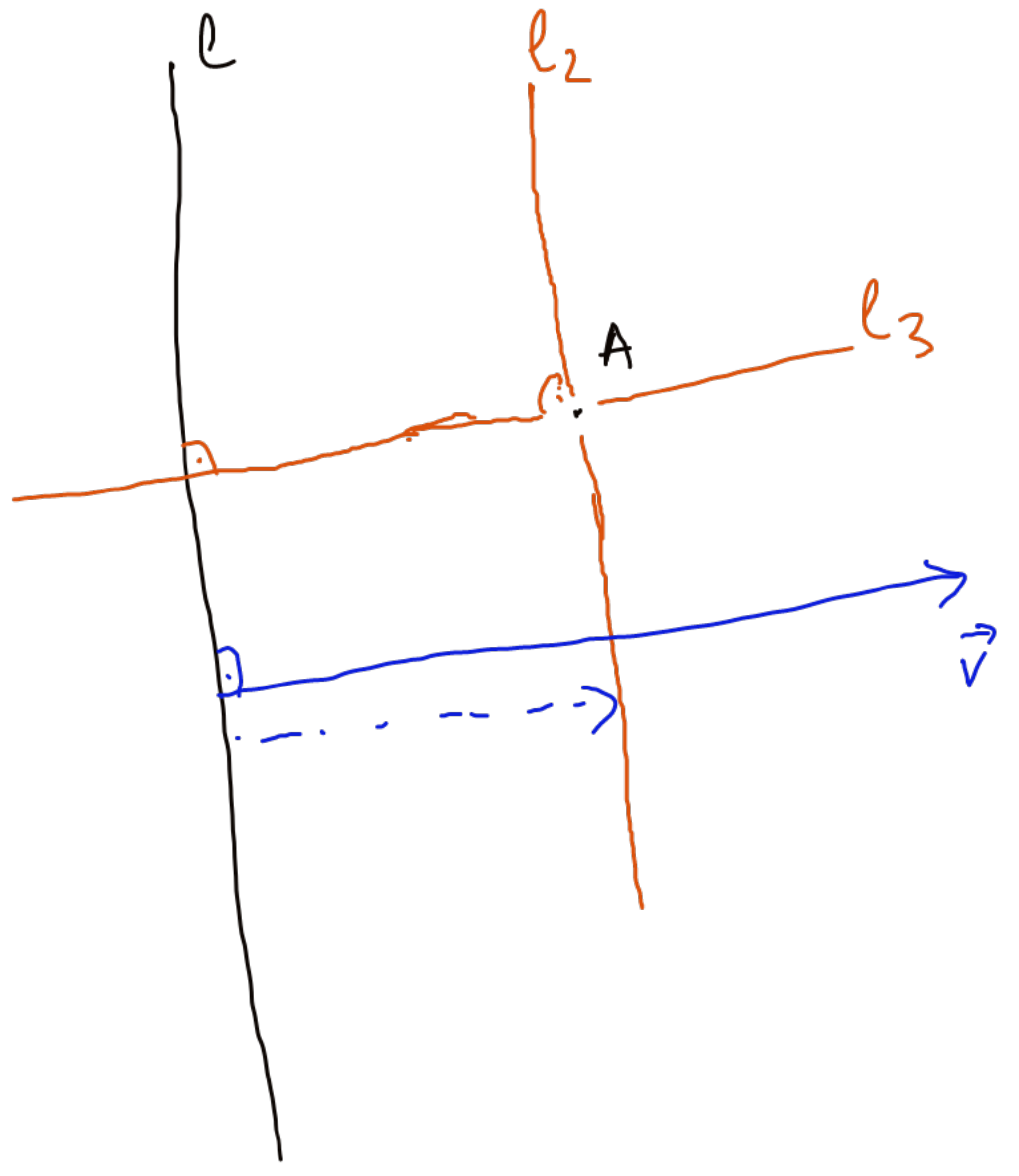


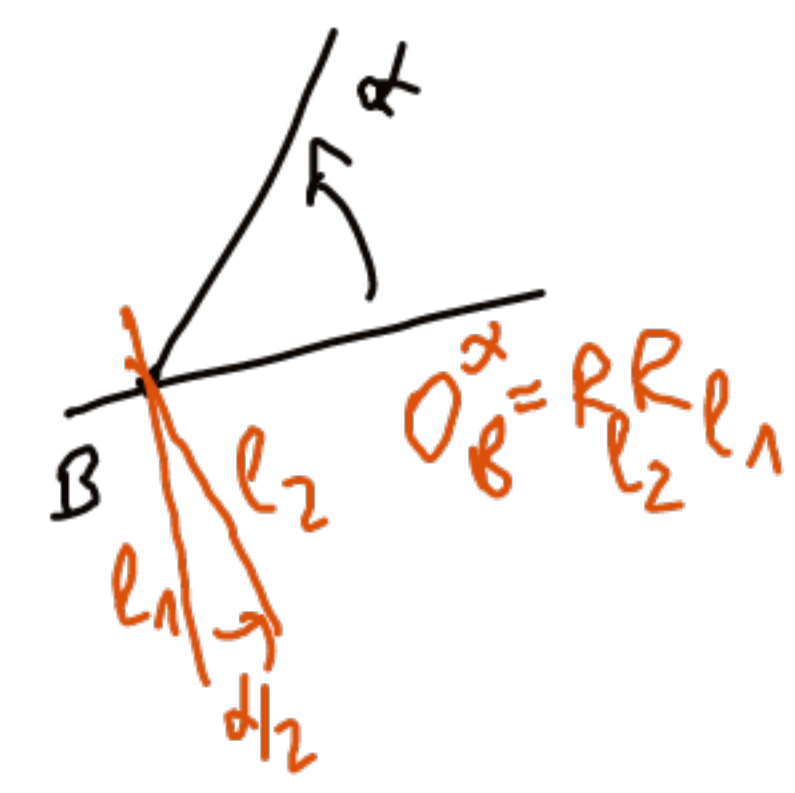
$\frac{v}{3}$ $R_{\ell} H_A =$
 \underbrace{RR}

$A \neq \ell$

$= R_{\ell} R_{\ell_2} R_{\ell_3} =$
 $= \underbrace{R_{\ell} R_{\ell_2}}_{G} R_{\ell_3} = G \vec{v}$



$\vec{v} \parallel \ell_3$



v/A

$$O_A^\alpha G_{\vec{v}}^l = \underbrace{R_{l_2} R_{l_1}}_{O_A^\alpha} R_{l_2} T_{\vec{v}} =$$

