

Question #245**Answer: E**

Let G denote the gross premium.

EPV (expected present value) of benefits = $1000 {}_{10|20}A_{30}$.

EPV of premiums = $G \ddot{a}_{30:\overline{5}|}$.

EPV of expenses = $(0.05 + 0.25)G + 20$ first year

+ $\left[(0.05 + 0.10)G + 10 \right] a_{30:\overline{4}|}$ years 2-5

+ $10 {}_5\ddot{a}_{35:\overline{4}|}$ years 6-10 (there is no premium)

$$= 0.30G + 0.15G a_{30:\overline{4}|} + 20 + 10 a_{30:\overline{4}|} + 10 {}_5\ddot{a}_{30:\overline{5}|}$$

$$= 0.15G + 0.15G \ddot{a}_{30:\overline{5}|} + 20 + 10 a_{30:\overline{9}|}$$

(The step above is motivated by the form of the answer. You could equally well put it that form later).

Equivalence principle:

$$G \ddot{a}_{30:\overline{5}|} = 1000 {}_{10|20}A_{30} + 0.15G + 0.15G \ddot{a}_{30:\overline{5}|} + 20 + 10 a_{30:\overline{9}|}$$

$$G = \frac{\left(1000 {}_{10|20}A_{30} + 20 + 10 a_{30:\overline{9}|} \right)}{(1 - 0.15) \ddot{a}_{30:\overline{5}|} - 0.15}$$

$$= \frac{\left(1000 {}_{10|20}A_{30} + 20 + 10 a_{30:\overline{9}|} \right)}{0.85 \ddot{a}_{30:\overline{5}|} - 0.15}$$