$\frac{dy}{dt} + a(t).y = b(t).y^n$

The question says the above equation is multiplied by

$\mu(t) = \exp(\int a(t).dt)$ And could be re-written as below (I don't know why! But let's assume this is true)

Then we would have:

$\frac{d}{dt}(\mu(t).y) = \mu(t).b(t).y^n$

Could we now assume $\mu(t).y = \psi(\mu, y)$?

And rewrite the equation as :

$\frac{d}{dt}(\psi) = \frac{b(t)}{\mu(t)^{n-1}}.\psi^n$

And

$-\frac{b(t)}{\mu(t)^{n-1}} + \frac{1}{\psi^n}.\frac{d}{dt}(\psi) = 0$

Now could we say below?

$\frac{\partial\left(-\frac{b(t)}{\mu(t)^{n-1}}\right)}{\partial\psi} = 0$ and

$\frac{\partial\left(\frac{1}{\psi^n}\right)}{\partial t} = \frac{\partial((\mu(t).y)^{-n})}{\partial t} = -n(\mu(t).0 + y)(\mu(t).y)^{-n-1}$

And

$\frac{\frac{\partial\left(-\frac{b(t)}{\mu(t)^{n-1}}\right)}{\partial\psi} - \frac{\partial\left(\frac{1}{\psi^n}\right)}{\partial t}}{\frac{1}{\psi^n}} = \frac{n(\mu(t).0+y)(\mu(t).y)^{-n-1}}{(\mu(t).y)^{-n}} = \frac{n.\mu(t)^{-n-1}.y^{-n}}{\mu(t)^{-n}y^{-n}} =$

$\frac{n}{\mu(t)}$ *which is a function of* (t)

Therefore the integration factor should be $\exp\left(\int \frac{n}{\mu(t)}.dt\right)$

And we knew $\mu(t) = \exp(\int a(t).dt)$ so our integration factor becomes like this: $\exp\left(\int \frac{n}{\exp(\int a(t).dt)}.dt\right)$ Could we say such things? Or it is all wrong! I am really confused!