$A \in l$

$$= R_{l_2} T_{\vec{v}} =$$

$$= R_{l_2} T_{\vec{v}_2} T_{\vec{v}_1} =$$

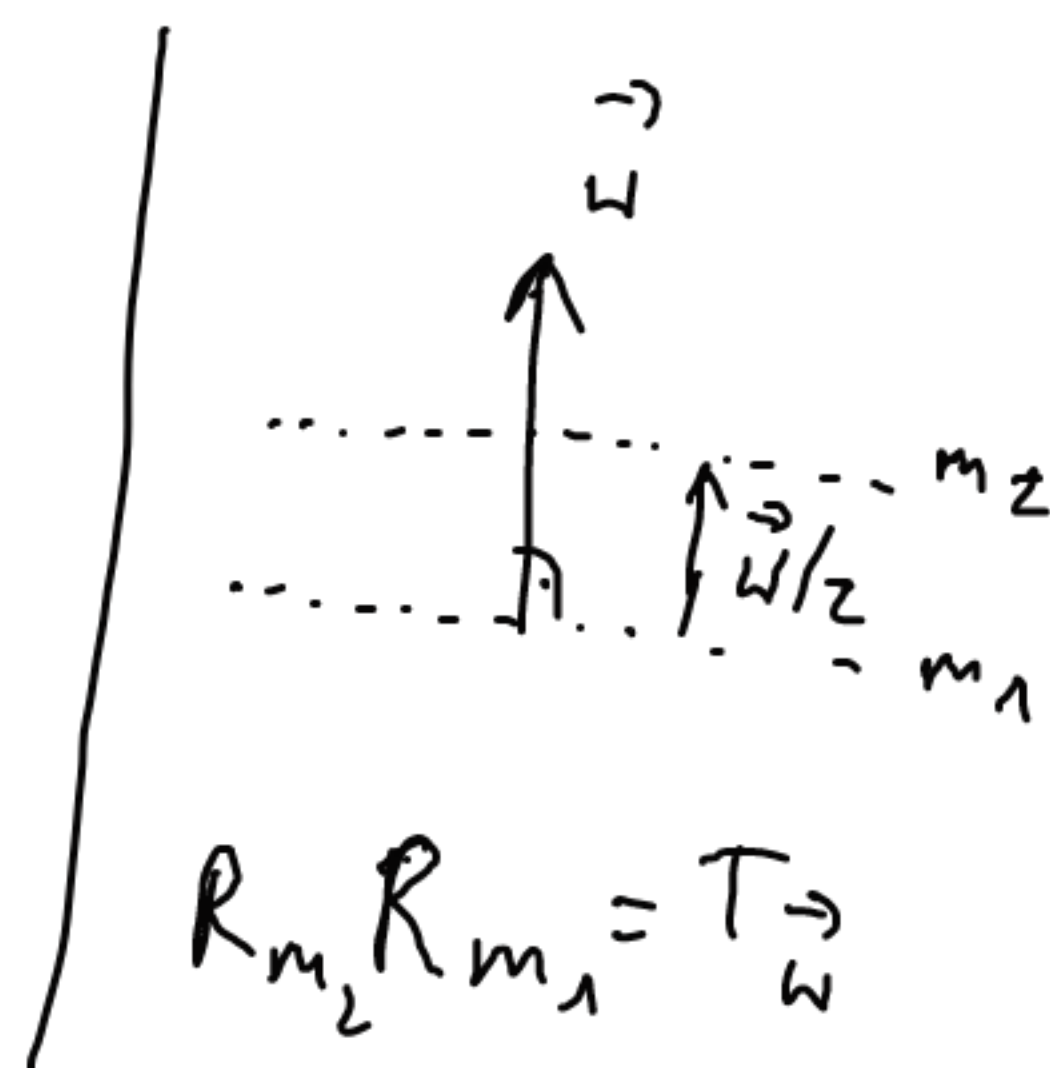
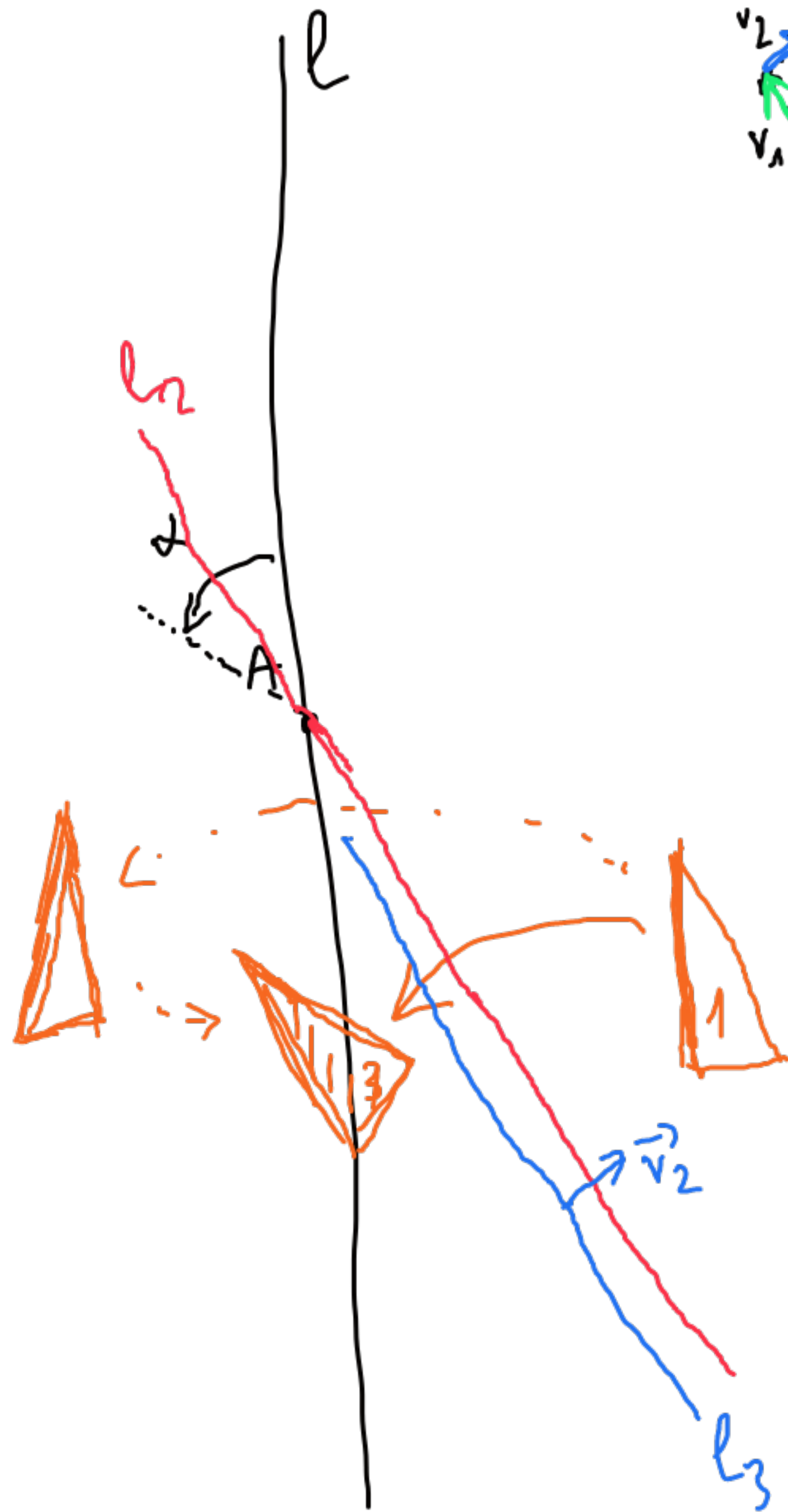
$$= \underbrace{R_{l_2} R_{l_2}}_{R_{l_3}} T_{\vec{v}_1} =$$

