Exercise 8.3

Let P be the annual premium rate so that

$$\begin{aligned}
\text{APV(premiums)} &= P \times \int_0^2 e^{-.05t} {}_tp_{50}^{00} dt \\
&= P \times \int_0^2 e^{-.05t} \left(\frac{2}{3} e^{-.015t} + \frac{1}{3} e^{-.01t} \right) dt \\
&= P \times \frac{1}{3} \left[\frac{2}{.065} \left(1 - e^{-.065(2)}\right) + \frac{1}{.06} \left(1 - e^{-.06(2)}\right) \right] \\
&= P \times 1.878523
\end{aligned}$$

and

$$\begin{aligned}
\text{APV(benefits)} &= 60000 \times \int_0^2 e^{-.05t} {}_tp_{50}^{00} dt \\
&= 60000 \times \frac{2}{3} \int_0^2 e^{-.05t} \left(e^{-.01t} - e^{-.015t}\right) dt \\
&= 60000 \times \frac{2}{3} \left[\frac{1}{.06} \left(1 - e^{-.06(2)}\right) - \frac{1}{.065} \left(1 - e^{-.065(2)}\right) \right] \\
&= 368.1792
\end{aligned}$$

Solving for the premium, we get $P = \dfrac{368.1792}{1.878523} = 195.994$.