Exercise 6.6

Let G the required gross annual premium so that the APV of gross premiums is

$$\text{APV(premiums)} = G\,\ddot{a}_{[45]:\overline{20|}}.$$

The APV of the 20-year endowment insurance policy is

$$\text{APV(benefits)} = 100000\,A_{[45]:\overline{20|}}$$

The APV of the expenses can be found using

$$\text{APV(expenses)} = 0.02G\ddot{a}_{[45]:\overline{20|}} + 0.08G + 8\ddot{a}_{[45]:\overline{20|}} + 42$$

This gives us, by the equivalence premium principle, the following:

$$G = \frac{100000\,A_{[45]:\overline{20|}} + 8\ddot{a}_{[45]:\overline{20|}} + 42}{0.98\ddot{a}_{[45]:\overline{20|}} - 0.08}.$$

Based on the Standard Select Survival Model,

$$A_{[45]:\overline{20|}} = 0.15149 - 0.35999(0.35477) + 0.35999 = 0.3837663$$

and

$$\ddot{a}_{[45]:\overline{20|}} = (1 - 0.3837663)/(1 - (.05/1.05)) = 12.94091.$$

Finally, the gross annual premium is

$$G = \frac{100000(0.3837663) + 8(12.94091) + 42}{0.98(12.94091) - 0.08} = 3056.808.$$