$$= R_{l_3} T_{\vec{v}_1} = \underline{\underline{G_{\vec{v}_1}^{l_3}}}$$



$$\vec{v} = \vec{v}_1 + \vec{v}_2$$

$$\vec{v}_1 \parallel l_2, \vec{v}_2 \perp l_2$$



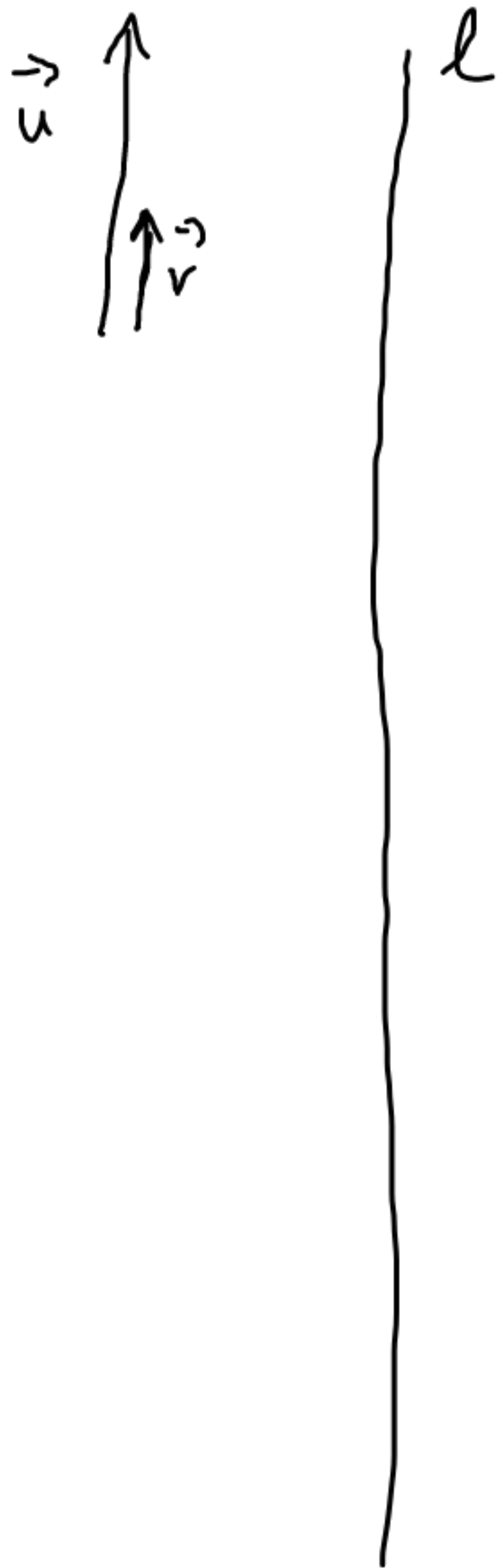
$$R_{m_2} R_{m_1} = T_{\vec{w}/2}$$

$$\frac{v/8}{\vec{u}} G_{\vec{u}}^l T_{\vec{v}} =$$

