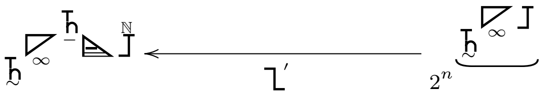


$$\ni \ell^{J} = \bigwedge_{j \in J} \ell^{j} \quad \text{dual standard basis}$$

$$\ell^{*I}\, \ell^{J} = \det\, \ell^{*i}\, \ell^{j} = \det\, {}_{i}\delta^{j} = {}_{I}\delta^{J} = {}_{I}\ell\, \ell^{J}$$

$$\ell^{*I} = {}_{I}\ell$$

$$\ell^{I} \bowtie \ell^{J} = \ell^{*I}\, \mathring{\eta}\, \ell^{J} = \det\, \ell^{i} \bowtie \ell^{j} = \det\, {}_{i}\eta^{j} = {}_{I}\eta^{J} = {}_{I}\mathring{\eta}^{J}$$

$$\bowtie\, {}_{I}\ell = \ell^{I}\, {}_{I}\eta^{I}$$

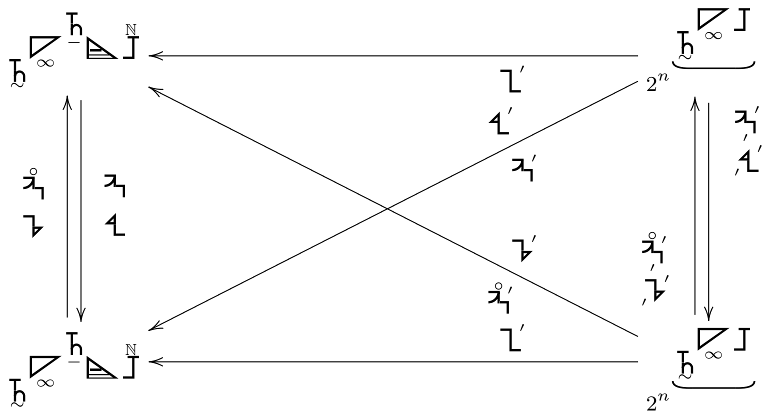
$$\ell^{I} = (\bowtie {}_{I}\ell)\, {}_{I}\eta^{I}$$

$$* \ell^{I} = \ell^{N \llcorner I}\, \overline{I > N \llcorner I}\, {}_{I}\eta^{I}$$

$$_{M}\ell\, \ell^{N} = \det\left({}_{\mu}\ell\, \ell^{\nu}\right) = \det\, {}_{\mu}\delta^{\nu} = {}_{M}\delta^{N}$$

$$\ell^{*I}\, \ell^{J} = \det\, \ell^{*i}\, \ell^{j} = \det\, {}_{i}\delta^{j} = {}_{I}\delta^{J} = {}_{I}\ell\, \ell^{J}$$

$$\ell^{*I} = {}_{I}\ell$$



$$\ell^{*I} \bowtie \ell^{J} = \begin{cases} \ell^{*I}\, \ell^{J} & = {}^{IJ} \\ \ell^{*I}\, \ell^{J} & = {}_{I}\ell\, \ell^{J} = \det\, \ell^{i} \bowtie \ell^{j} = \det\, {}_{I}{}^{J} = {}_{I}{}^{J} \end{cases}$$

$$\overset{z}{\bowtie}\, {}_{J}\ell = \sum_{|I| = |J|} \ell^{I}\, {}^{z}_{I}{}^{J}$$

$$[\text{illegible}]^J = \sum_{|I|=|J|} \left(\overset{z}{[\text{illegible}]}\, {}_I[\text{illegible}] \right) {}_I[\text{illegible}]^J_z$$

$${}_M[\text{illegible}] \sum_I [\text{illegible}]^I \; {}_I[\text{illegible}]^J = \sum_I {}_M\delta^I \; {}_I[\text{illegible}]^J = {}_M[\text{illegible}]^J = {}_M[\text{illegible}] \; [\text{illegible}] \; {}_J[\text{illegible}]$$

