

Title: Special Relativity 11 - Simultaneity and Length Contraction

Date: Aug 13, 2008 09:00 AM

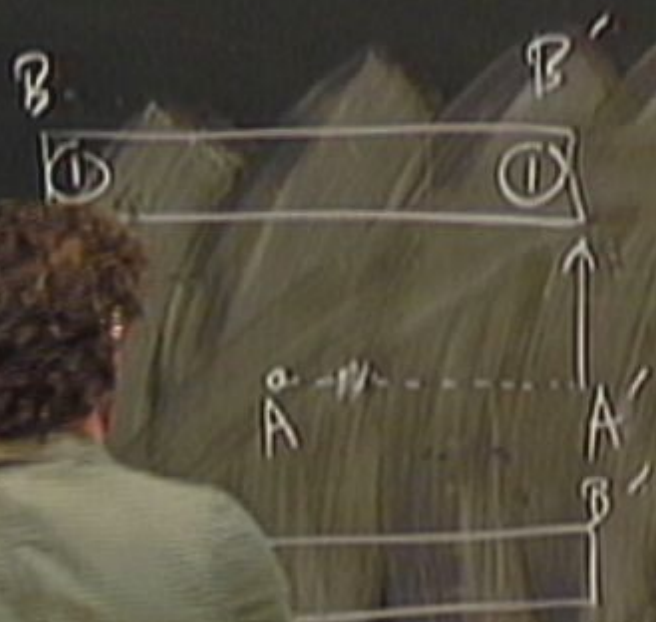
URL: <http://pirsa.org/08080070>

Abstract: A continuation of the SR-10 discussion on length contraction. Resolving Principle 2\*.  
Learning Outcomes:   
• Relativity of simultaneity revisited – gaining a deeper understanding of what it means.   
• A full understanding of the nature of length contraction based on relativity of simultaneity.   
• Resolving a key paradox in special relativity: Principle 2\*, introduced in SR-4. How it is possible to measure the same speed for the light whether you are running toward or away from a flashlight.

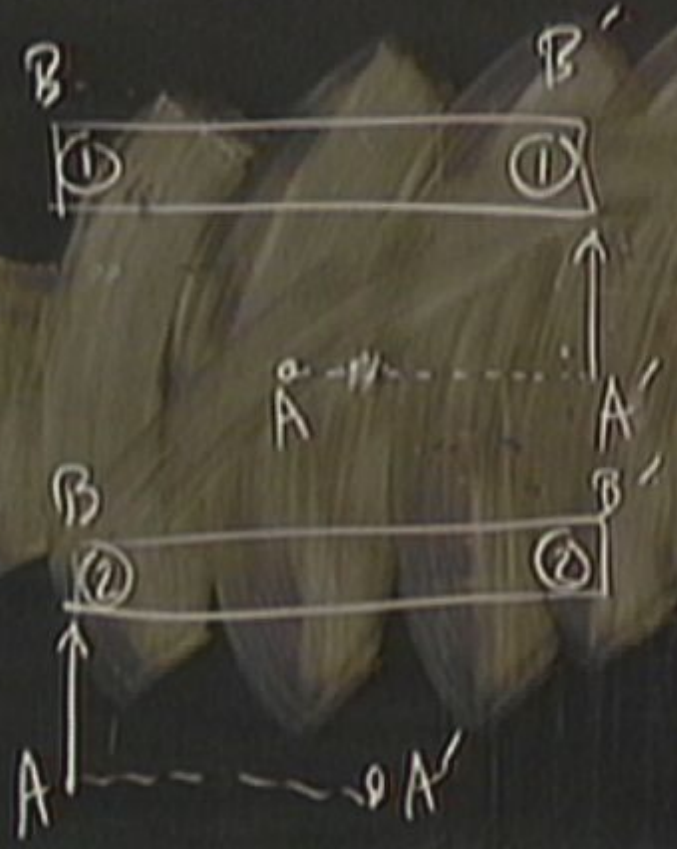
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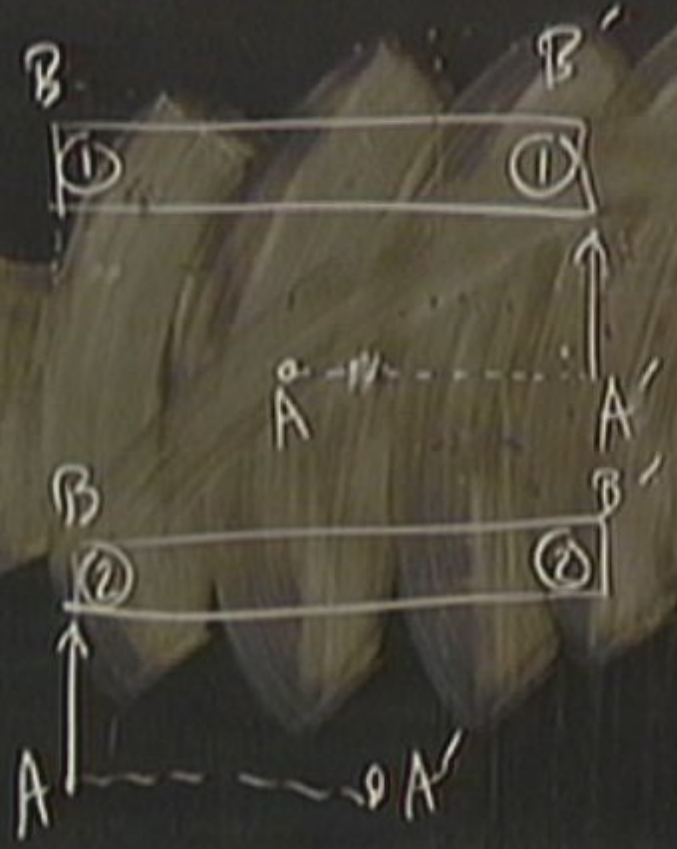
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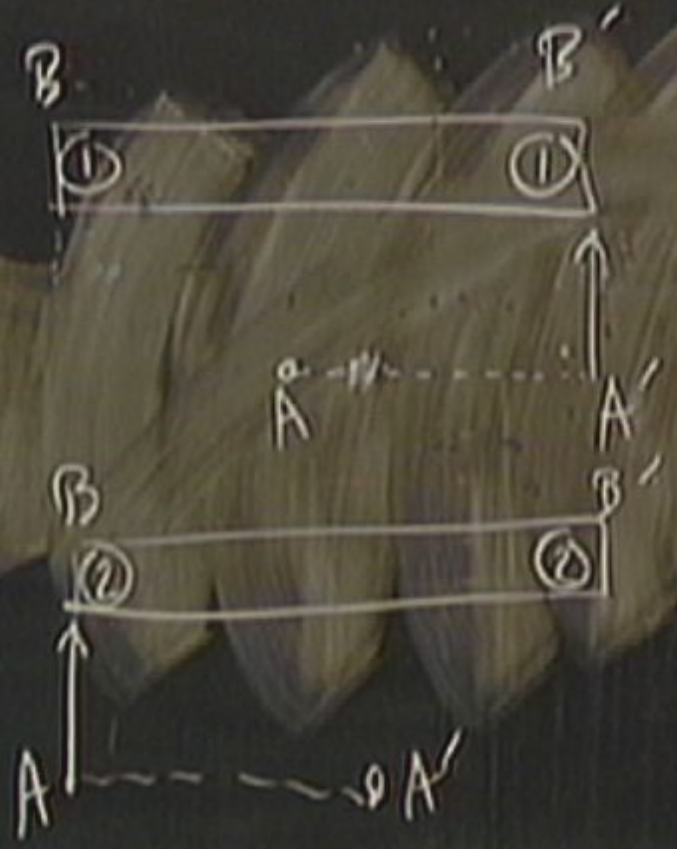
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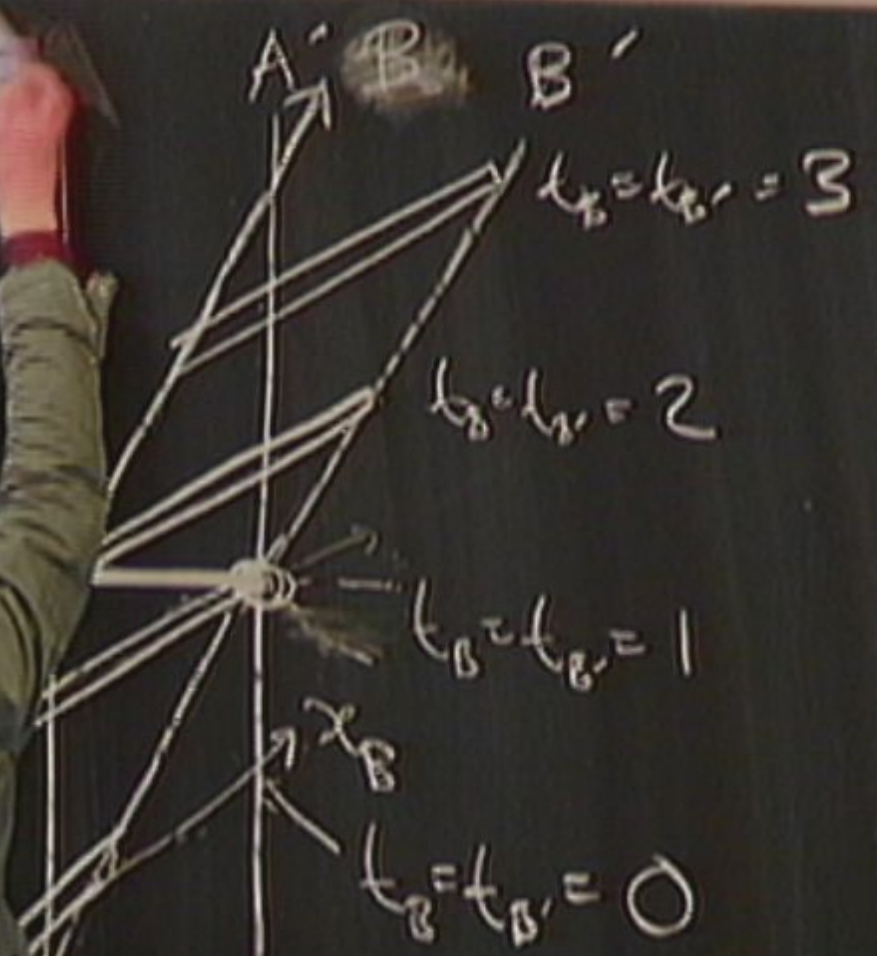
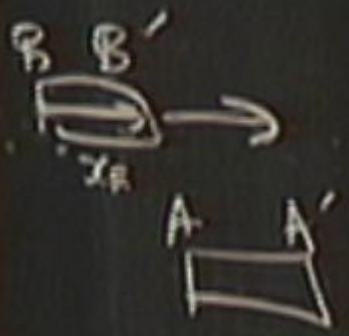
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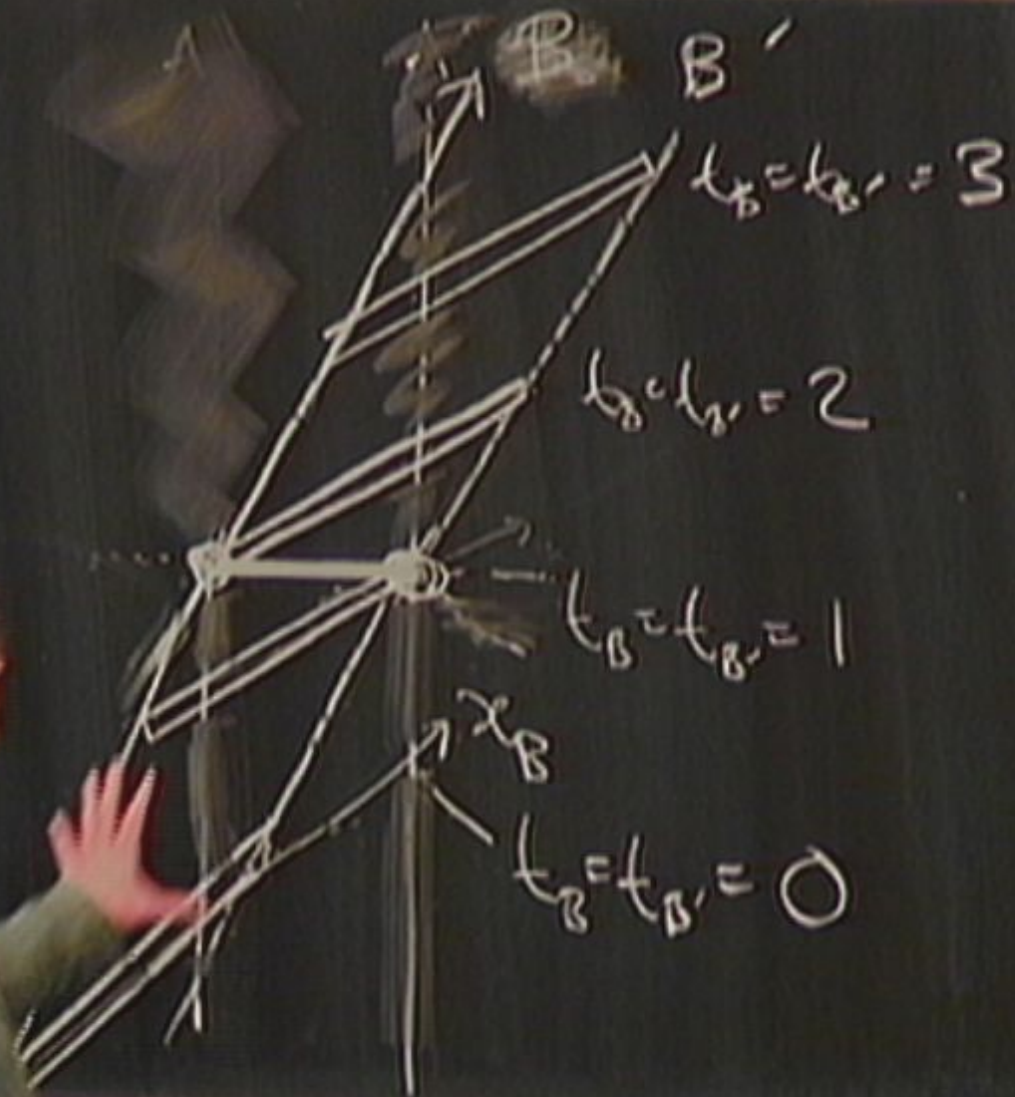
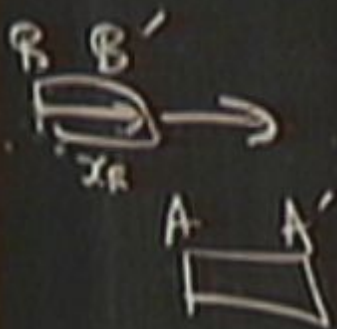
BB' see:



# Length Contraction

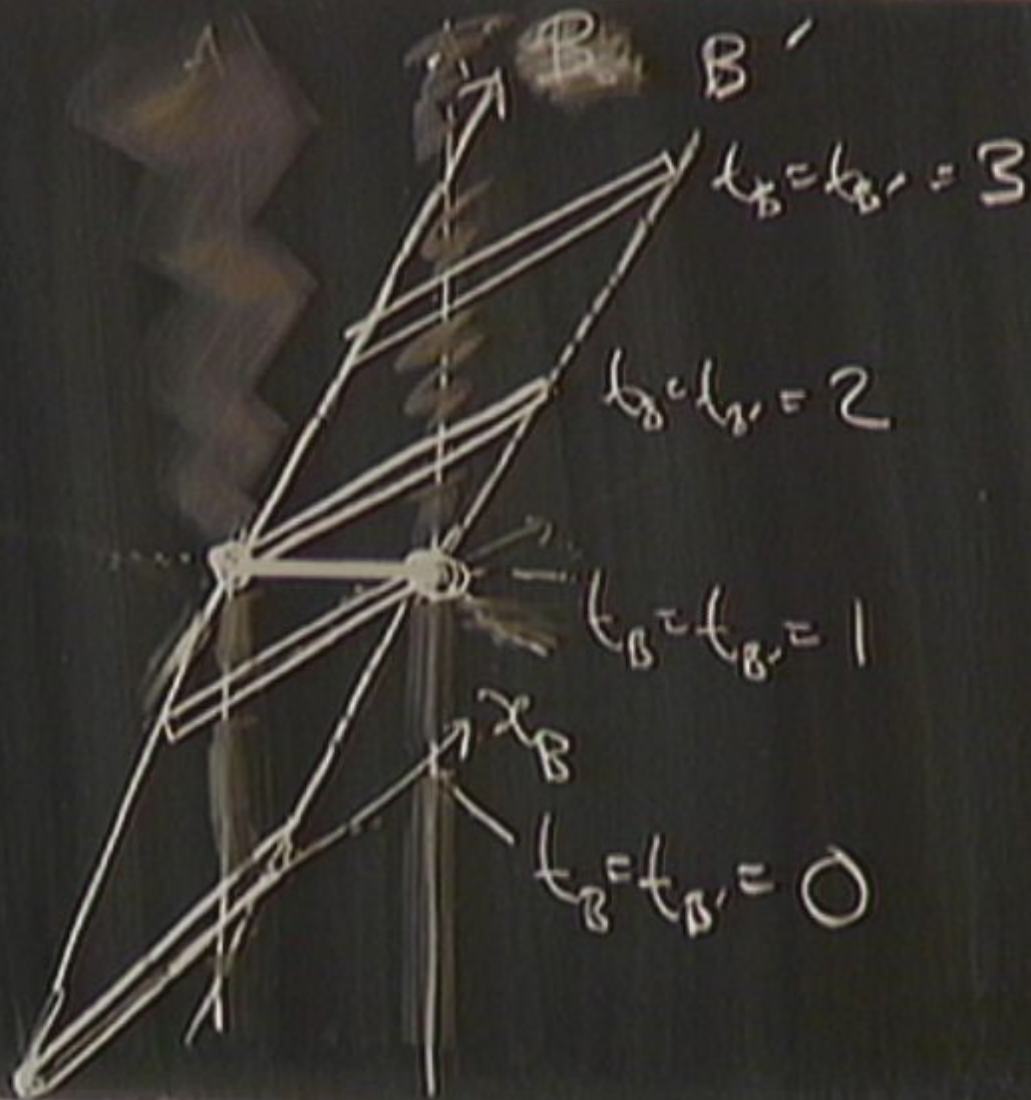
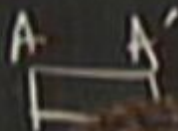
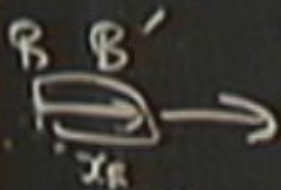


# Length Contraction

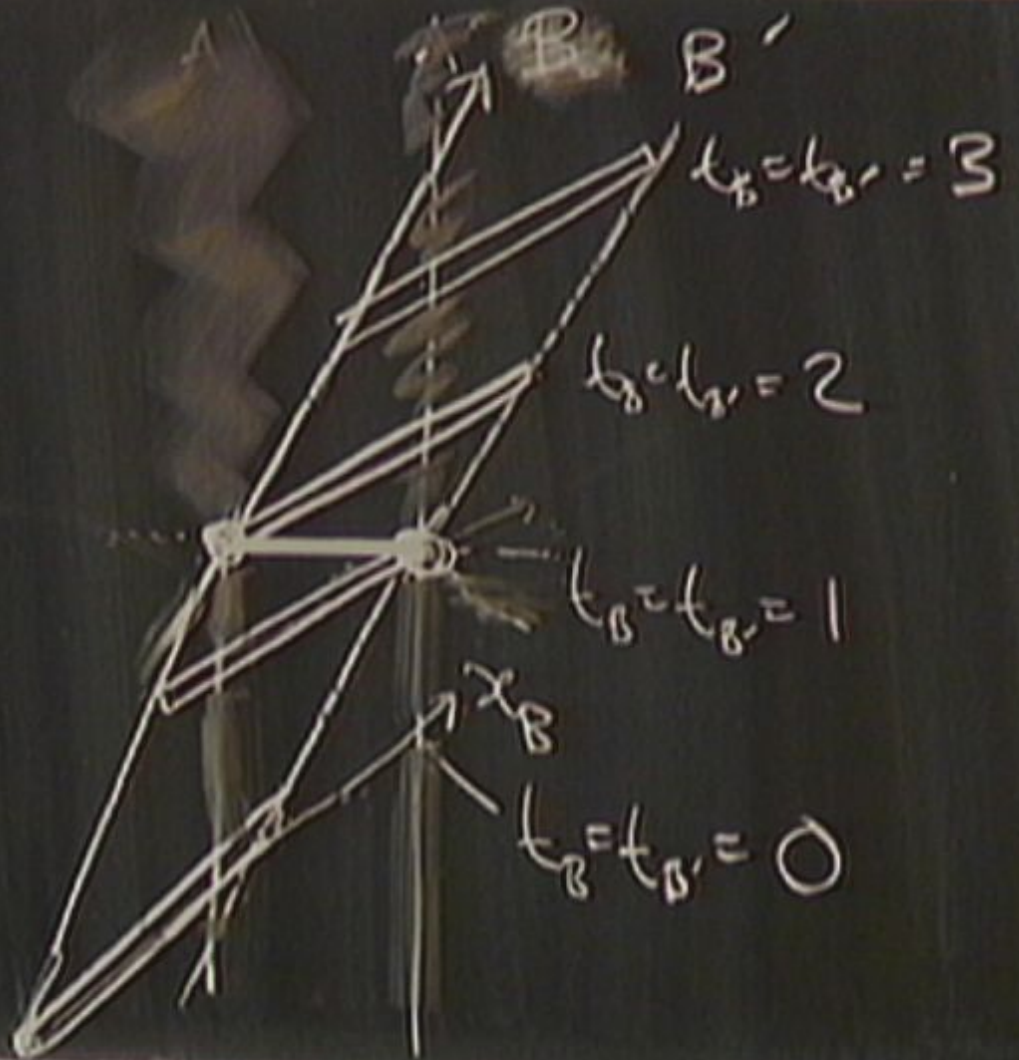
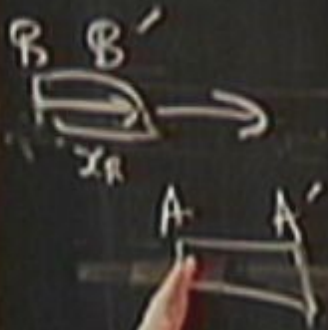




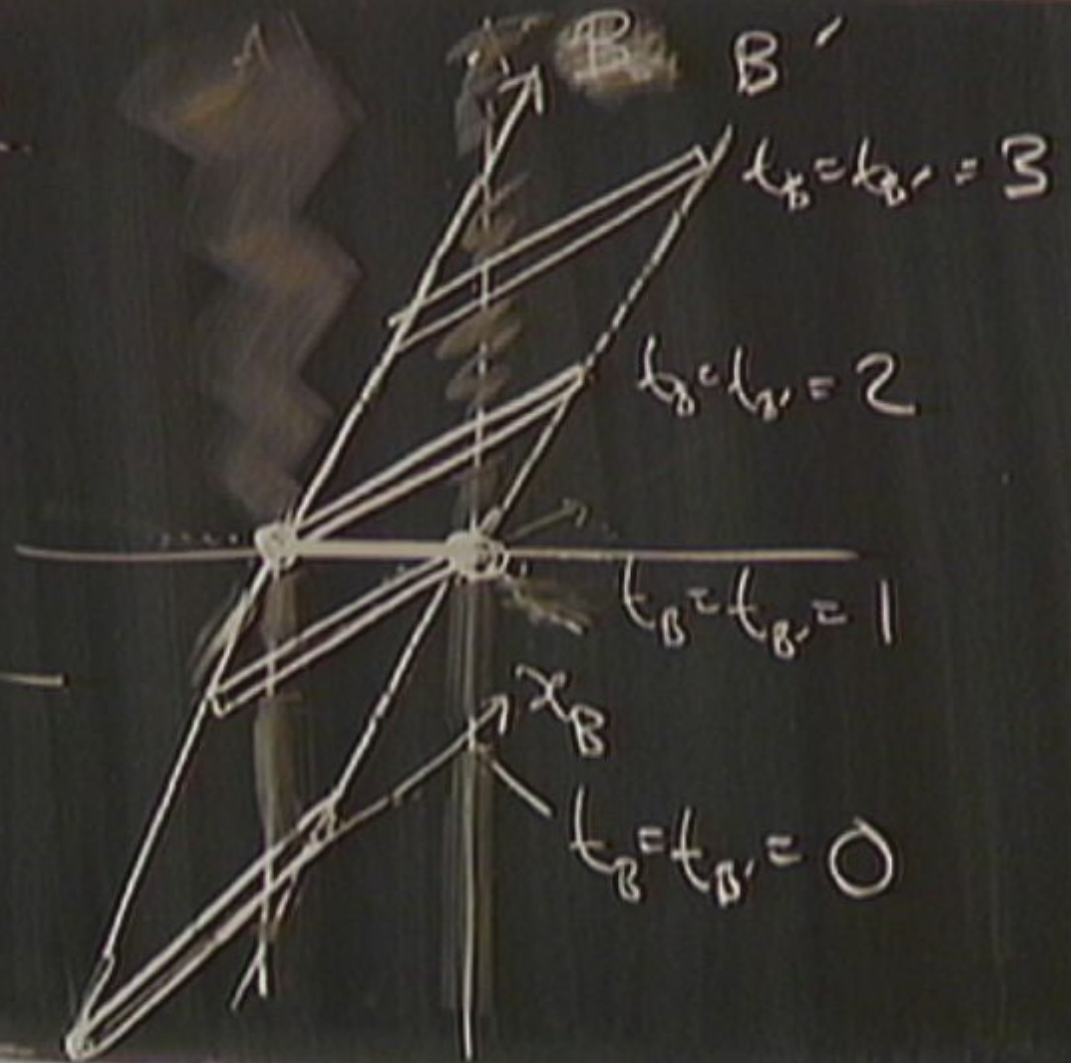
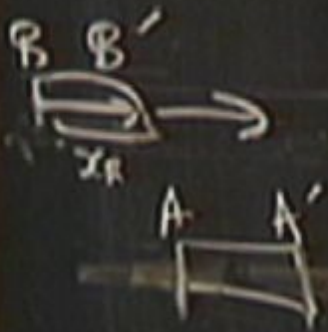
# Length Contraction