$$\vec{u} \parallel \vec{v}$$

$$= R_{\ell} T_{\vec{u}} T_{\vec{v}} =$$

$$= R_{\ell} T_{\vec{u}+\vec{v}} = G_{\vec{u}+\vec{v}}^l$$



$v \perp u$

$$G_{\vec{u}}^l T_{\vec{v}} =$$

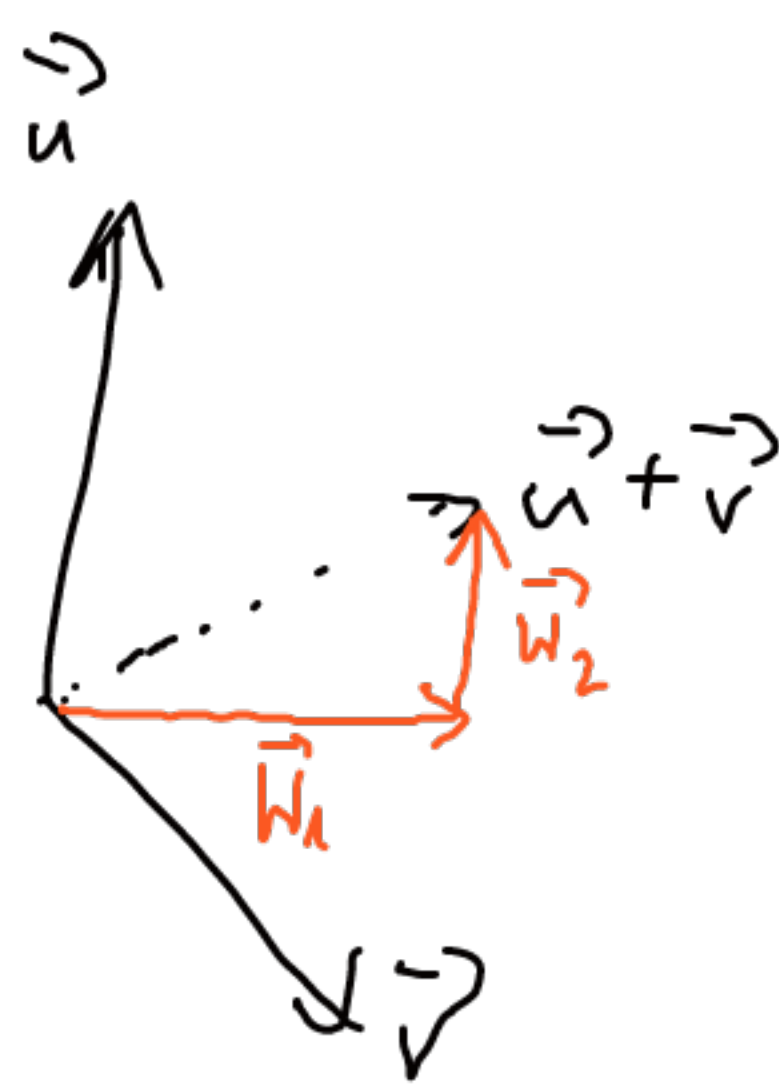
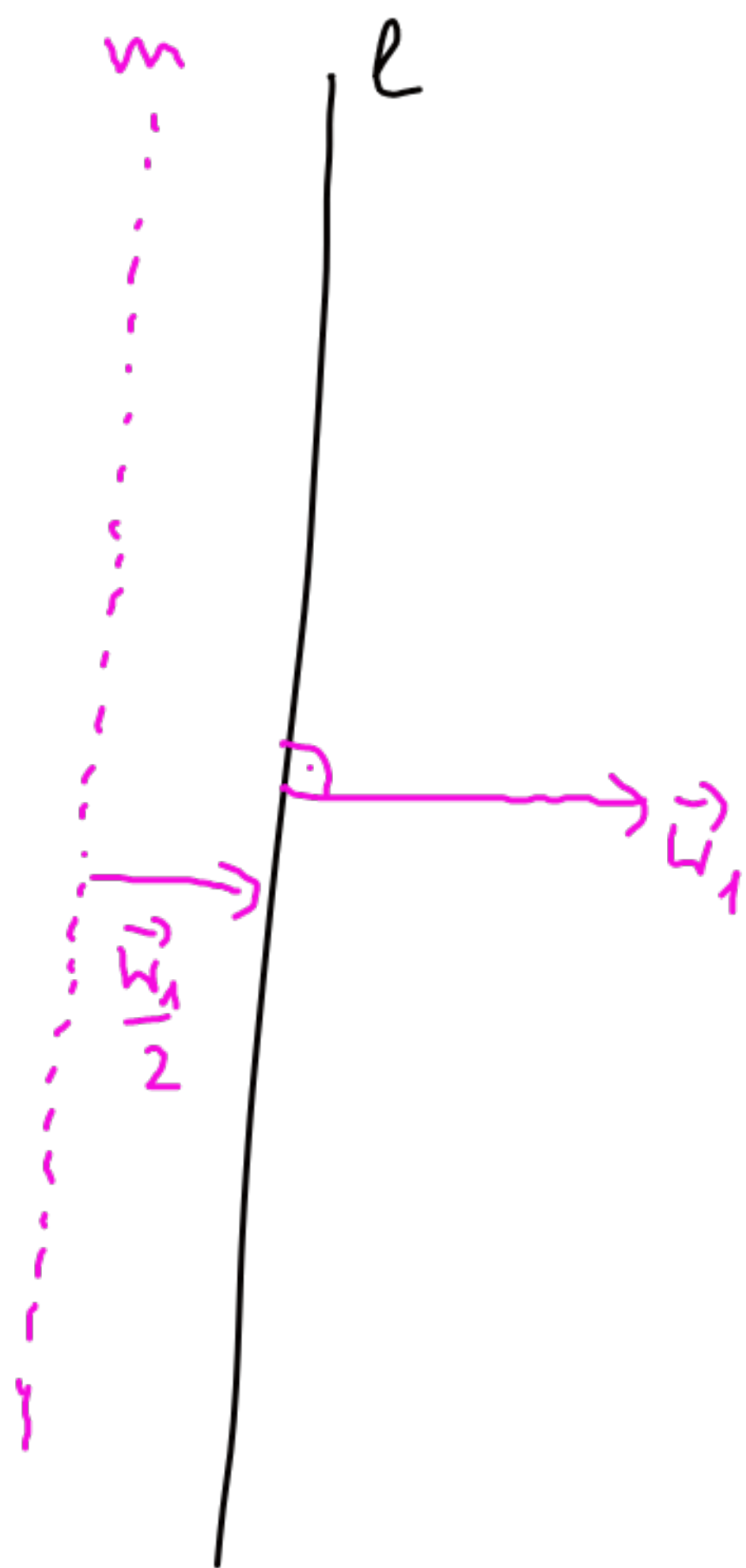
$\vec{u} \perp \vec{v}$

