

EXAM M QUESTIONS OF THE WEEK

S. Broverman, 2005

Week of January 23/06

A fully discrete whole life insurance is issued at age 35 with a face amount of \$1,000,000. Premiums are payable for life, and calculations and mortality are based on the illustrative Exam M table, at an annual effective interest rate of 6%. The policy has the following expenses:

- 25% of premium in the 1st year, 10% of premium in subsequent years,
- per policy expense of \$1000 in the first year and \$200 per year in subsequent years,
- face amount expense of $\frac{1}{2}\%$ of face amount in the first year and $\frac{1}{10}\%$ of face amount in subsequent years

Calculate the first and second year expense augmented reserves, ${}_1V_e$ and ${}_2V_e$, and calculate the first and 2nd year expense reserves.

The solution can be found below.

Week of January 23/06 - Solution

$$P \cdot \ddot{a}_{35} = 1,000,000 \cdot A_{35} \rightarrow P = \frac{1,000,000 A_{35}}{\ddot{a}_{35}} = 8,362.41 \text{ is the annual benefit premium.}$$

The equivalence principle equation for the expense-loaded premium is

$$G \cdot \ddot{a}_{35} = 1,000,000 \cdot A_{35} + .25G + .1G \cdot a_{35} + 1000 + 200a_{35} + 5000 + 1000a_{35}$$
$$\rightarrow G = \frac{1,000,000 \cdot A_{35} + 800 + 200\ddot{a}_{35} + 4000 + 1000\ddot{a}_{35}}{.9\ddot{a}_{35} - .15} = 11,091.48 \text{ is the equivalence principle expense loaded premium.}$$

$${}_1V = 1,000,000A_{36} - 8,362.41\ddot{a}_{36} = 6,864.37 \text{ is the 1st year terminal benefit reserve,}$$

$${}_1V_e = 1,000,000A_{36} + (1109.15 + 200 + 1000)\ddot{a}_{36} - 11,091.48\ddot{a}_{36} = 445.07$$

is the 1st year terminal expense augmented reserve,

$${}_1V^e = {}_1V_e - {}_1V = 445.07 - 6,864.37 = -6,419.30 \text{ is the 1st year terminal expense reserve.}$$

$${}_2V = 1,000,000A_{37} - 8,362.41\ddot{a}_{37} = 14,030.21 \text{ is the 2nd year terminal benefit reserve,}$$

$${}_2V_e = 1,000,000A_{37} + (1109.15 + 200 + 1000)\ddot{a}_{37} - 11,091.48\ddot{a}_{37} = 7,657.23$$

is the 2nd year terminal expense augmented reserve,

$${}_2V^e = {}_2V_e - {}_2V = -6,372.98 \text{ is the 2nd year terminal expense reserve.}$$