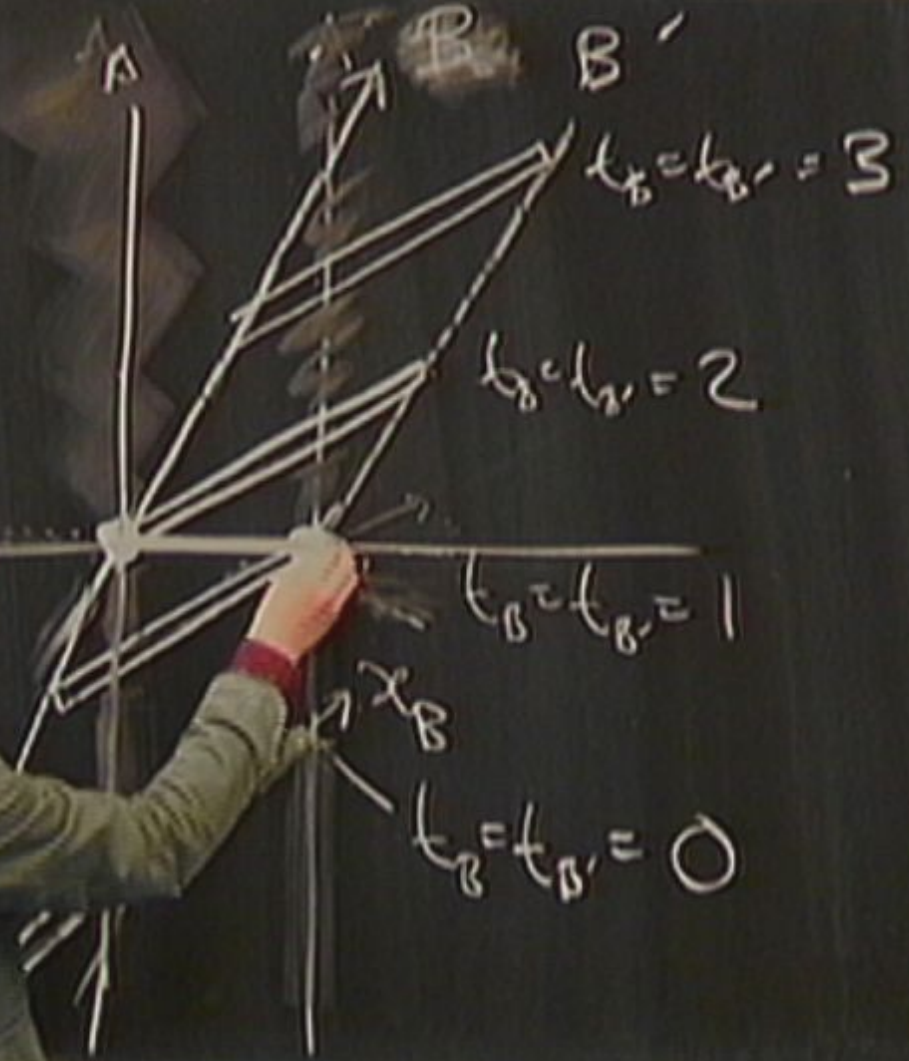
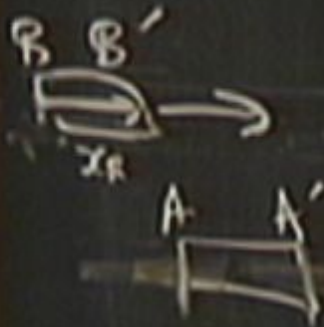
# Length Contraction



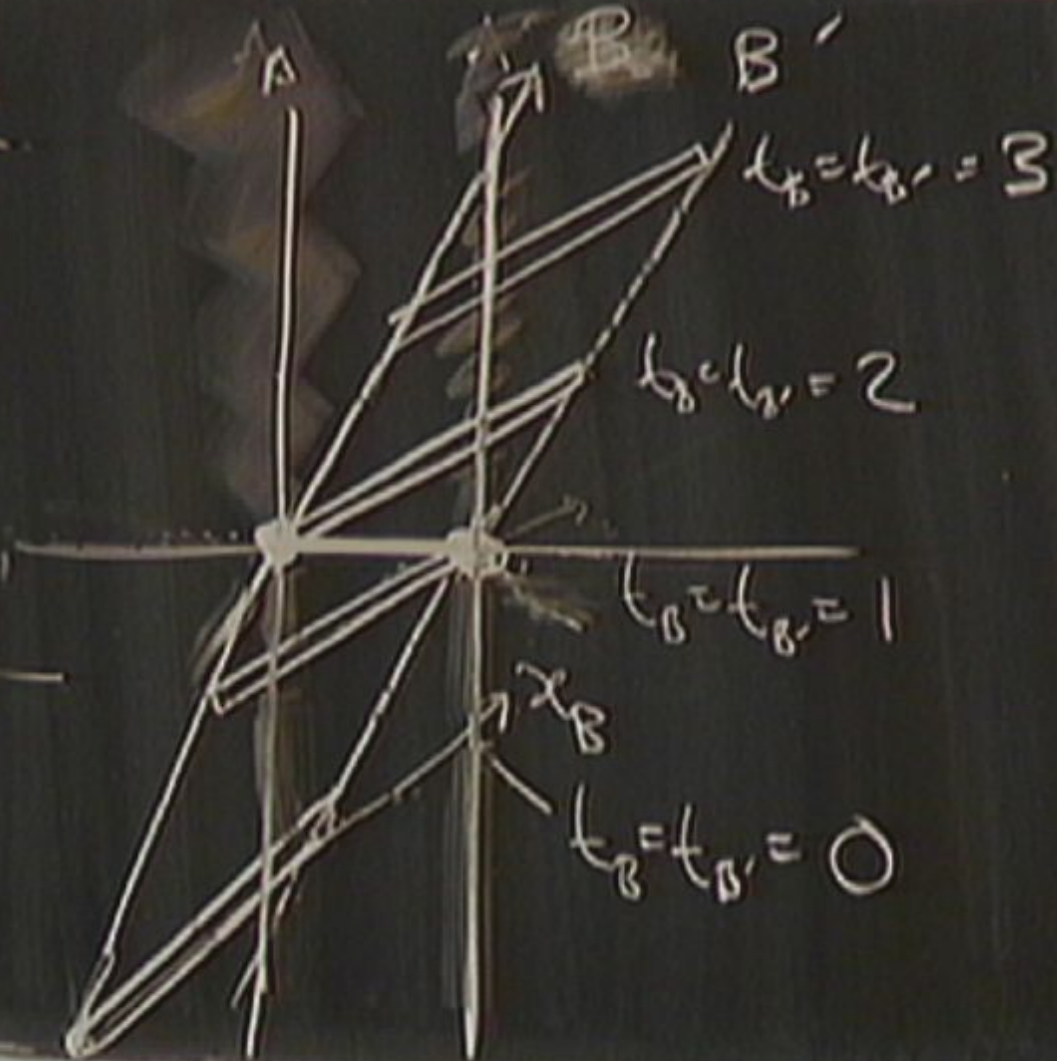
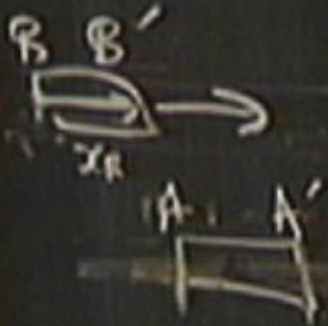
# Length Contraction



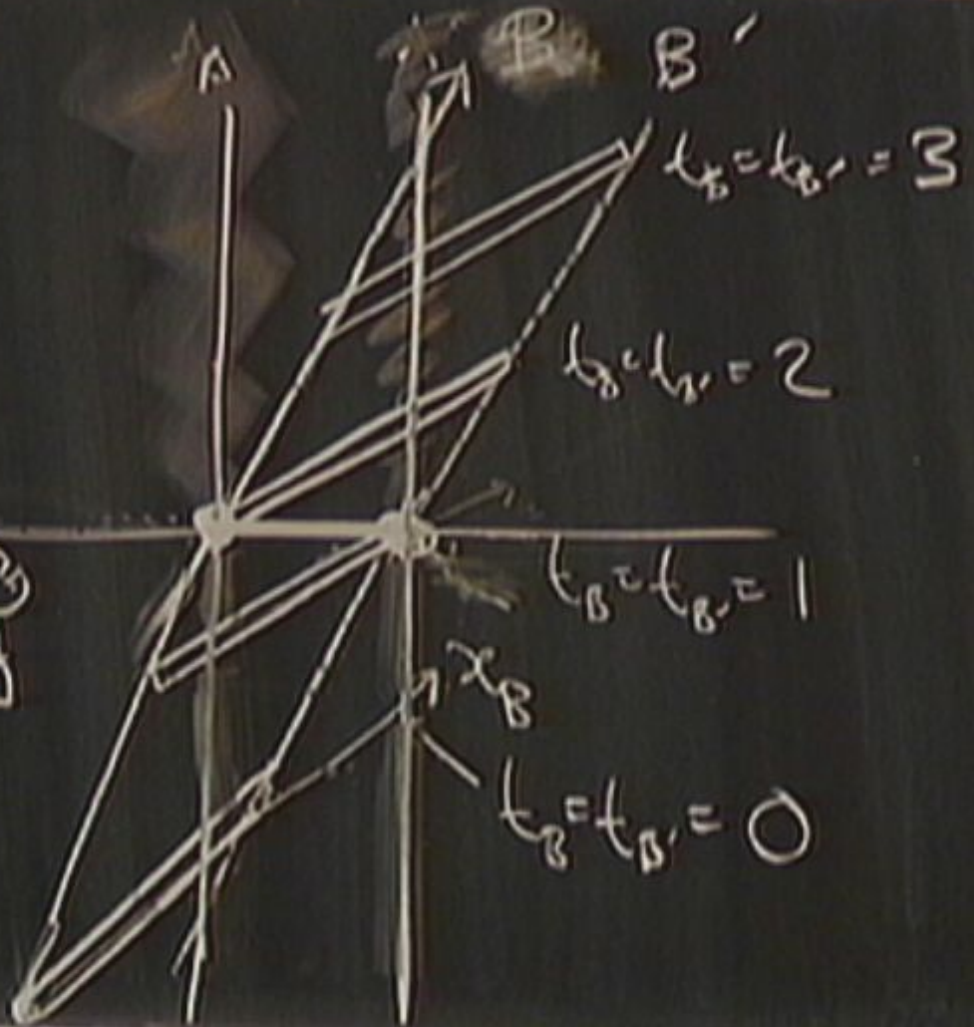
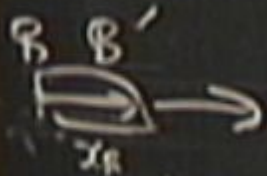
# Length Contraction



