Problem 1:

$$
\begin{aligned}
& {\left[D_{\alpha}, D_{p}\right] \vee^{\lambda}} \\
& =P_{\alpha}\left(\partial_{\beta} v^{\lambda}+1^{-\lambda} \rho_{k} v^{k}\right)-(\alpha \leftrightarrow \beta) \\
& \left.=\partial_{\alpha}\right)_{\beta} V^{\lambda} \Gamma_{\beta \alpha}^{k} \partial_{k} L^{\lambda}+\Gamma_{\alpha \rho}^{\lambda} \partial_{\beta} L \rho \\
& +\left(\partial_{\alpha} \Gamma_{\beta+1}^{\lambda}\right) u^{k}+\Gamma_{\beta k}^{\lambda} \partial_{\alpha} \nu^{k} \\
& =\text { Syunctic } \\
& - \text {-drops out }+\Gamma_{\alpha \rho}^{\lambda} \Gamma_{\beta k} V^{k}-\Gamma_{\beta \alpha} \Gamma_{\rho_{k}}^{1} V^{k} \\
& -(\alpha \leftrightarrow \beta) \\
& =\left(\partial_{\alpha} T_{p k}^{\lambda}-\partial_{\rho} T_{\alpha k}^{\lambda}+\Gamma_{\alpha \rho}^{\lambda} \Gamma_{\beta k}^{\rho}\right. \\
& \left.-\Gamma_{\beta \rho}^{\lambda} \Gamma_{\alpha k}^{j}\right) V^{k} \\
& =-R_{\operatorname{sap}}^{\lambda} V^{*}
\end{aligned}
$$

Likewise: $\left[D_{\alpha_{1}} \nabla_{\beta}\right] T_{\mu v}$

$$
\begin{gathered}
=R_{\mu \alpha \beta}^{\rho} T_{\rho l}+R_{\nu \alpha \beta}^{\rho} T_{\mu \rho} \\
C_{\rho}\left[D_{\alpha}, D_{\beta}\right] g_{\mu \nu}=0 \quad\left(D_{\alpha} g_{\mu \nu}=0\right) \\
=R_{\nu \mu \alpha \beta}+R_{\mu \nu \alpha \beta} \\
\Rightarrow R_{\mu \omega \alpha \beta} \text { antisymmetric in } \mu \leftrightarrow L
\end{gathered}
$$

Problem 2:

$$
\begin{aligned}
& g_{\mu v}=\frac{\partial x^{*}}{\partial y^{*}} \frac{\partial x^{\beta}}{\partial y^{*}} q_{\alpha \beta} \\
& T_{v 1}^{\mu}=\frac{1}{2} g^{\mu k}\left\{\frac{\partial g_{n \lambda}}{\partial g_{i}}+\frac{\partial g k}{\partial g^{\prime} \lambda}-\frac{\partial g_{v \lambda}}{\partial g^{k}}\right\} \\
& \frac{\partial g_{k t}}{\partial y^{l}}=\left(\frac{\partial^{2} x^{\alpha}}{\partial y^{k} \partial y^{v}} \frac{\partial x \beta}{\partial y^{\lambda}}+\frac{\partial x^{\alpha}}{\partial y^{k}} \frac{\partial^{2} x \beta}{\partial y^{\lambda} \partial y^{l}}\right) \eta_{k \beta} \\
& + \text { Kb-入 }+k-\lambda v \\
& +v \lambda-k+v=\lambda k \\
& -v k \rightarrow \lambda+\frac{v-\lambda_{k}}{} \\
& F_{v \lambda}^{\mu}=y^{\mu n} \frac{\partial^{2} x^{\alpha}}{\partial y^{\nu} \partial y^{\lambda}} \frac{\partial x^{\beta}}{\partial y^{k}} \quad_{\alpha \beta}
\end{aligned}
$$