$$= R_e T_{\vec{u}} T_{\vec{v}} = R_e T_{\vec{u}+\vec{v}} =$$

$$= R_e T_{\vec{w}_1} T_{\vec{w}_2} =$$

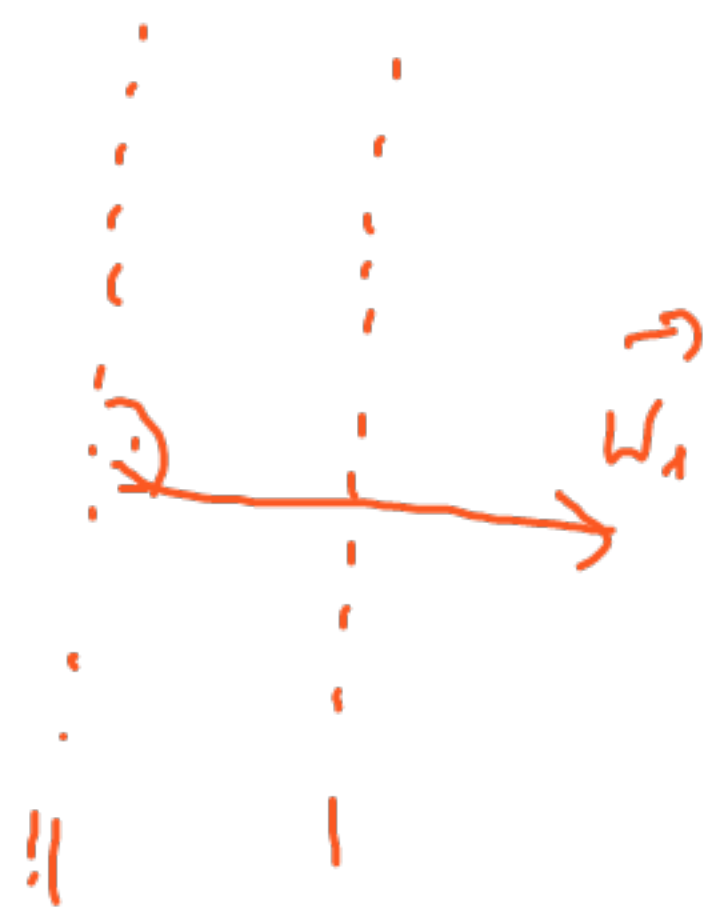
$$= R_e R_e R_m T_{\vec{w}_2} =$$

$$= R_m T_{\vec{w}_2} = G_{\vec{w}_2}^m$$

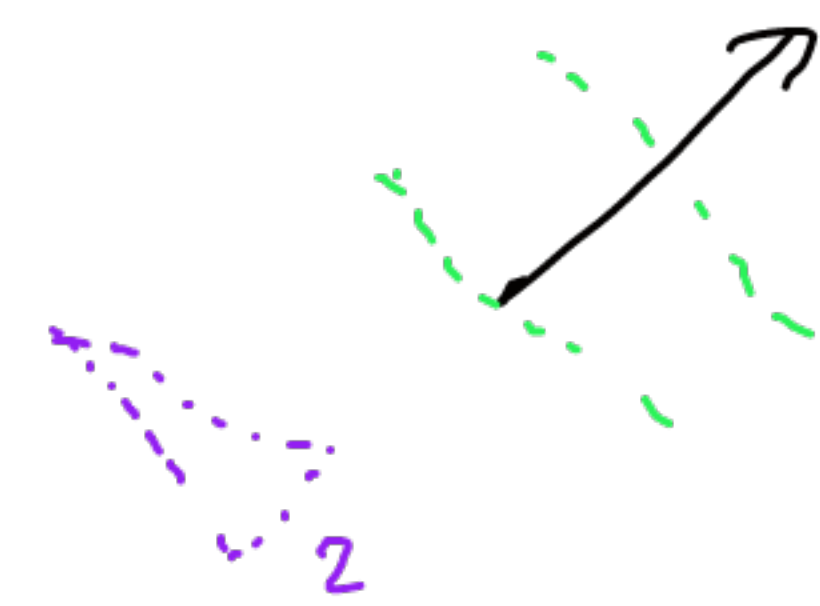
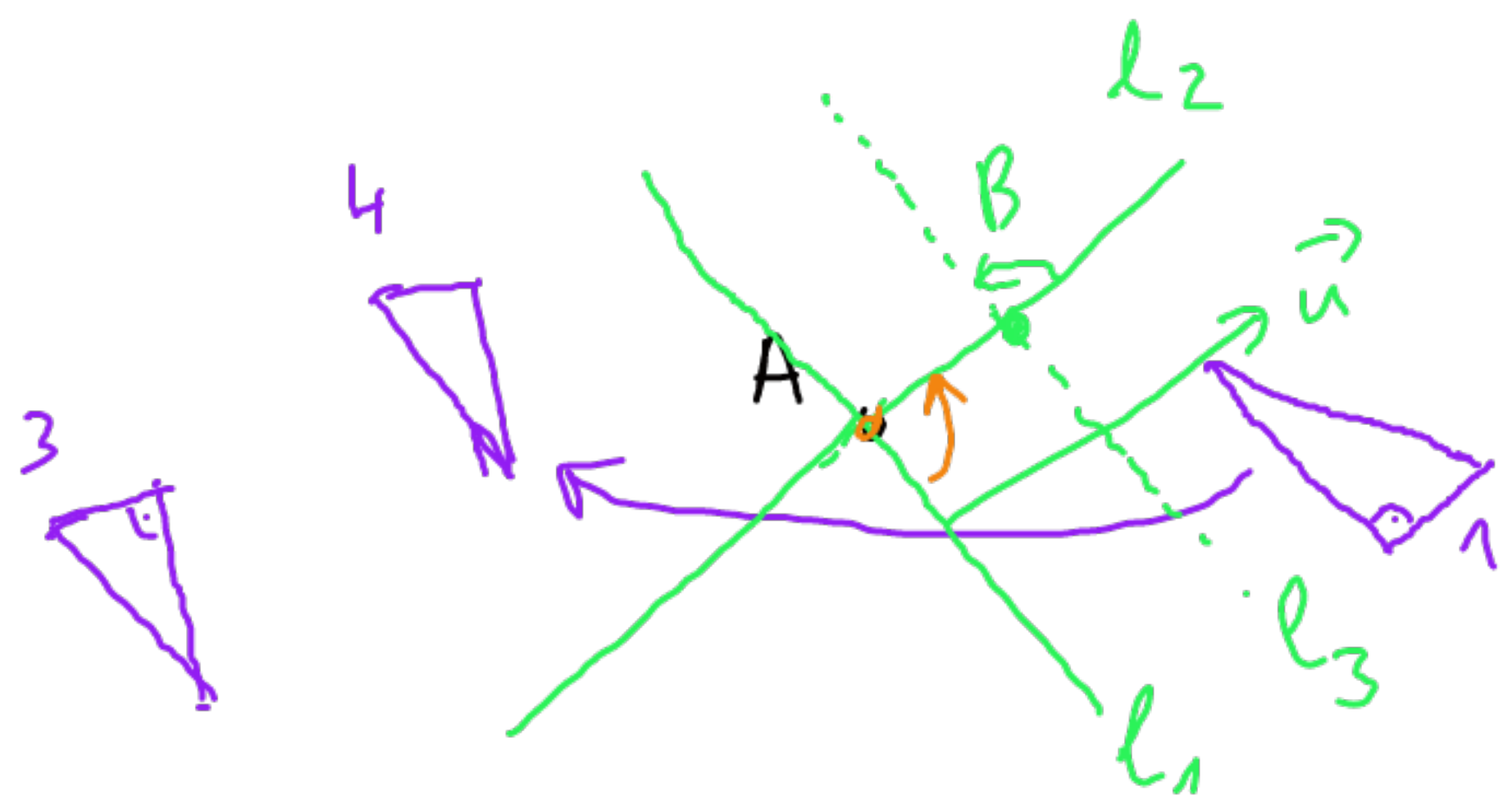


$$(\vec{u} + \vec{v}) = \vec{w}_1 + \vec{w}_2$$

$$\vec{w}_1 \perp l, \vec{w}_2 \parallel l$$



$\frac{v_1/2}{T_u H_A T_u} = \underbrace{R_{l_3} R_{l_1} R_{l_1} R_{l_2}}_{T_u} T_u = \underbrace{R_{l_3} R_{l_2}}_{H_B} T_u = H_B T_u = \underbrace{R_{l_2} R_{l_3}}_{H_B} \underbrace{R_{l_3} R_{l_1}}_{T_u} = R_{l_2} R_{l_1} = O_A^{180^\circ} = H_A$

