1. A 20 year endowment insurance to (50) pays a death benefit of 100,000 at the end of the year of death.

You are given:

a. Mortality follows the Illustrative Life Table.

b. \( i = 6\% \)

c. Net premiums are determined using the equivalence principle.

Determine the net premium reserve at the end of ten years.

**Solution:**

\[
PVP = PVB
\]

\[
P\ddot{a}_{50:20} = (100,000)A_{50:20}
\]

\[
P = \frac{(100,000)(A_{50:20} - E_{50} \cdot A_{70:20} + E_{50})}{\ddot{a}_{50:20} E_{50} \cdot \ddot{a}_{70}} =
\]

\[
\frac{(100,000)[0.24905 - (0.23047)(0.51495) + 0.23047]}{13.2668 - (0.23047)(8.5693)} = 3195.579139
\]

\[
\text{PVFB} - PVFP = (100,000)A_{60:10} - (3195.579139)\ddot{a}_{60:10} =
\]

\[
(100,000)(A_{60:10} - E_{60} \cdot A_{70:10} + E_{60}) - (3195.579139)(\ddot{a}_{60:10} - E_{60} \cdot \ddot{a}_{70}) =
\]

\[
(100,000)[0.36913 - (0.45120)(0.51495) + 0.45120] - (3195.579139)[11.1454 - (0.45120)(8.5693)]
\]

\[= 35,538.05\]
2. A whole life insurance policy on (60) pays a death benefit of 150,000 at the end of the year of death.

You are given:

a. Mortality follows the Illustrative Life Table.

b. \( i = 5\% \)

c. \( V' = 76,000.00 \)

d. \( V' = 81,988.06 \)

Determine the net premium for this policy.

Solution:

Using the recursive formula:

\[
(15V + P)(1+i) = (150,000)q_75 + 16V(1-q_75)
\]

\[
(76,000 + P)(1.05) = (150,000)(0.05169) + (81,988.06)(1-0.05169)
\]

\[
P = \frac{(150,000)(0.05169) + (81,988.06)(1-0.05169)}{1.05} - 76,000 = 5432
\]
1. A 30 year term insurance to (40) pays a death benefit of 100,000 at the end of the year of death.

You are given:

a. Mortality follows the Illustrative Life Table.

b. \( i = 6\% \)

c. Net premiums are determined using the equivalence principle.

Determine the net premium reserve at the end of ten years.

**Solution:**

\[
P_{V^P} = P_{V^B}
\]

\[
P_{\ddot{a}_{40:30}} = (100,000)A_{40:30}^1
\]

\[
P = \frac{(100,000)(A_{40} - 30 E_{50} \cdot A_{70})}{\ddot{a}_{40} - 30 E_{50} \cdot \ddot{a}_{70}} = \frac{(100,000)(0.16132 - (0.53667)(0.23047)(0.51495))}{14.8166 - (0.53667)(0.23047)(8.5693)} = 709.6642527
\]

\[
_{10}V^n = PVFB - PVFP = (100,000)A_{50:20}^1 - (709.6642527)\ddot{a}_{50:20} = (100,000)(A_{50 - 20} E_{50} \cdot A_{70}) - (709.6642527)(\ddot{a}_{50 - 20} E_{50} \cdot \ddot{a}_{70}) = (100,000)(0.24905 - (0.23047)(0.51495) + 0.45120] - (709.6642527)[13.2668 - (0.23047)(8.5693)] = 5023.54
\]
2. A whole life insurance policy on (50) pays a death benefit of 150,000 at the end of the year of death.

You are given:

a. Mortality follows the Illustrative Life Table.

b. \( i = 5\% \)

c. \( 15 \ V^g = 38,000 \)

d. The gross premium is 3456.00.

e. Commissions are 100% in the first year and 8% thereafter

f. Issue Expenses are 1000 at the beginning of the first year.

g. Maintenance expenses are 35 per policy at the beginning of every year including the first year.

Determine \( 16 \ V^g \). 

Solution:

\[
[ V^g + P_t (1 - e_t^x) - X_t^RBOY ](1 + i) = (S_{t+1} + E_{t+1})q_{k+t} + t^g \cdot V^g \cdot p_{k+t}
\]

\[
[38,000 + 3456(1 - 0.08) - 35](1.05) = (150,000 + 0)(0.02132) + 16 V^g \cdot (1 - 0.02132)
\]

\[
16 V^g = \frac{[38,000 + 3456(1 - 0.08) - 35](1.05) - (150,000 + 0)(0.02132)}{1 - 0.02132} = 40,875.21
\]