Student handout

Here is a geometric derivation of the Lorentz Transformation using hyperbola geometry:

$$\begin{bmatrix} x' \\ ct' \end{bmatrix} = \begin{bmatrix} \cosh\alpha & -\sinh\alpha \\ -\sinh\alpha & \cosh\alpha \end{bmatrix} \begin{bmatrix} x \\ ct \end{bmatrix}$$

On the spacetime diagrams, the large black dot is the event we're trying to describe. The small black dot indicates a right angle for a hyperbolic triangle.

Starting with the time coordinate:

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Now thinking about the spatial coordinate:

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