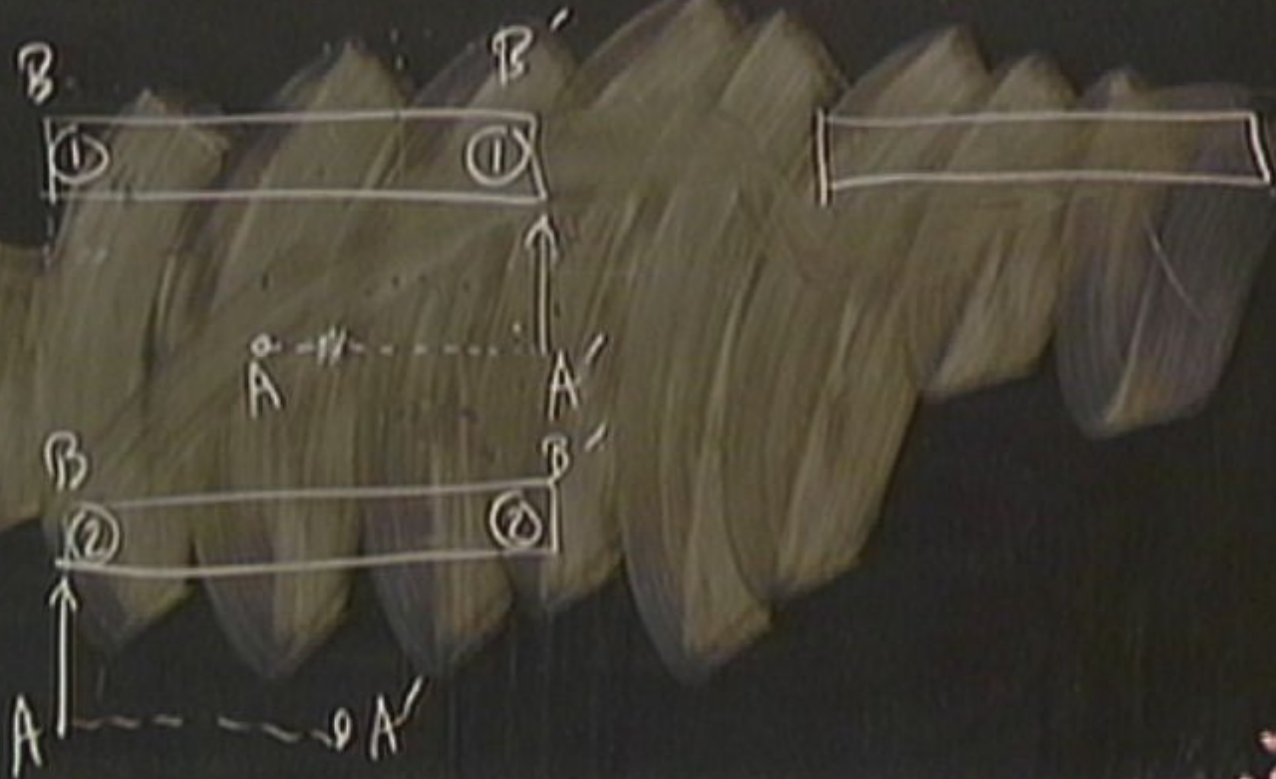
# Length Contraction



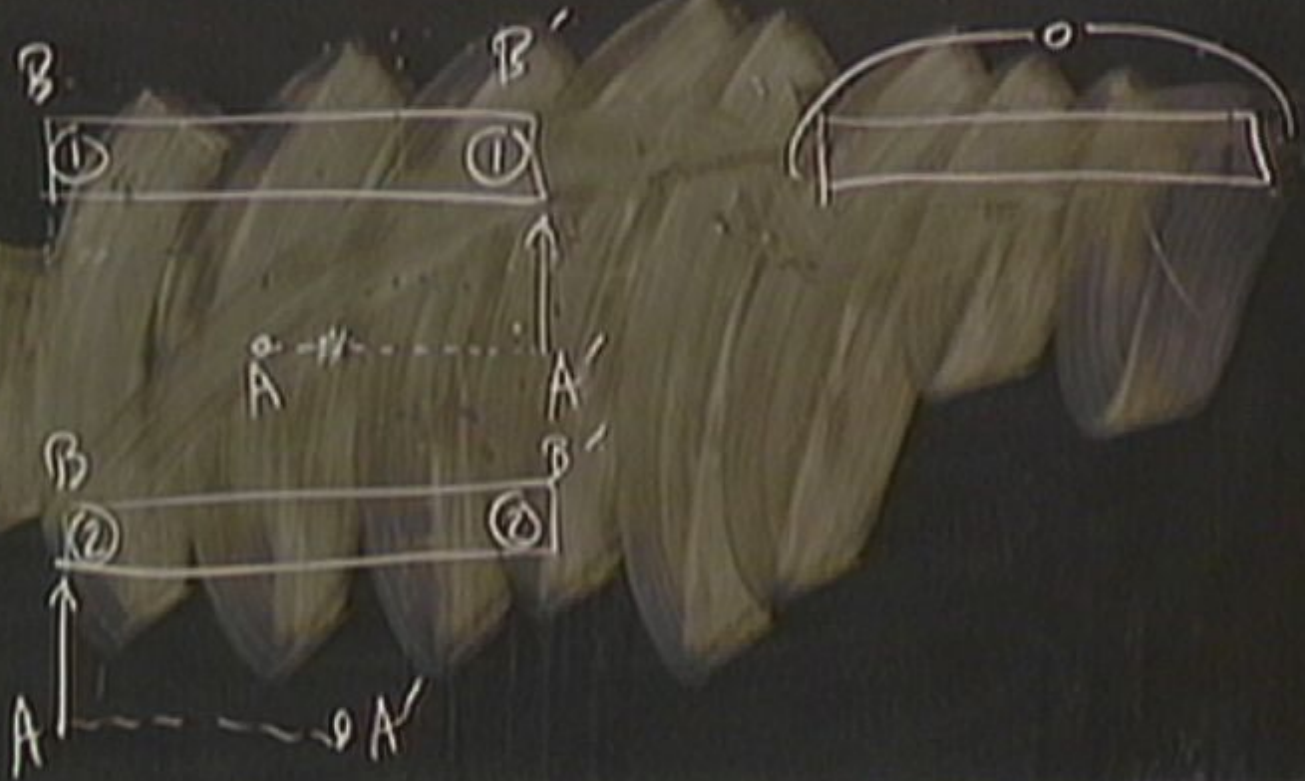
# Length Contraction



BB' see:

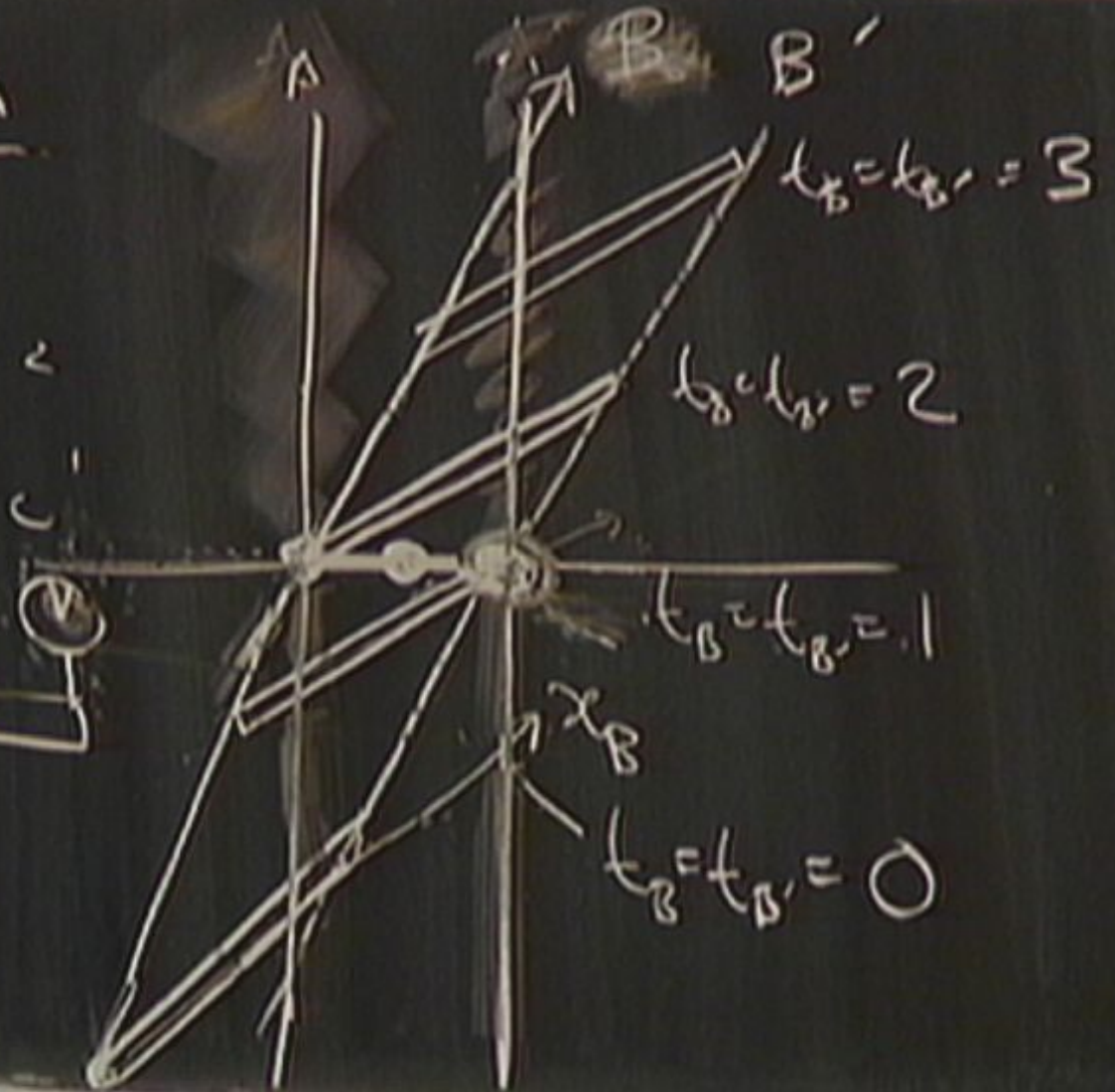
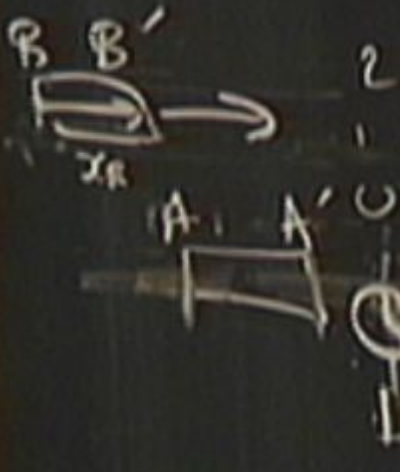


