Solution #229

Mortality follows a DeMoivre distribution with $\omega = 120$

$$\Rightarrow \quad S_{40}(t) = 1 - \frac{t}{80} \qquad 0 \le t \le 80$$

$$F_{40}(t) = t/80 \qquad 0 \le t \le 80$$

$$\Pr(Y \le y) = 0.75 \qquad Y = \frac{1 - e^{-\delta T_{40}}}{\delta}$$

$$\Pr\left[\frac{1 - e^{-\delta T}}{\delta} \le y\right] = 0.75$$

$$\Pr\left[1 - \delta y \le e^{-\delta T}\right] = 0.75$$

$$\Pr\left[-\delta T \ge \ln(1 - \delta y)\right] = 0.75$$

$$\Pr\left[T_{40} \le \frac{-\ln(1 - \delta y)}{\delta}\right] = 0.75$$

$$\Rightarrow \text{Find } {}_tq_{40} = 0.75 \quad \text{where } t = \frac{-\ln(1 - \delta y)}{\delta}$$

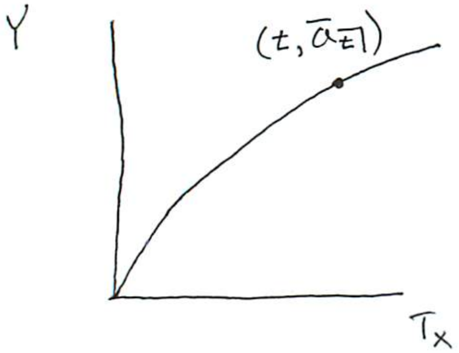
$$0.75 = \frac{-\ln(1 - 0.05y)/0.05}{80}$$

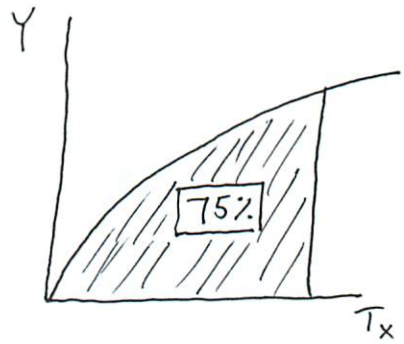
$$-3 = \ln(1 - 0.05y)$$

$$y = \frac{1 - e^{-3}}{.05} \quad \Rightarrow \quad y = 19.0 \qquad \text{E}$$

Alternative Solution

Annuity random variables increase as survival time increases





So we can find the 75^{th} percentile of Y by finding T such that ${}_tq_{40} = 0.75$ and letting $y = \bar{a}_{\overline{t}|}$ where $y = 75^{th}$ percentile

$$0.75 = {}_tq_{40}$$

$$0.75 = t/80 \quad \Rightarrow \quad t = 60$$

$$y = \bar{a}_{\overline{60}|}$$

$$y = \frac{1 - e^{-0.05(60)}}{0.05}$$

$$y = 19.0$$

E