$R_{p v k \lambda} \ni \frac{1}{2}\left\{\begin{array}{l}\partial^{2} \mu k k \\ \partial^{v} \partial y^{2}\end{array}+\right.$ 3pem $\}$

$$
\begin{aligned}
\frac{\partial g \mu k}{\partial y^{\imath} \partial y^{\lambda}}= & \frac{\partial^{2} x^{\alpha}}{\partial y^{\alpha} \partial y^{\imath} \partial y^{\lambda}} \frac{\partial x^{\beta}}{\partial y^{k}} \varphi \alpha \beta * \\
& +\frac{\partial^{3} x \beta}{\partial y^{\lambda} \partial y^{\prime} \partial y^{\prime}} \frac{\partial x^{\alpha}}{\partial y^{\mu}} \eta_{\alpha \beta}^{*}
\end{aligned}
$$

$$
\begin{aligned}
& +\frac{\partial^{2} x^{\alpha}}{\gamma y^{\mu} \partial y^{v}} \frac{\partial^{2} x \beta}{\partial y^{*} \partial y^{\lambda}} \eta \alpha \beta \\
& +\frac{\partial^{\prime} x^{\alpha}}{\partial y^{\mu} \partial y^{\lambda}} \frac{\partial^{2} x \beta}{\partial y^{k} \partial y^{2}} y_{\alpha \beta} \\
& R_{\mu \nu k \lambda} \rightharpoonup k^{\prime}\left\{\begin{array}{l}
\partial^{2} \times \alpha \\
\partial y^{\mu} \partial y^{\prime}
\end{array} \frac{\partial^{2} x \beta}{\partial y^{v} \partial y^{k}}-\frac{\partial^{2} \alpha}{\partial y^{v} \partial y^{\lambda}} \frac{\partial^{2} x \beta}{\partial y^{\prime \prime 2} \partial y^{n}}\right. \\
& \left.-\frac{\partial^{2} x^{\alpha}}{\partial y y^{2}} \frac{\partial^{2} x \beta}{\partial y^{2} \partial y t}+\frac{\partial x^{\alpha}}{\partial y^{v} \partial y^{k}} \frac{\partial x \beta}{\partial y^{2} y^{2}}\right\} \mid \eta_{\alpha \beta} \\
& R_{\mu+\lambda \lambda} \circ g_{g \sigma}\left(\Gamma_{j k}^{\rho} \Gamma_{v \lambda}^{\sigma}-\Gamma \rho_{\mu \lambda} \Gamma_{v k}^{\sigma}\right) \\
& \Gamma S_{\mu^{*}}=g^{\delta \delta} \frac{\partial^{2} \alpha}{\partial y^{\alpha} \partial y^{\alpha}} \frac{\partial x^{\beta}}{\partial y^{\delta}} \quad q_{\alpha \beta}
\end{aligned}
$$

$$
\begin{aligned}
& \left.x \eta_{\alpha \beta} \eta_{\gamma \epsilon} \quad-\frac{\partial^{2} x^{\alpha}}{\partial \rho \partial y^{\lambda}} \frac{\partial x^{\beta}}{\partial y^{\rho}} \frac{\partial^{2} x^{\gamma}}{\partial y^{\star} \partial y^{k} x^{*} \partial y^{\sigma}}\right\} \\
& x \quad g^{j \sigma} \frac{\partial x \beta}{\partial y^{\rho}} \frac{\partial x^{\epsilon}}{\partial y^{\sigma}}=\delta_{\alpha}^{\beta} \delta_{\delta}^{\epsilon} \quad q^{\alpha \delta}=q^{\beta \epsilon} \\
& y^{g \sigma}=\frac{\partial y^{\rho} 2 y^{\sigma}}{\partial x^{\sigma}} \frac{y^{\sigma}}{\partial x^{2}} q^{\alpha \delta}
\end{aligned}
$$

$$
\begin{aligned}
& \eta_{\alpha \beta} \eta_{\gamma \epsilon} q^{\beta \epsilon}=\eta_{\alpha \gamma} \\
& \eta_{\alpha \gamma}\left\{\frac{\partial^{\alpha} \alpha}{\partial y^{\alpha} \partial y^{*}} \frac{\partial^{2} x^{\gamma}}{\partial y^{2} \partial y^{\lambda}}-\frac{\partial^{2} x^{\alpha}}{\partial y^{\beta} \partial y^{\lambda}} \frac{\partial^{L} \gamma}{\partial y^{n} \partial_{y} L}\right\} \\
& Q_{\mu v \pi \lambda}=0
\end{aligned}
$$

Problem 3:
Where things go wrong is in the following step

$$
\gamma_{\alpha \beta}=\frac{\partial x^{\alpha}}{\partial y^{\alpha}} \frac{\partial x^{\omega}}{\partial y^{\beta}} q_{l-}
$$

there are $2 \times 3$ madicer.!