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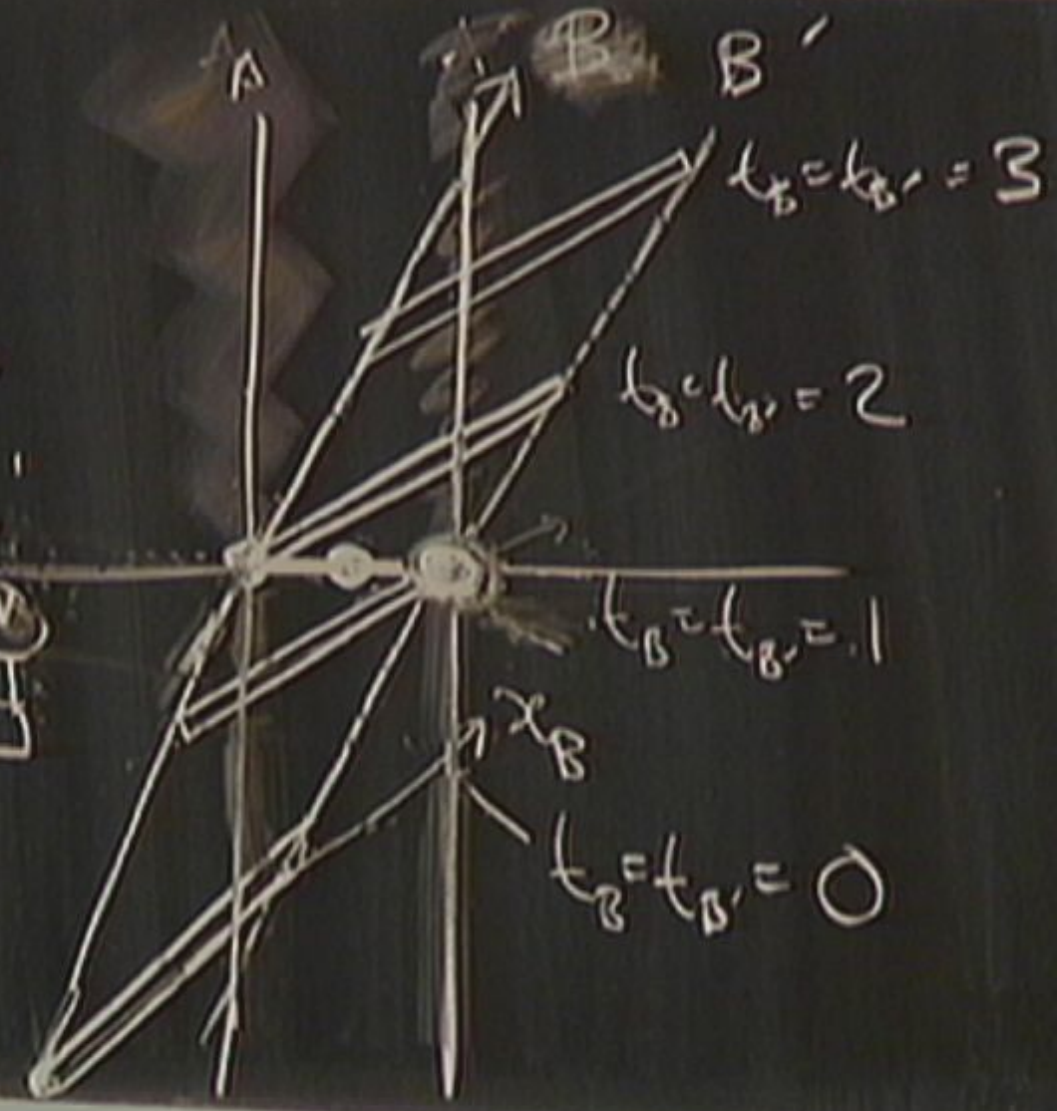
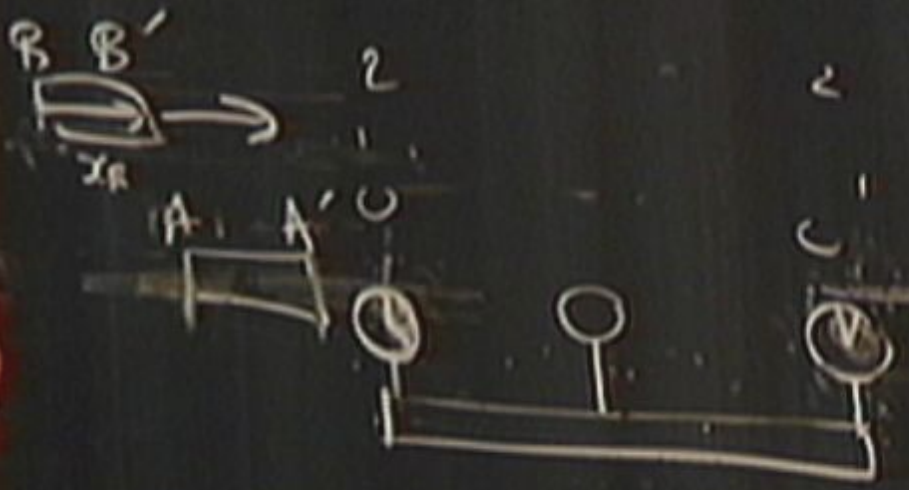




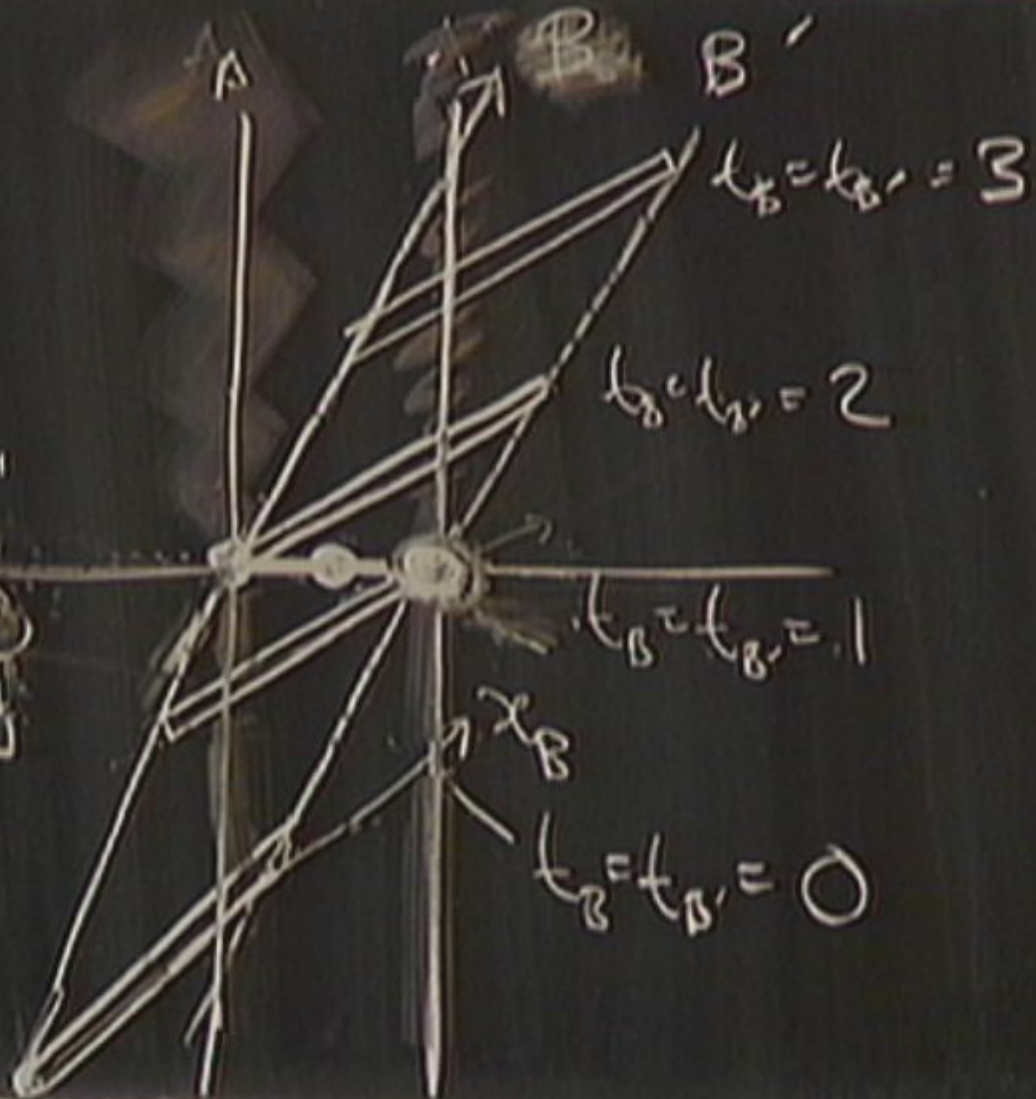
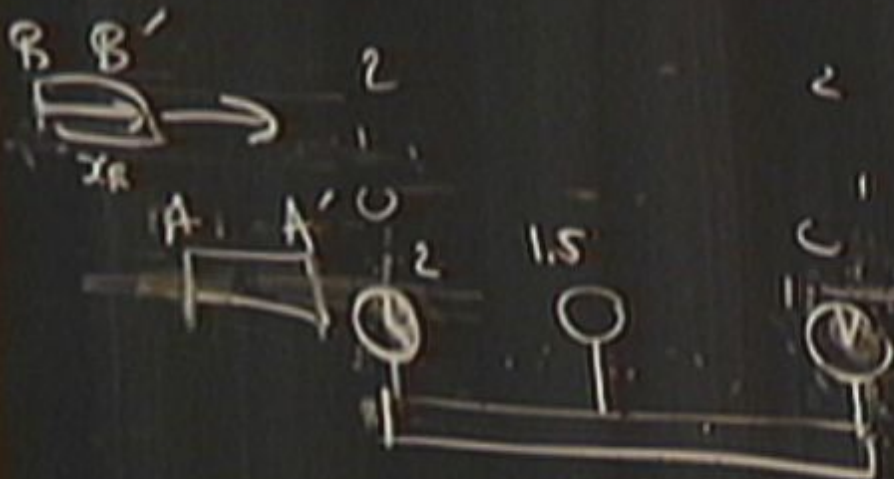
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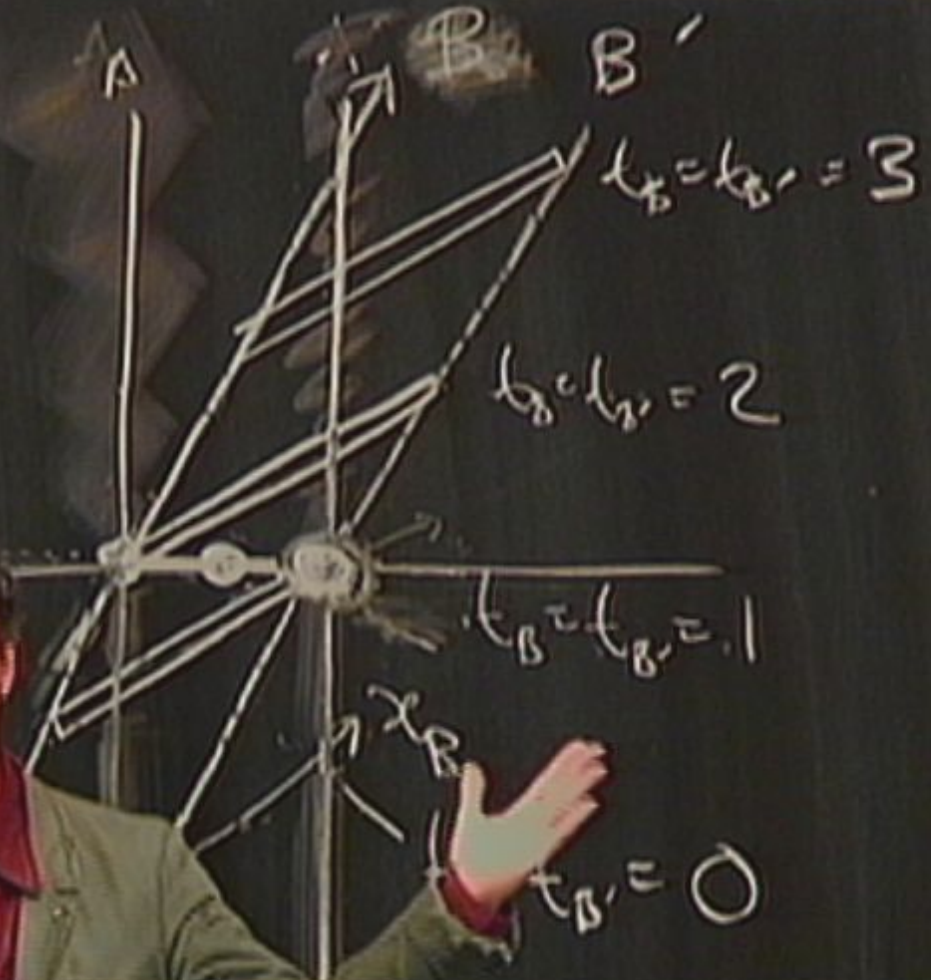
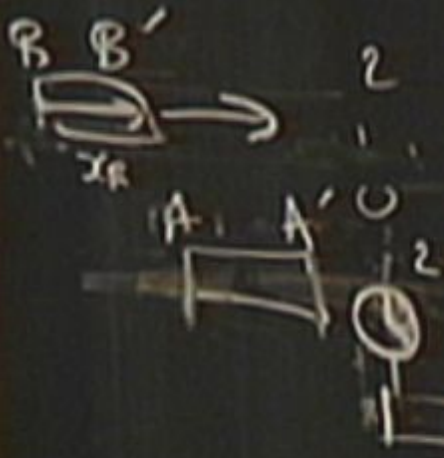
# Length Contraction