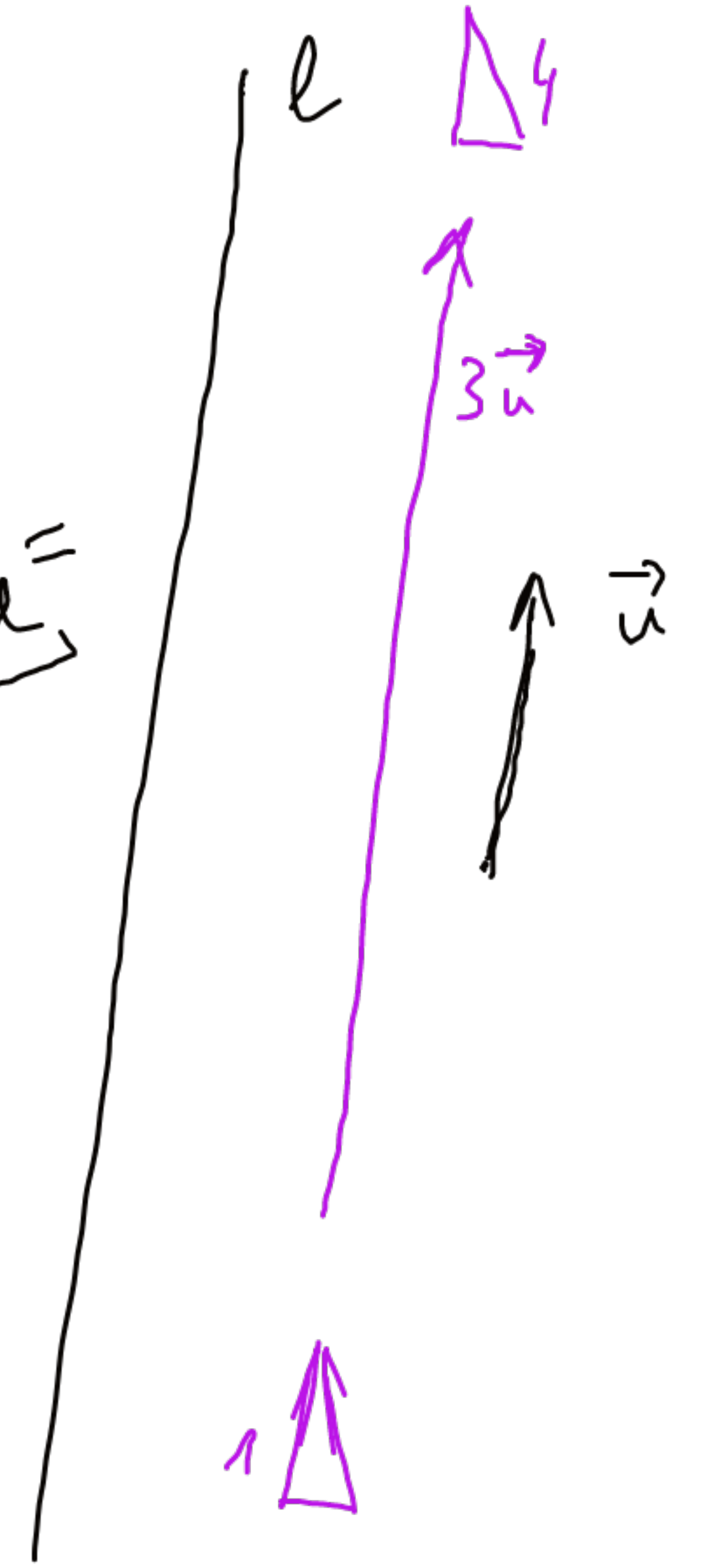


$$\frac{v/3}{G_{\vec{u}}^l T_{\vec{u}} G_{\vec{u}}^l =}$$

$$= R_l T_{\vec{u}} T_{\vec{u}} T_{\vec{u}} R_l =$$

$$= R_l T_{3\vec{u}} R_l = T_{3\vec{u}} R_l R_l =$$

$$= T_{3\vec{u}}$$



$$\frac{v}{5} \quad \boxed{T_u G_v^l T_u} =$$

$$\vec{u} \times \vec{v} = T_u R_l \overbrace{T_v T_u} =$$

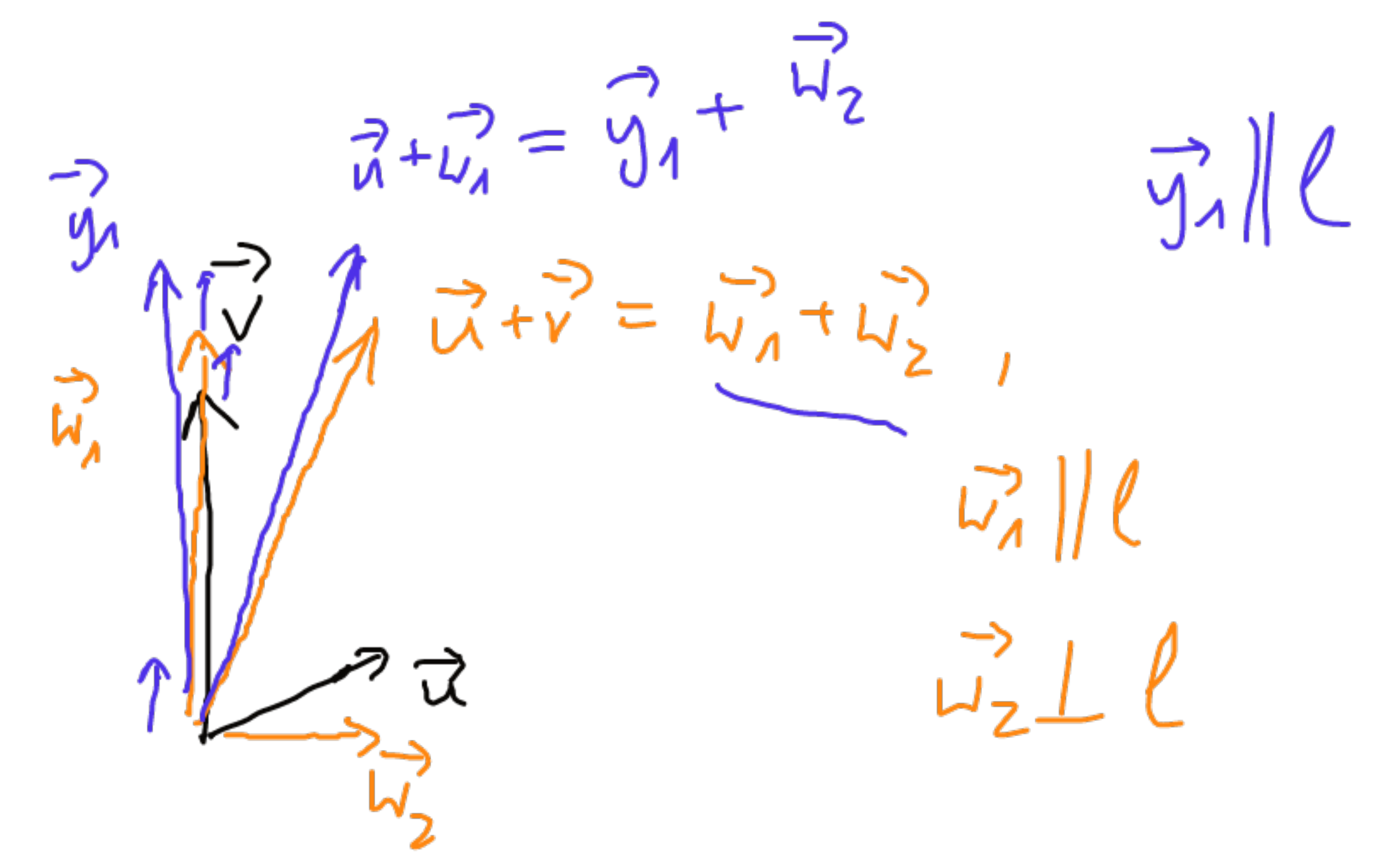
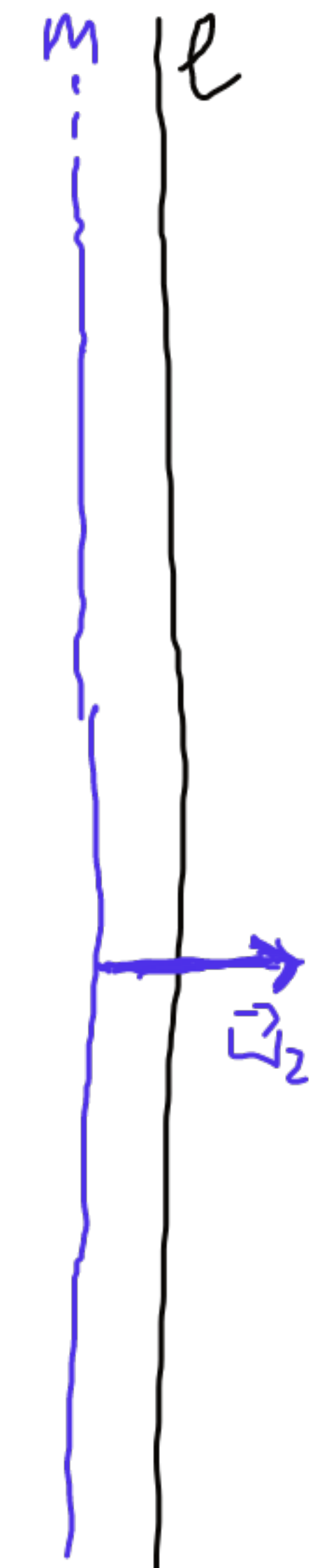
$$= T_u R_l T_{u+v} = T_u R_l T_{\vec{w}_2} T_{\vec{w}_1} =$$