$${}_M[\text{illegible}] \, [\text{illegible}]^J = {}_M\delta^J = \det{}_M \left([\text{illegible}]_z \, {}^z[\text{illegible}] \right)^J = \sum_{|I|=|J|} {}_M[\text{illegible}]^I_z \; {}^z_I[\text{illegible}]^J = \sum_I \left({}_M[\text{illegible}] \, [\text{illegible}] \, {}_I[\text{illegible}] \right) {}^z_I[\text{illegible}]^J$$

$$\overset{z}{[\text{illegible}]} \, {}_I[\text{illegible}] = [\text{illegible}]^I \; {}_I\eta^I$$

$$[\text{illegible}] \, [\text{illegible}]^I = \left({}_I[\text{illegible}] \right) {}_I\eta^I$$

$$[\text{illegible}] \ni \begin{cases} [\text{illegible}]^J & = [\text{illegible}]_9[\text{illegible}] \\ [\text{illegible}]^J & = \underset{j \in J}{[\text{illegible}]} [\text{illegible}]^j = [\text{illegible}]\,[\text{illegible}]^J \end{cases} \text{ dual ONBasis}$$

$$\begin{cases} [\text{illegible}] & = [\text{illegible}]^I \, {}_I[\text{illegible}] \\ [\text{illegible}] & = [\text{illegible}]^I \, {}_I[\text{illegible}] \end{cases}$$

$$\begin{cases} [\text{illegible}]^I \, [\text{illegible}] \, [\text{illegible}]^J = [\text{illegible}] = \cdots = [\text{illegible}] \\ [\text{illegible}]^I \, [\text{illegible}] \, [\text{illegible}]^J = \det [\text{illegible}]^i \left([\text{illegible}] \eta [\text{illegible}] \right) [\text{illegible}]^j = \det \left([\text{illegible}]^i \right) \eta \left([\text{illegible}]^j \right) = \det {}_i[\text{illegible}] \eta [\text{illegible}]^j = \cdots = [\text{illegible}] \end{cases}$$

$$\underset{z}{[\text{illegible}]} \, [\text{illegible}]^I = [\text{illegible}]^{N \llcorner I} \; \overline{I > N \llcorner I} \; {}_I\eta^I$$

$$\underset{z}{[\text{illegible}]} \, [\text{illegible}]^J = \sum_{|I|=|J|} [\text{illegible}]^{N \llcorner I} \; \overline{I > N \llcorner I} \; {}_I[\text{illegible}]^J_z \left({}_N\eta^N / {}_N[\text{illegible}]^N_z \right)^{1/2}$$

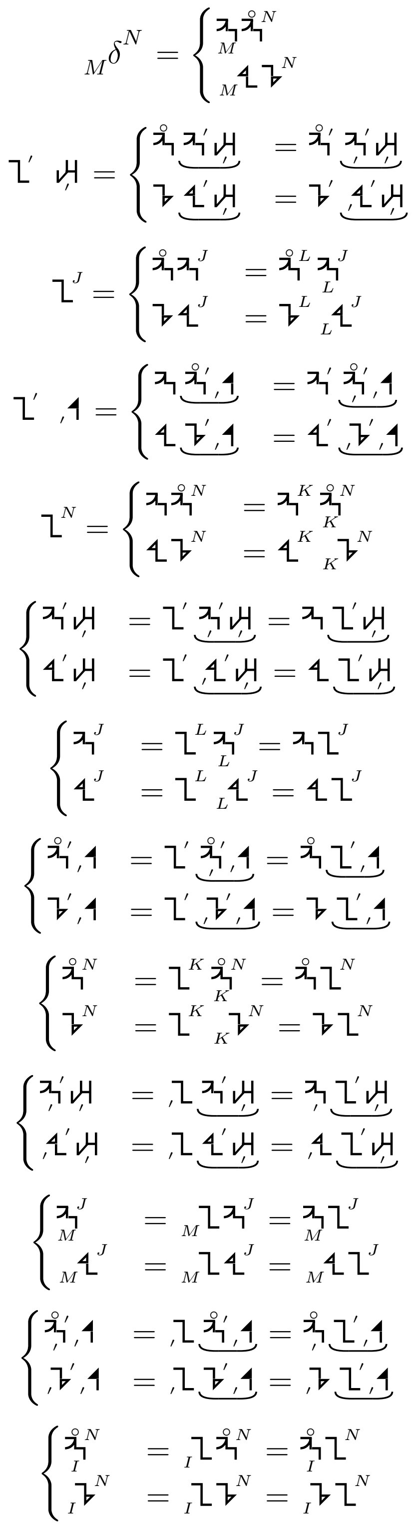
$$[\text{illegible}]^N = c \, [\text{illegible}]^N$$