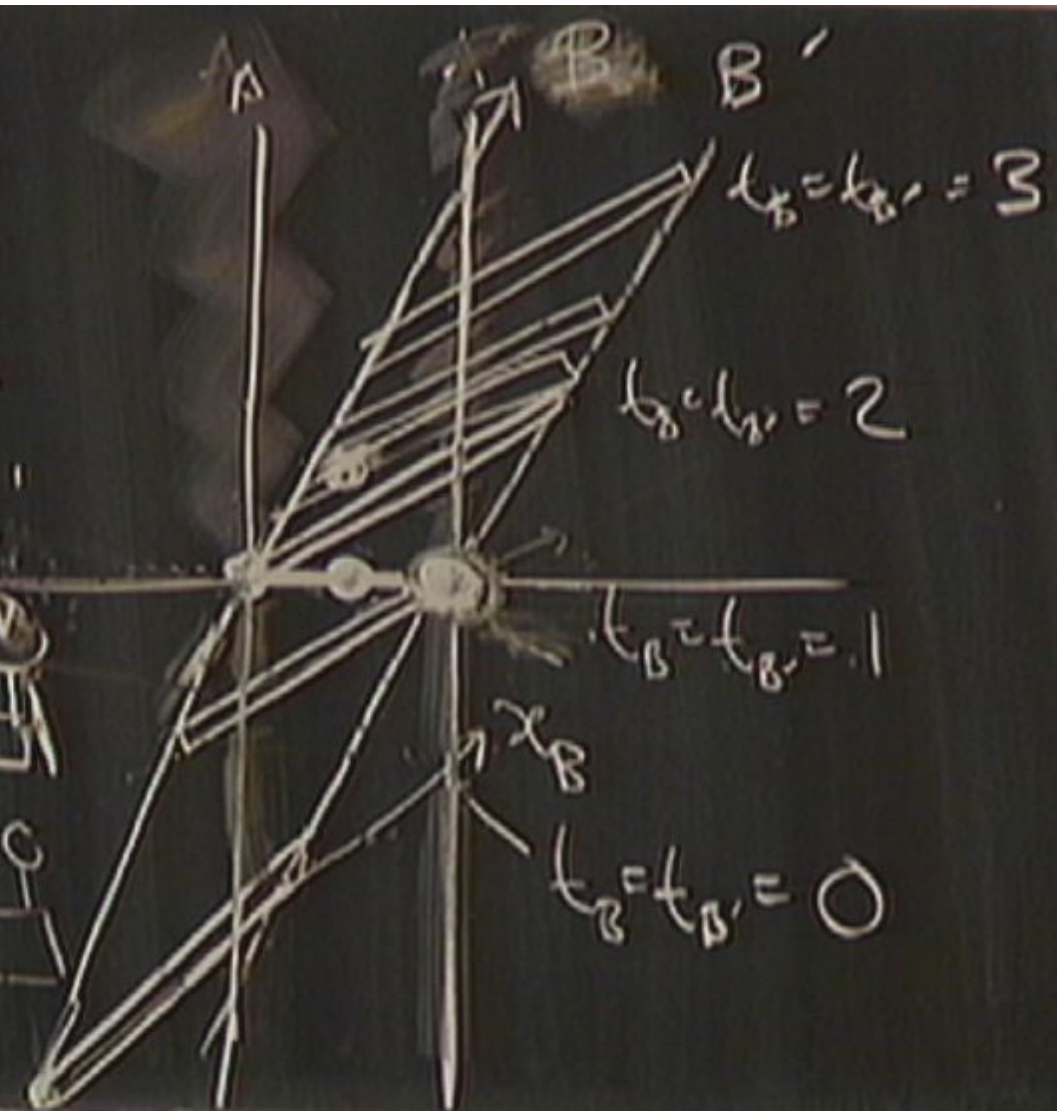
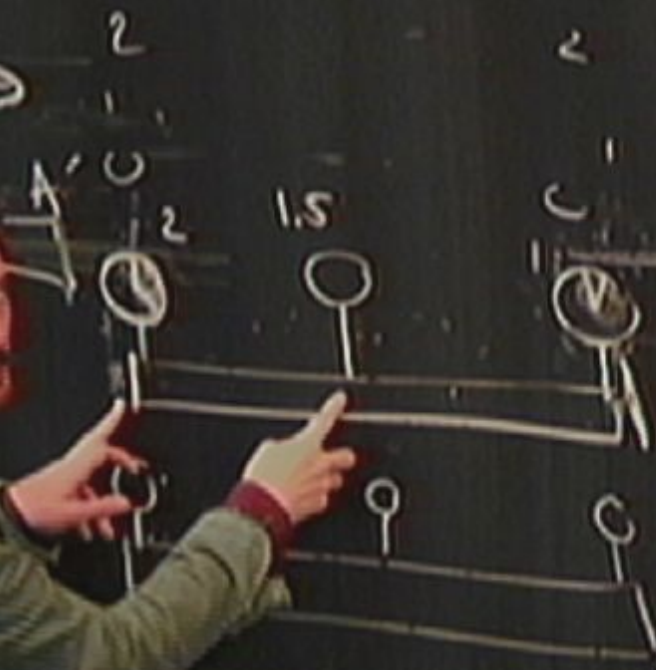
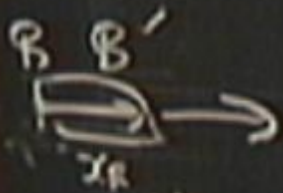
# Length Contraction