$$= T_u R_l R_l R_m T_{\vec{w}_1} =$$

$$= T_u R_m T_{\vec{w}_1} = T_u G_{\vec{w}_1}^m =$$

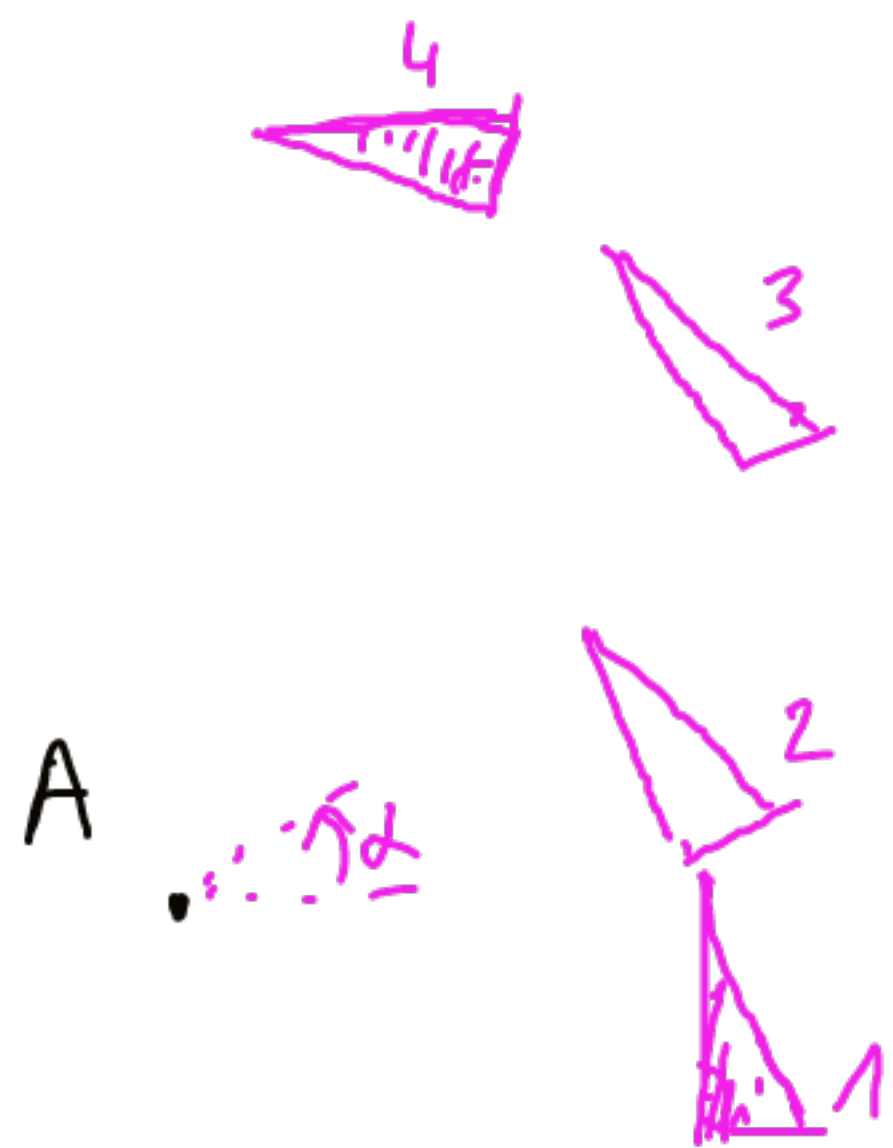
$$= T_u T_{\vec{w}_1} R_m = T_{u+w_1} R_m =$$

$$T_{\vec{y}_1} \underbrace{T_{\vec{w}_2} R_m}_{T_{\vec{w}_2}} = T_{\vec{y}_1} R_l R_m R_m = T_{\vec{y}_1} R_l = G_{\vec{y}_1}^l$$