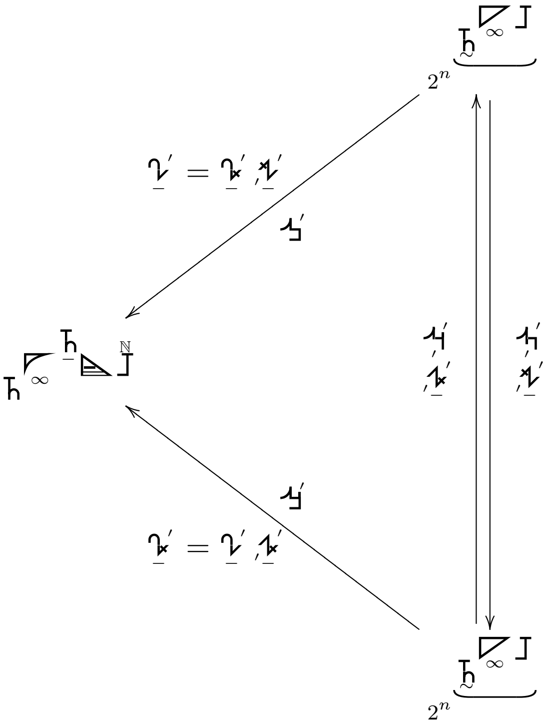
$${}_N\eta^N = [\text{illegible}]^N \, \underset{z}{[\text{illegible}]} \, [\text{illegible}]^N = c^2 \, [\text{illegible}]^N \, \underset{z}{[\text{illegible}]} \, [\text{illegible}]^N = c^2 \, {}_N[\text{illegible}]^N_z \implies \text{LHS} = \sum_I \underbrace{{}_I[\text{illegible}] \vDash [\text{illegible}]^N} \, {}_I[\text{illegible}]^J_z = \sum_I {}_I[\text{illegible}] \vDash [\text{illegible}]^N \left({}_N\eta^N / {}_N[\text{illegible}]^N_z \right)^{1/2} {}_I[\text{illegible}]^J_z = \text{RH}$$

$$[\text{illegible}] = \begin{cases} [\text{illegible}] \, \underbrace{[\text{illegible}]' \, [\text{illegible}]} \\ {}_{,}[\text{illegible}] \, \underbrace{[\text{illegible}]' \, [\text{illegible}]} \end{cases}$$

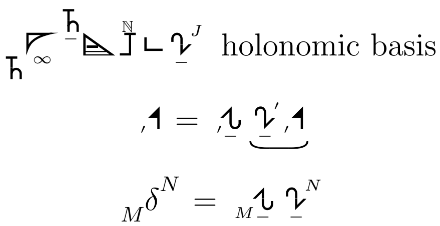
$${}_I\delta^J = \begin{cases} {}_I[\text{illegible}] \, [\text{illegible}]^J \\ {}_I[\text{illegible}] \, [\text{illegible}]^J \end{cases}$$

$${}_{,}[\text{illegible}] = \begin{cases} [\text{illegible}] \, \underbrace{[\text{illegible}]' \, {}_{,}[\text{illegible}]} \\ {}_{,}[\text{illegible}] \, \underbrace{[\text{illegible}]' \, {}_{,}[\text{illegible}]} \end{cases}$$

