4. Suppose that the present value of annuity-due of n years is 31.61667882 and the accumulation value of annuity-immediate of (n+1) years is 64024.90944. Determine the effective annual rate and n.

Given:

$\ddot{a}_{\overline{n}|i} = 31.61667882$

$s_{\overline{n+1}|i} = 64.024.90944$

want:

i and n

① $\ddot{s}_{\overline{n}|i} = 1 = s_{\overline{n+1}|i} \implies \ddot{s}_{\overline{n}|i} = s_{\overline{n+1}|i} - 1$

② $\ddot{s}_{\overline{n}|i} = (1+i)^n \ddot{a}_{\overline{n}|i} \implies (1+i)^n = \dfrac{\ddot{s}_{\overline{n}|i}}{\ddot{a}_{\overline{n}|i}}$

$$(1+i)^n = \frac{\ddot{s}_{\overline{n}|i}}{\ddot{a}_{\overline{n}|i}} = \frac{s_{\overline{n+1}|i} - 1}{\ddot{a}_{\overline{n}|i}} = \frac{64.024.90944 - 1}{31.61667882} = 2025.004$$

$$\ddot{a}_{\overline{n}|i} = \frac{(1-(1+i)^{-n})}{d}$$

$$d = \frac{(1-(1+i)^{-n})}{\ddot{a}_{\overline{n}|i}}$$

$$d = \frac{\frac{(1-\ddot{a}_{\overline{n}|i})}{(-1+\ddot{s}_{\overline{n+1}|})}}{\ddot{a}_{\overline{n}|i}}$$

$$d = \frac{1}{\ddot{a}_{\overline{n}|i}} - \frac{1}{-1+s_{\overline{n+1}|i}}$$

$$d = \frac{1}{31.61667882} - \frac{1}{64.024.90944-1} = 0.03161326$$

$$i = \frac{d}{1-d} = 0.03264528$$

$*i = 0.03264528$

$$(1+i)^n = 2025.068$$

$$(1.03264528)^n = 2025.068$$

$$\log(1.03264528)^n = \log(2025.068)$$

$$n\log(1.03264528) = \log(2025.068)$$

$$n = \frac{\log(2025.068)}{\log(1.03264528)}$$

$$n = 237$$