# Length Contraction



# Length Contraction



$$t_B = t_{B'} = 3$$

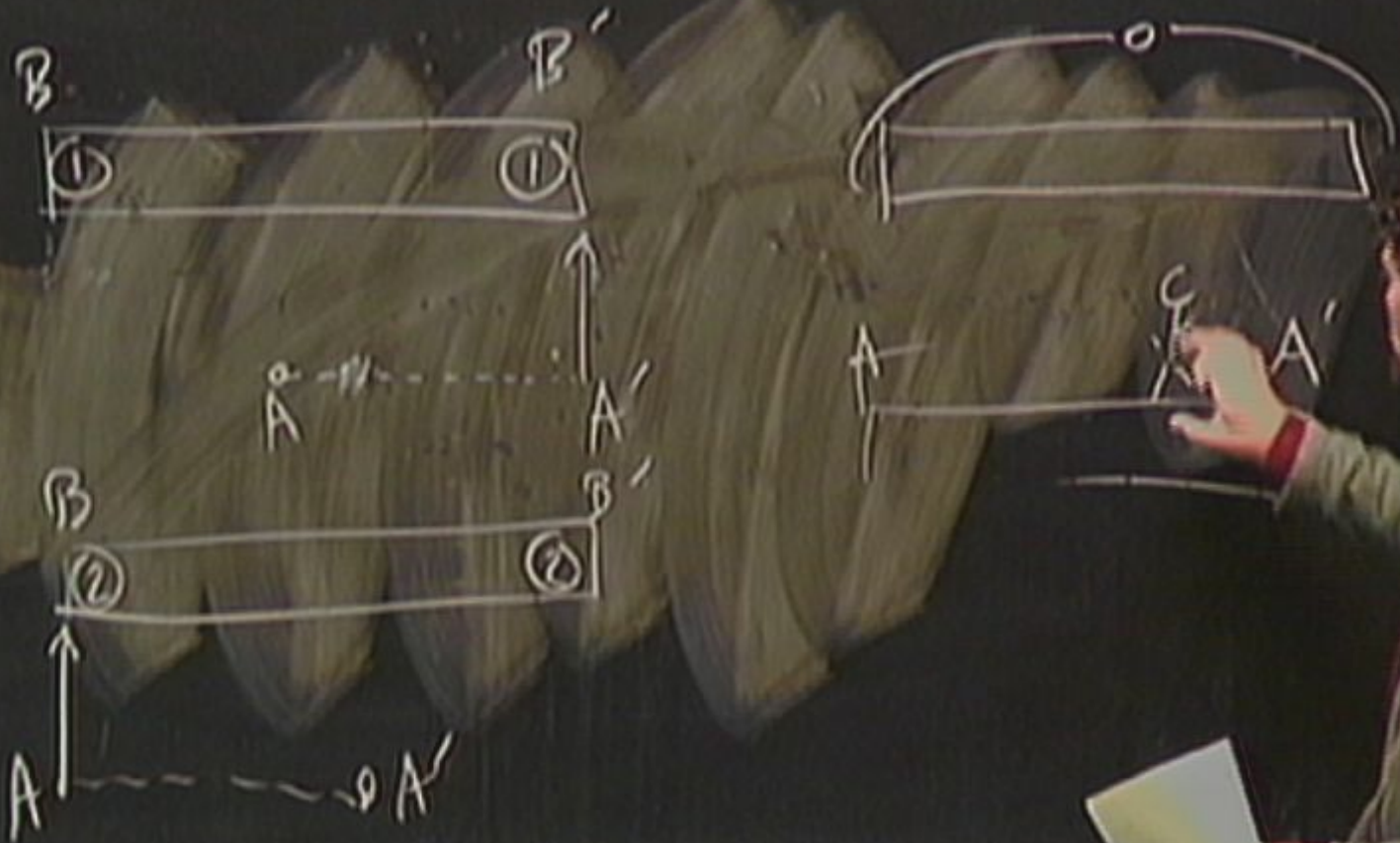
$$t_B = t_{B'} = 2$$

$$t_B = t_{B'} = 1$$

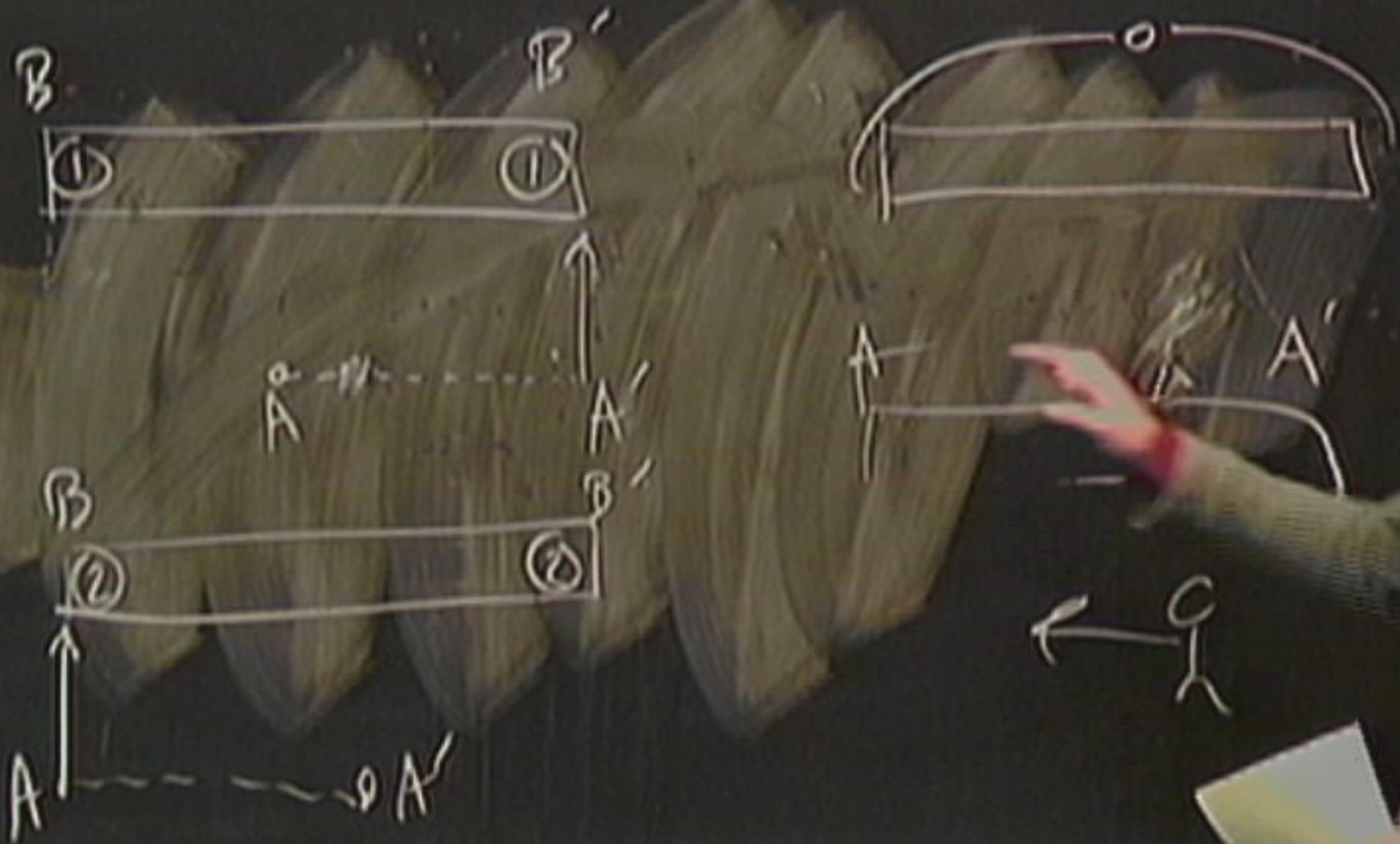
$$t_B = t_{B'} = 0$$



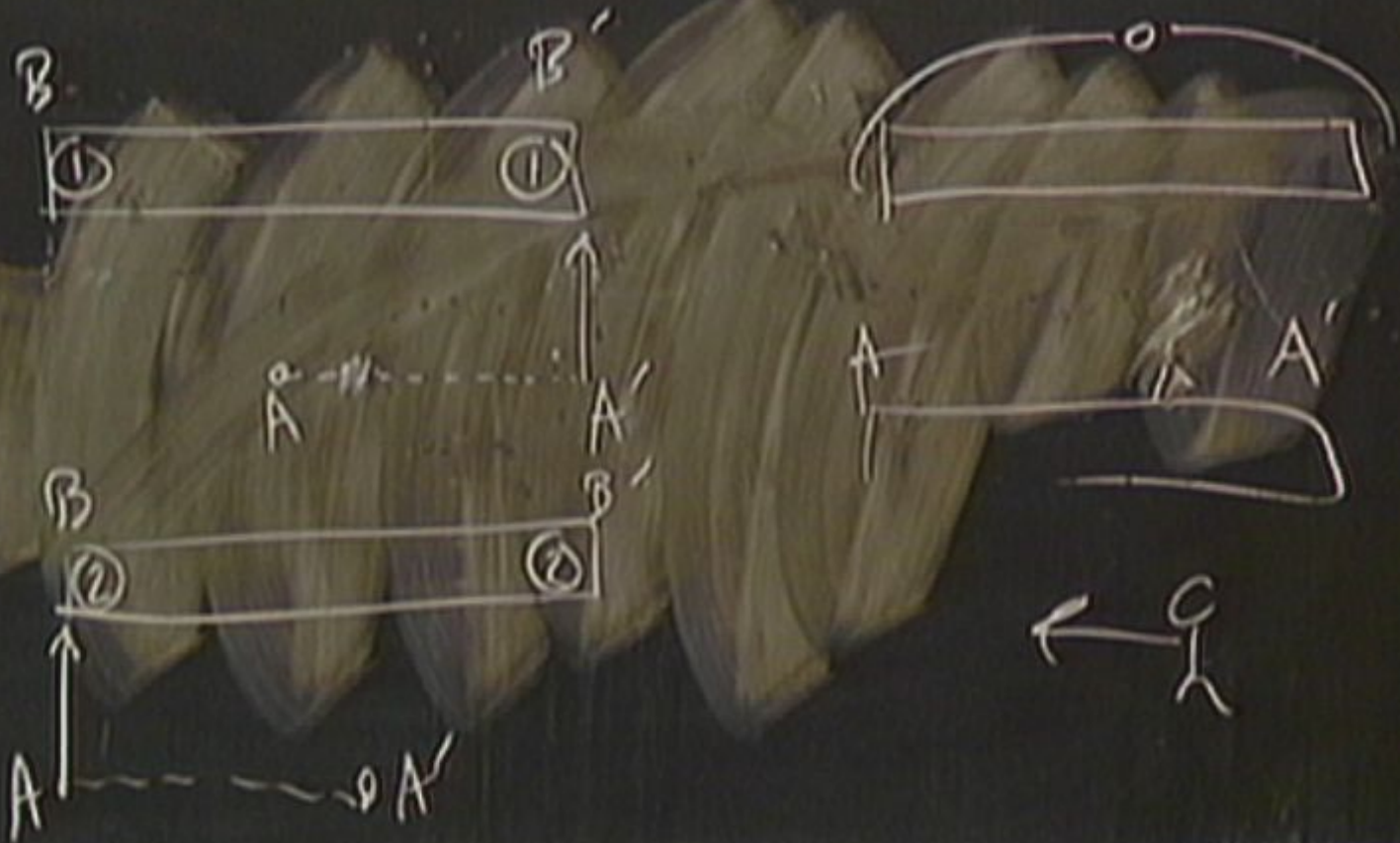
BB' see:



BB' see:

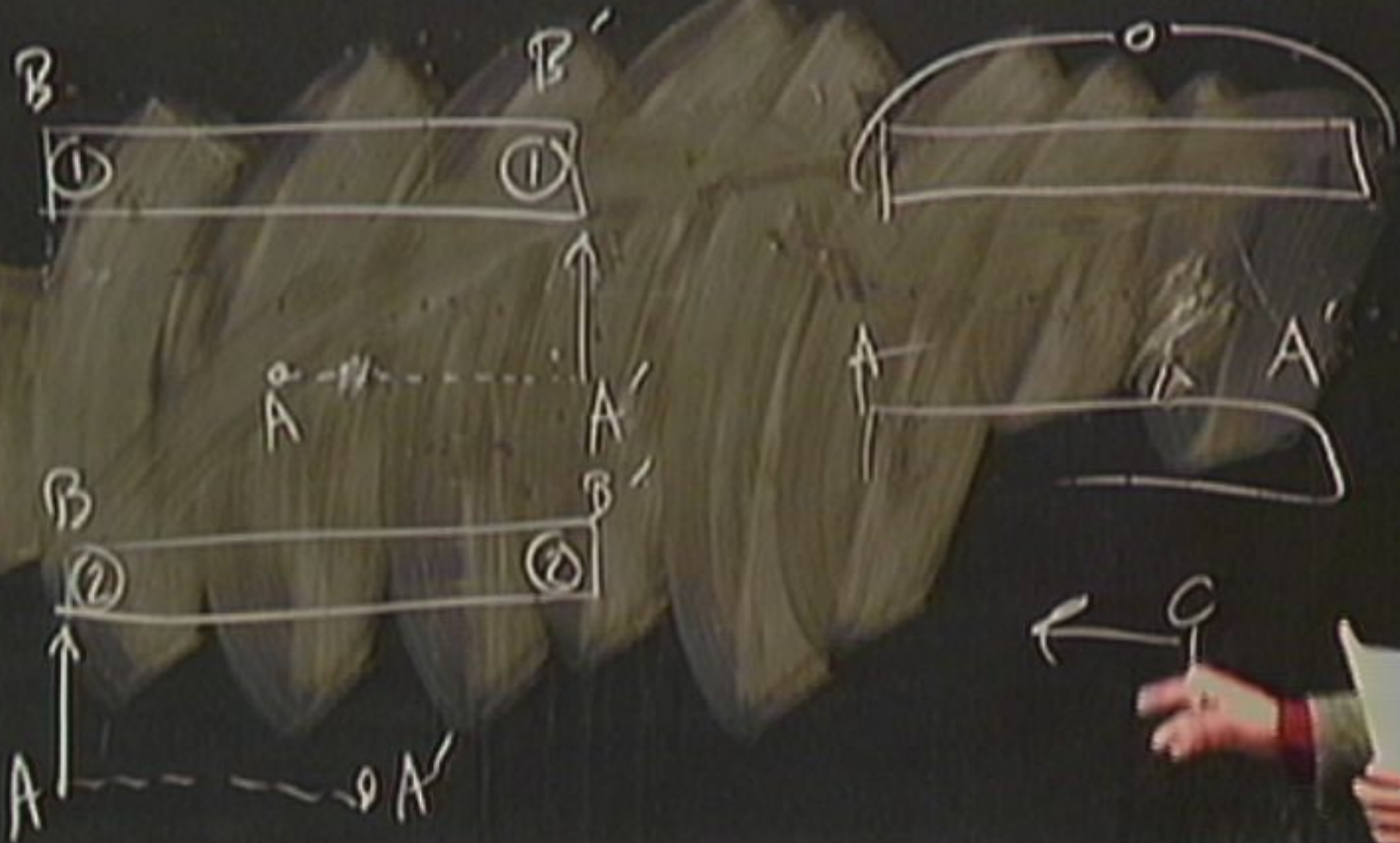


BB' see :