$$
\gamma^{\alpha \beta}=\frac{\partial y^{\alpha}}{\partial x \alpha} \frac{\partial y^{\beta}}{\partial x \nu} q^{\alpha c}
$$

this does not exist for enbeddry!
$P^{\prime}{ }_{k}$ is a projectioc opeator!'

$$
\begin{aligned}
& P^{2}=P \quad P_{k}^{\mu} D_{\lambda}^{*}=P_{-1}^{\mu}
\end{aligned}
$$

$$
\begin{aligned}
& \gamma_{p \beta} \\
& =\underbrace{\gamma^{\alpha \beta} \gamma_{\beta \gamma} \gamma^{\gamma} \frac{\partial x^{\beta}}{\partial y^{\alpha}} \frac{\partial x \rho}{\partial y^{\delta}}\langle\rho \lambda}_{\gamma^{\alpha \delta}}=p^{\gamma} t \\
& \gamma^{\alpha \delta} \quad \delta_{\beta-3^{k}}^{\lambda} \delta^{k} \mu^{\mu}=\delta^{-1} \mu \\
& \operatorname{Tr} P, \quad \delta_{\mu}^{\lambda} P_{\lambda}^{\lambda}= \\
& \gamma^{\alpha \beta} \frac{\partial y^{\beta}}{\partial y^{\alpha}} \underbrace{\frac{\partial x^{n}}{\partial y_{\rho}} \underbrace{\eta_{k j} \delta^{\beta}}_{\lambda^{\alpha}} \underbrace{\eta_{k \mu}}_{\mu}}_{\gamma^{\alpha \beta}} \\
& =\gamma^{\alpha \beta} \gamma_{\alpha \beta}=\delta_{k L^{\alpha}}^{\alpha}=\text { din of enb. }
\end{aligned}
$$

$$
\begin{aligned}
\alpha, \beta, \delta, & \in\{1,2\} \quad \mu, v, * \lambda \in\left\{1,2,3 \delta^{\prime}\right. \\
R_{\alpha \rho \gamma \delta} & =\left(\frac{\partial^{2} x^{\alpha}}{\partial y^{\alpha} \partial y \delta} \frac{\partial^{2} x^{v}}{\partial \rho \mu \partial \gamma}-\frac{\partial^{2} \times 1}{\partial y^{\alpha} \partial y^{\gamma}} \frac{\partial^{2} x^{v}}{\partial y^{\beta} \partial \partial \gamma}\right) \\
& \notin\left(-\eta_{\mu v}+P_{\mu v}\right)
\end{aligned}
$$

P is a projection on the tangent space:

$$
\begin{aligned}
& \rho^{\mu} \nu \frac{\partial x^{\nu}}{\partial y^{\alpha}}=\frac{\partial x^{\mu}}{\partial y^{\alpha}}
\end{aligned}
$$

$$
\begin{aligned}
& { }_{\delta}^{\gamma}-\gamma \beta \alpha \\
& \delta_{\alpha}^{\gamma} \\
& \bar{p}_{v}^{r}=\left(\delta_{v}^{\mu}-A_{v}^{\gamma}\right)= \\
& \bar{P}_{v}^{\mu} \bar{P}_{k}^{r}=\delta_{k}^{\mu}-2 P_{k}^{\mu}+P_{k}^{\mu} p_{k}^{2} \\
& =\delta \Gamma_{k}-P_{k}^{\mu}=\bar{P} \mu_{k}^{P_{k}^{\mu}} \\
& \overline{T r} \bar{D}_{L}^{\mu}=\delta_{\mu}^{L} \quad \bar{A}_{\nu}^{\mu}=3-\delta_{\mu}^{L} A_{c}^{a} \\
& \pm 1
\end{aligned}
$$

So it's a 1-dim projection operator:

$$
\begin{gathered}
\bar{P}_{k}^{\mu}=v^{\mu} v_{k} \equiv h^{\mu} \eta_{k} \\
\overline{P \mu_{k}}{ }_{k}=n^{\mu} \\
R_{\alpha \beta \gamma \delta}=-\left(M_{\alpha \gamma} M_{\beta \gamma}-M_{\alpha \gamma} M_{\rho \gamma}\right)
\end{gathered}
$$