$\sqrt{1}/6$

$$O_A^\alpha T_u O_A^\alpha$$



obrot wgt. (zakreś) punktu

V16

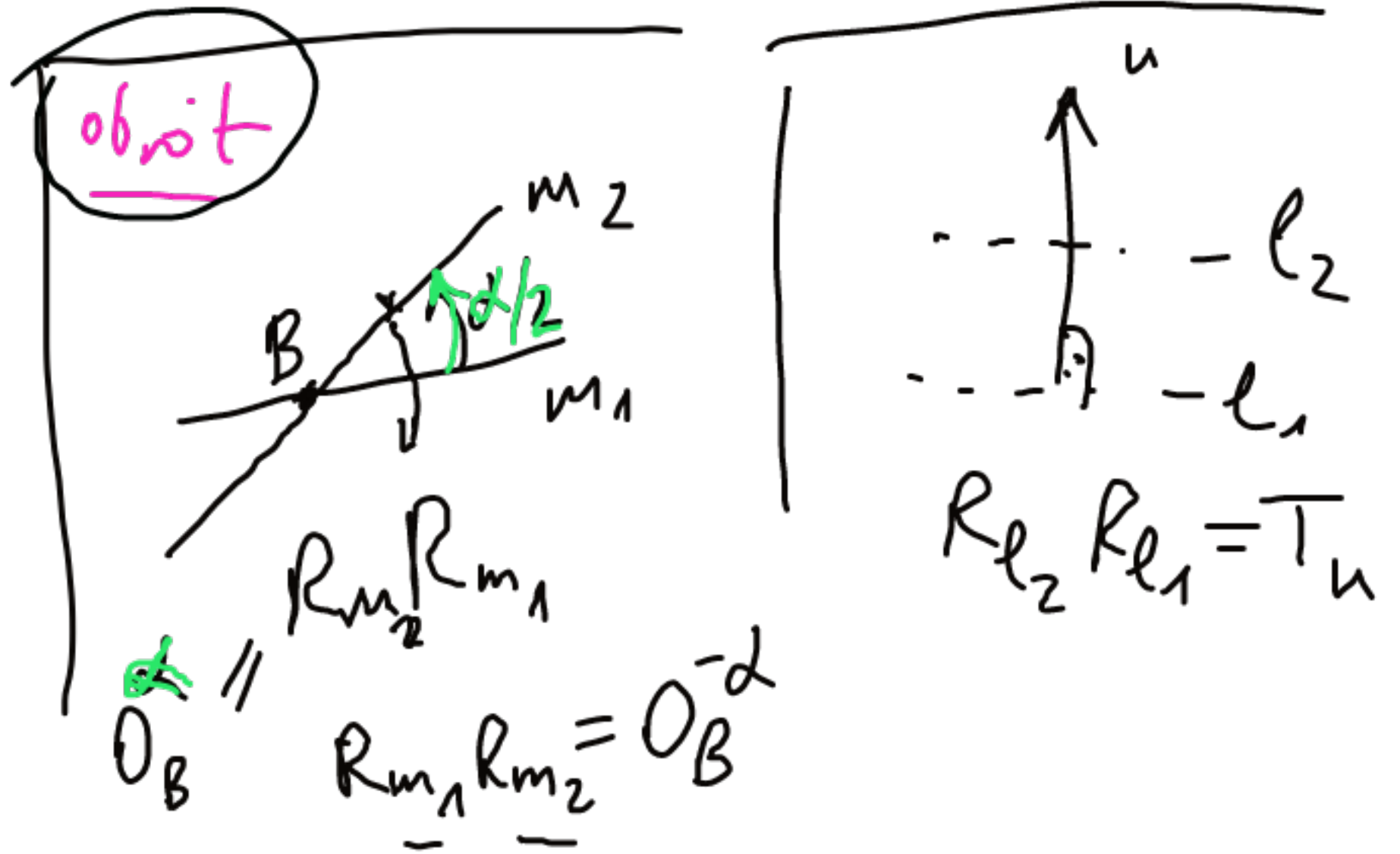
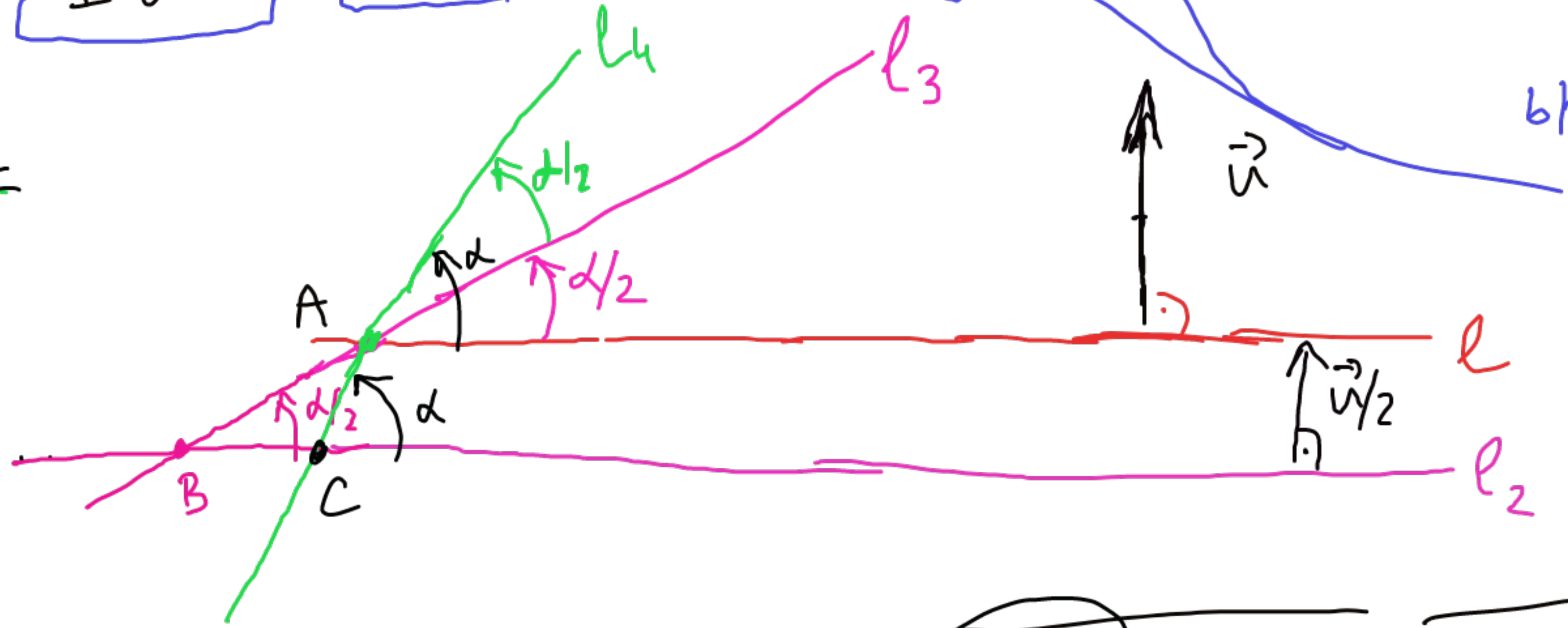
zak.
 $\alpha \neq \pi$

$$O_A^\alpha T_u O_A^\alpha = O_A^\alpha \underbrace{R_2 R_2}_{\text{dwie proste } \perp u \dots} \underbrace{R_2 R_2}_{\text{dwie proste przenajszcze sie w A}} = O_A^\alpha \underbrace{R_{l_3} R_{l_2}}_{O_A} \underbrace{R_{l_1} R_{l_2}}_{T_u} = O_A^\alpha \underbrace{R_{l_3} R_{l_2}}_{O_B} =$$

$$= \underbrace{R_{l_4} R_{l_3} R_{l_3} R_{l_2}}_{O_A} =$$

$$= R_{l_4} R_{l_2} =$$

$$= O_C^{2\alpha}$$



V17 pruzpedeln $\alpha = \pi = 180^\circ$

$$\underbrace{O_A^\pi}_{H_A} T_u \underbrace{O_A^\pi}_{H_A} = H_A T_u H_A = H_A \underbrace{R_{l_2} R_l R_l}_{R_m} R_m = \underbrace{H_A}_{R_l} \underbrace{R_{l_2} R_m}_{R_m} = \cancel{R_l R_{l_2} R_m}$$

$$= H_A H_B =$$

$$= \underbrace{R_l R_m}_{H_A} \underbrace{R_m R_{l_2}}_{H_B} = R_l R_{l_2} = T_{-\vec{u}}$$