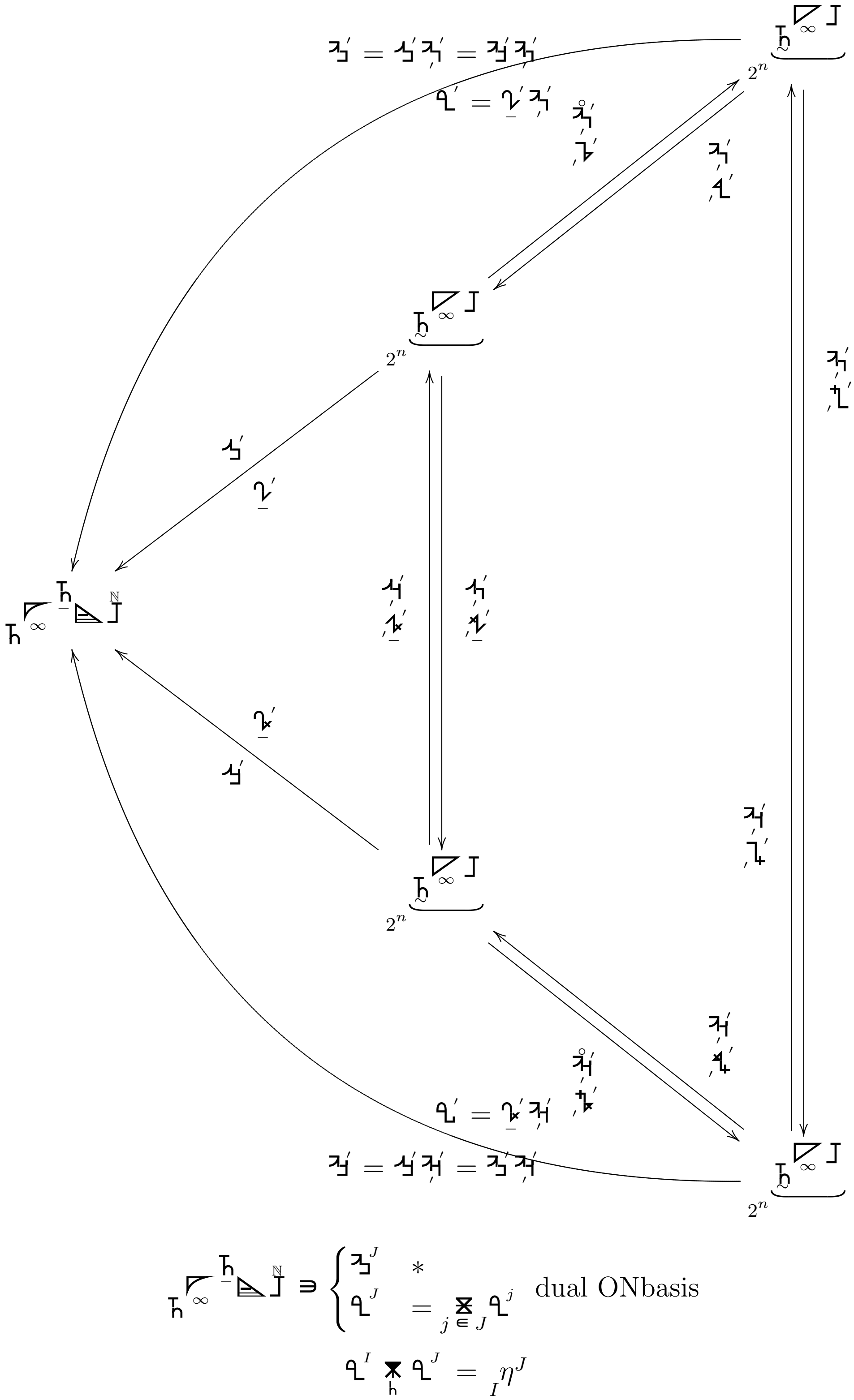




2^n
2^n



holonomic basis


dual ONbasis