4.82 % APR

0.0492792 0474 = AER

$\boxed{0.0481}$ = continuous years rate

$$\left(1 + \frac{0.0482}{12}\right)^{12} = 1 + AER$$

AER =

$$1 + AER = e^{r_c}$$

$$\ln(1 + AER) = r_c$$

r for $\alpha(t)$, ATTEMPT 2

$\frac{dB}{dt} - \alpha B = -r$, multiply by IF : $e^{-\int \alpha dt}$

$$e^{-\int \alpha dt} B' - e^{-\int \alpha dt} \alpha B = -e^{-\int \alpha dt} r$$

$$\frac{d}{dt}\left[B e^{-\int \alpha dt}\right] = B' e^{-\int \alpha dt} + B e^{-\int \alpha dt}(-\alpha)$$

$$\Rightarrow B e^{-\int \alpha dt} = -\int r e^{-\int \alpha dt} + c$$

$$B = -e^{\int \alpha dt}\left[\int r e^{-\int \alpha dt} dt + C\right]$$

apply $t = 0 \Rightarrow B = B_0$

$$B_0 = -e^0 [0 + c]$$

$$\Rightarrow -B_0 = c$$

thus, $B = -e^{\int \alpha dt}\left[\int r e^{-\int \alpha dt} dt - B_0\right]$

$$B = e^{\int \alpha dt}\left[\int B_0 - r e^{-\int \alpha dt} dt\right]$$

$$\Rightarrow B = e^{\int \alpha dt}\left[B_0 - \int r e^{-\int \alpha dt} dt\right]$$

apply, $t = T \Rightarrow B = 0$

$$0 = e^{\int_0^T \alpha dt}\left[B_0 - \int_0^T r e^{-\int \alpha dt} dt\right]$$

$$0 = e^{\int_0^T \alpha\,dt}\left[B_0 - \int_0^T r e^{-\int \alpha\,dt}\,dt\right]$$

$$\Rightarrow B_0 - \int_0^T r e^{-\int \alpha\,dt}\,dt = 0$$

$$\Rightarrow B_0 = \int_0^T r e^{-\int \alpha\,dt}\,dt$$

need $f(t)$ s.t $\int_0^T f(t)\,dt = B_0$

Let $f(t) = B_0/T$, $\int_0^T B_0/T = B_0$ As Required

hence, $\int_0^T r e^{-\int \alpha\,dt}\,dt = \int_0^T B_0/T\,dt$

Since we are not attempting to determine any underlying $r(t)$, simply any satisfying the definite Integral, it is appropriate to state.

$$r e^{-\int \alpha\,dt} = B_0/T$$

$$\Rightarrow \underline{\underline{r(t) = B_0/T\, e^{\int \alpha\,dt}}}$$