot{s}_{25:\overline{15}|} = \left(P_{25} - (P_{25:\overline{15}|} - P_{25:\overline{15}|}^1) \right) \cdot \frac{1}{P_{25:\overline{15}|}^1}.$$

Therefore,

$$\begin{aligned} 25,000 \cdot {}_{15}V_{25} &= 25,000 \cdot \left(\frac{P_{25}}{P_{25:\overline{15}|}^1} - \frac{P_{25:\overline{15}|}}{P_{25:\overline{15}|}^1} + 1 \right) = \\ &= 25,000 \cdot \left(\frac{0.01128}{0.05107} - \frac{0.05332}{0.05107} + 1 \right) \approx 4420.40337. \end{aligned}$$

Answer A.

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