AFDS1Q1

Streamline: $\underline{r}$

They are tangential to velocity vector field. $\Rightarrow \frac{d\underline{r}}{ds} \times \underline{u} = 0$

for arbitrary parametrisation s.

IN CPC:

$$\frac{d\underline{r}}{ds} = \left(\frac{dR}{ds}, R\frac{d\varphi}{ds}, \frac{dz}{ds} \right)$$

$$\underline{u} = (u_R, u_\varphi, u_z)$$

It might be important to note here that while $\frac{d\underline{r}}{ds}$ is given in cylindrical polar coordinate form, $\underline{u}$ is not: while $Rd\varphi$ is the displacement of a streamline element in the φ direction, the velocity ~~[illegible]~~ in the φ direction is u_φ, not $u_R\, du_\varphi$, or something like that. $\underline{r}$ is intrinsically cylindrical, while $\underline{u}$ is just a local cartesian coordinate system. (I hope I am correct about this.)

$$\therefore \frac{dR}{u_R} = \frac{Rd\varphi}{u_\varphi}$$

CASE I

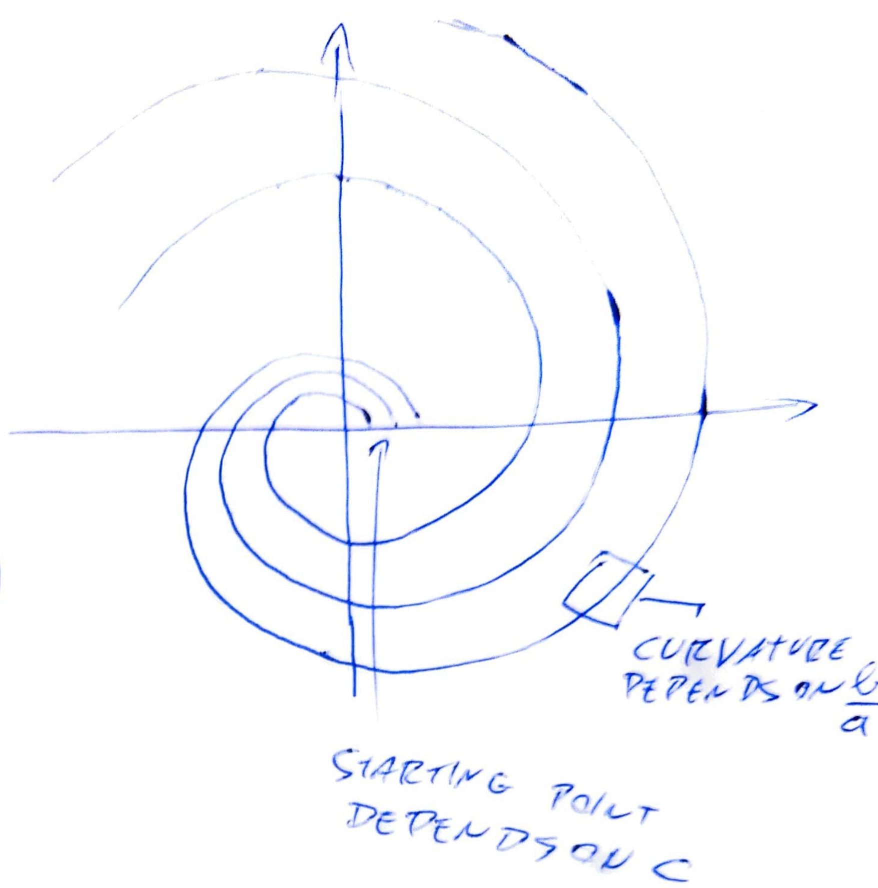
$\mu_\varphi = a, \quad \mu_R = b$.

$$\frac{dR}{b} = \frac{R\,d\varphi}{a}$$

$$\frac{dR}{R} = \frac{b}{a}\,d\varphi$$

$$\ln R = \frac{b}{a}\varphi + C$$

$$R = C \exp\left(\frac{b}{a}\varphi\right)$$



CASE II

$\mu_\varphi = aR^2 \quad \mu_R = bR^2$

$$\frac{dR}{bR^2} = \frac{R\,d\varphi}{aR^2}$$

Oh, it seems that the Rs just cancel.

So this is case I again.

Maybe I've done some steps wrong.