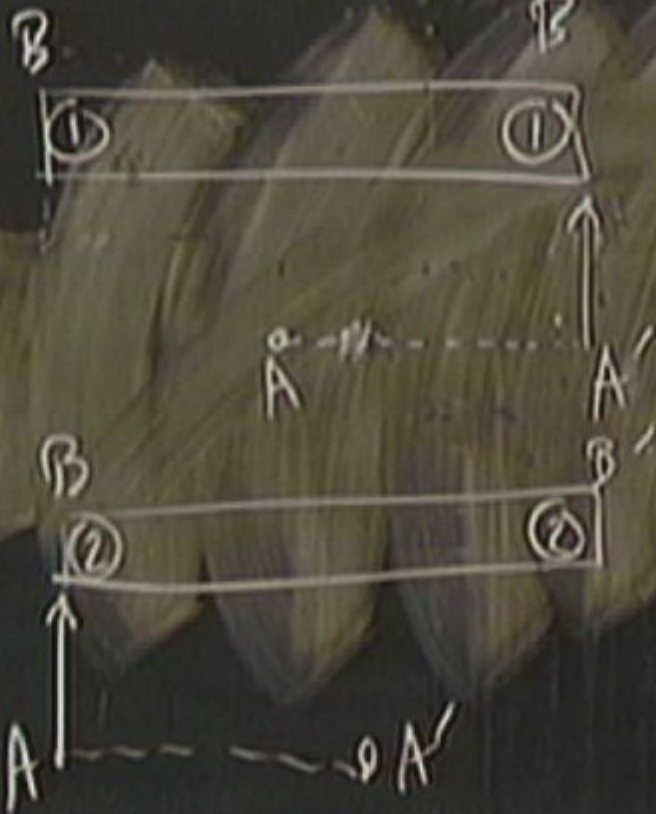




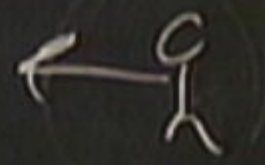
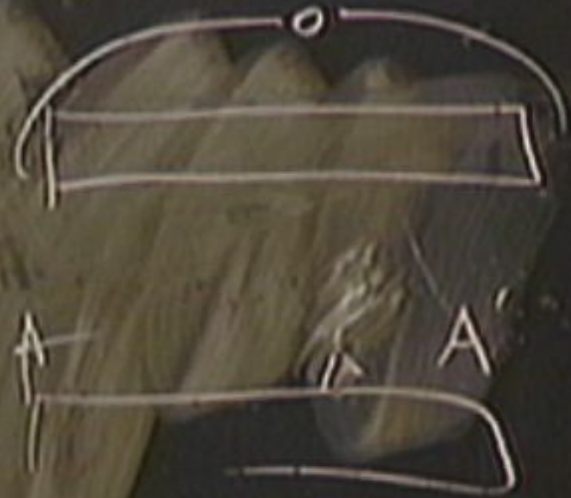
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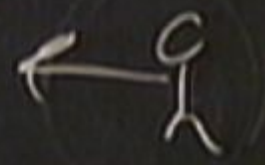
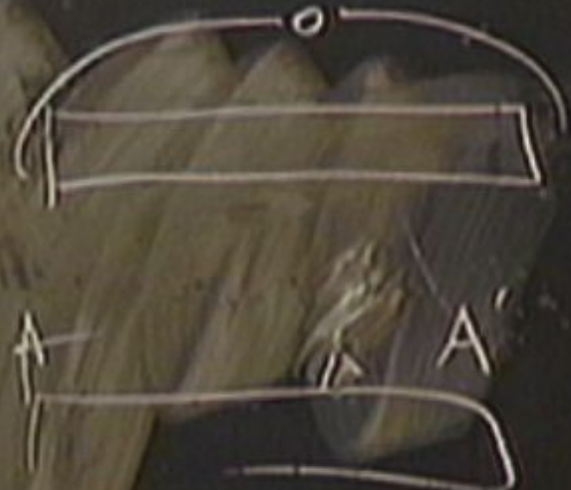
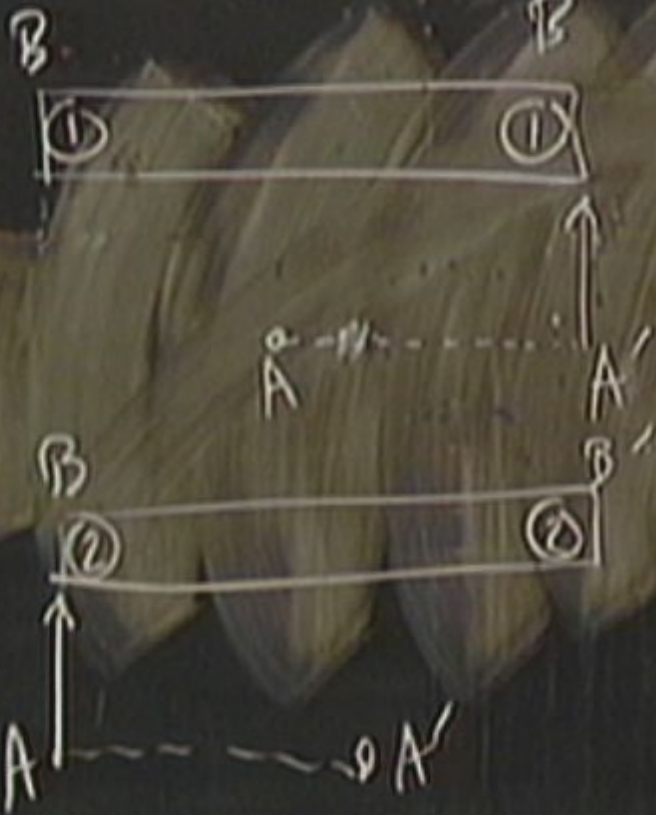
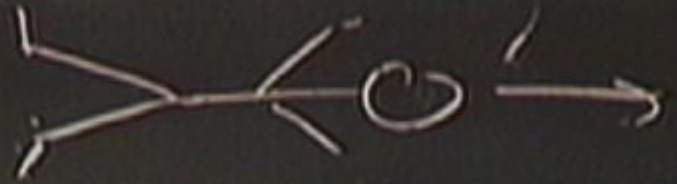
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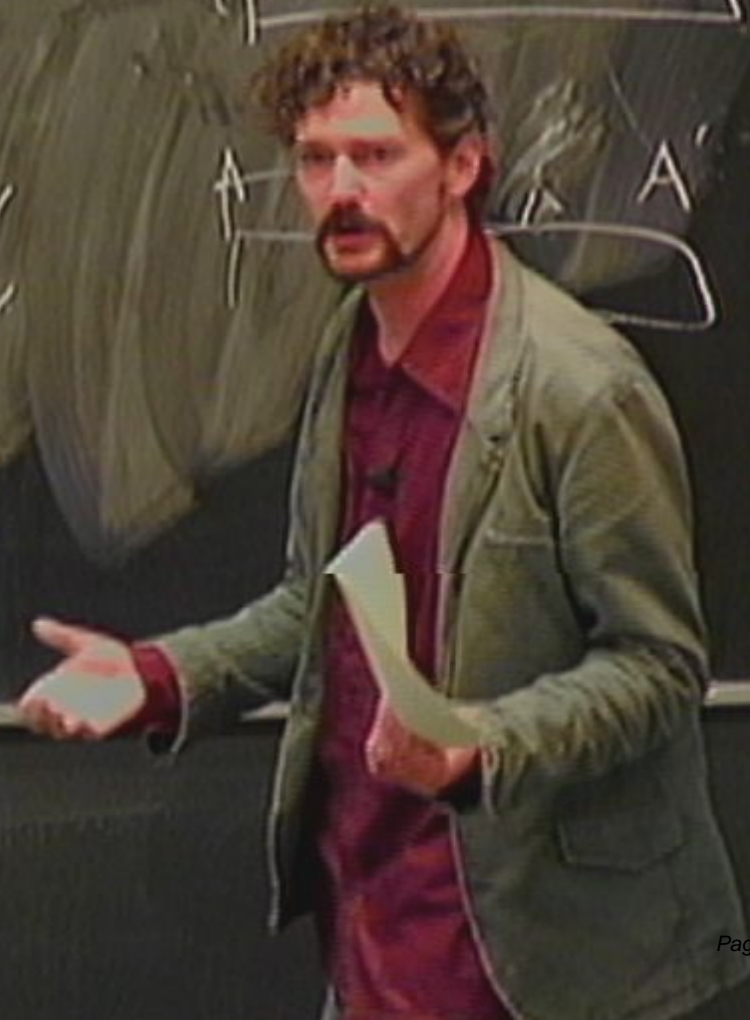
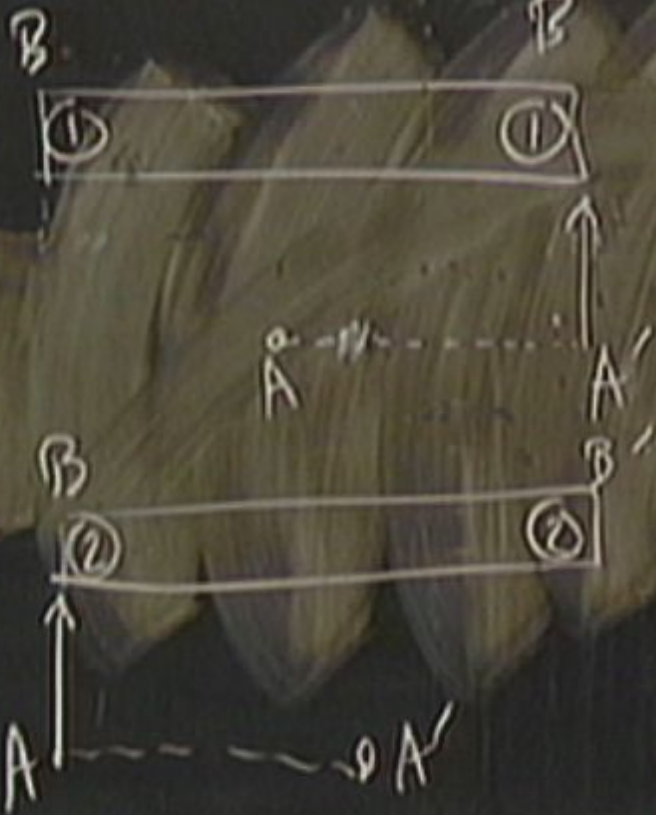
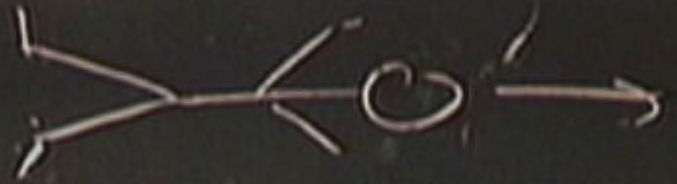
BB' see:



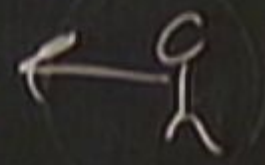
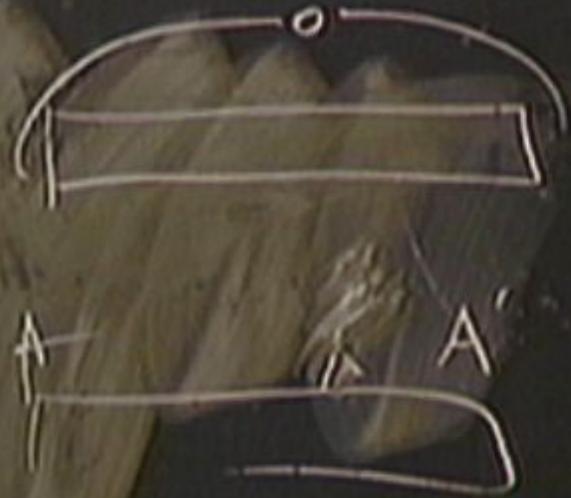
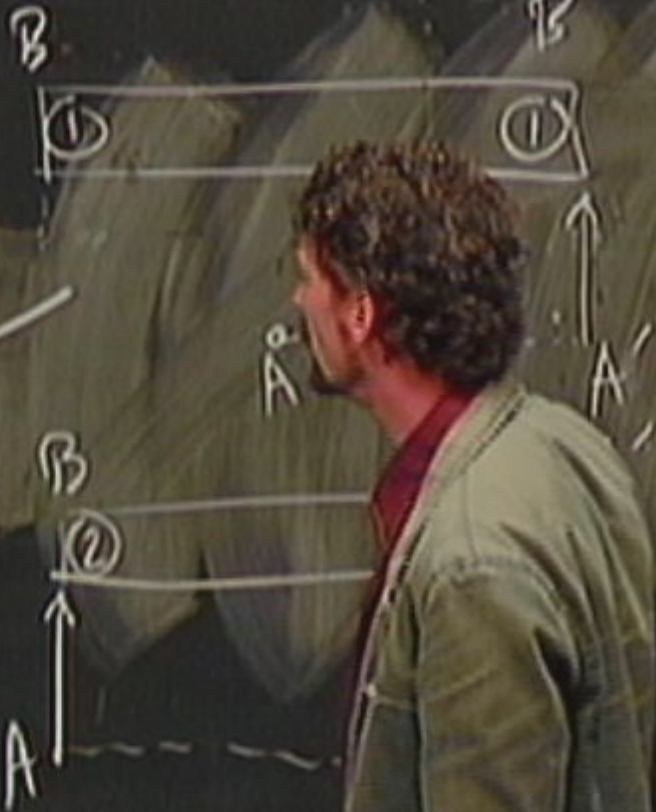
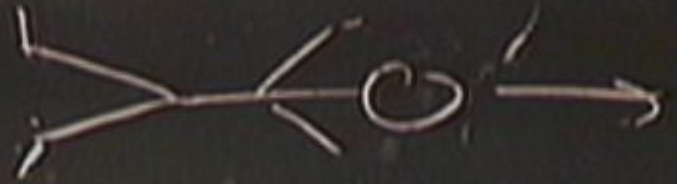
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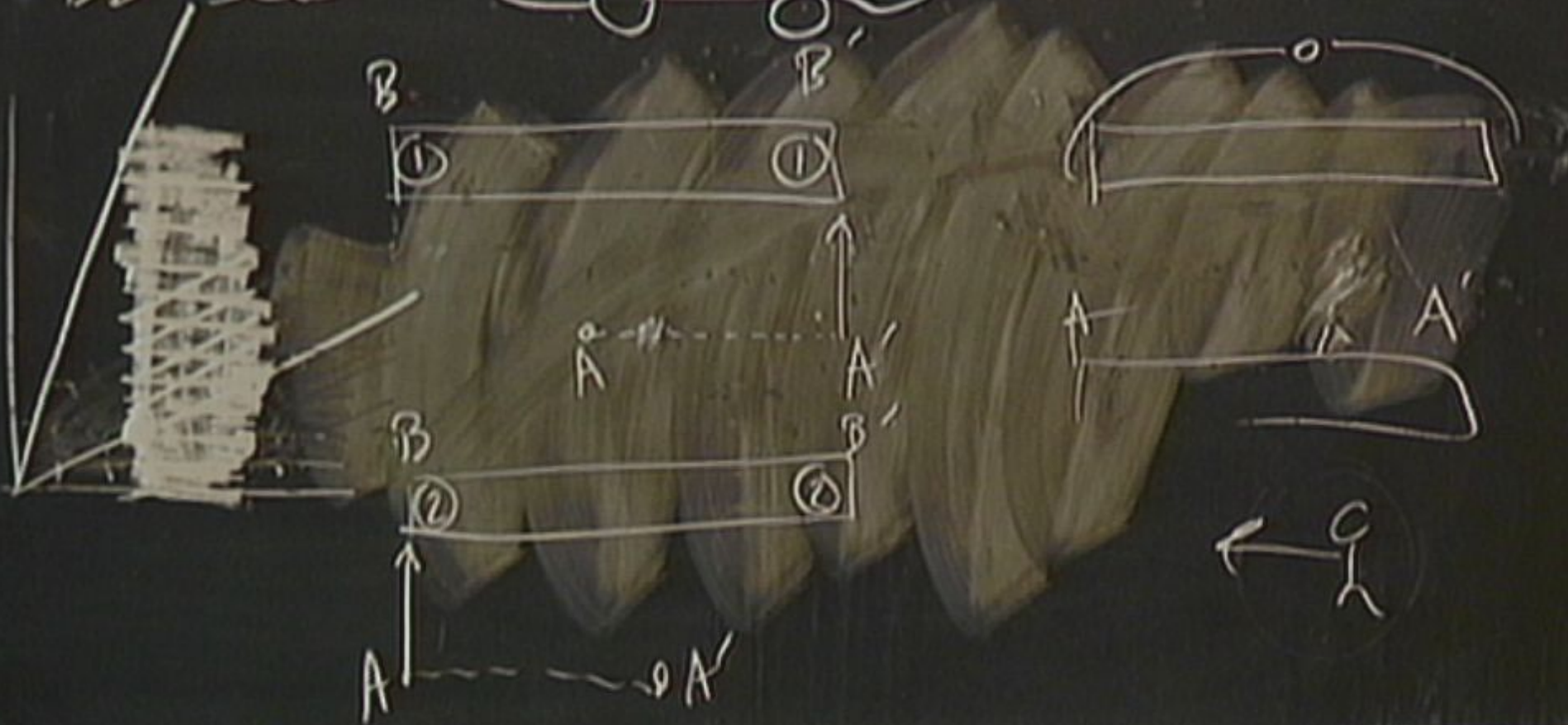
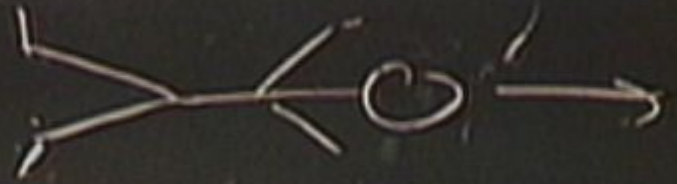
BB' see:



BB' see:



BB' see:

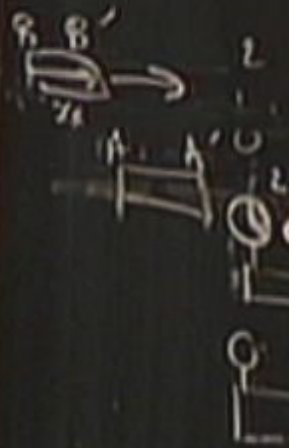


Eucl.

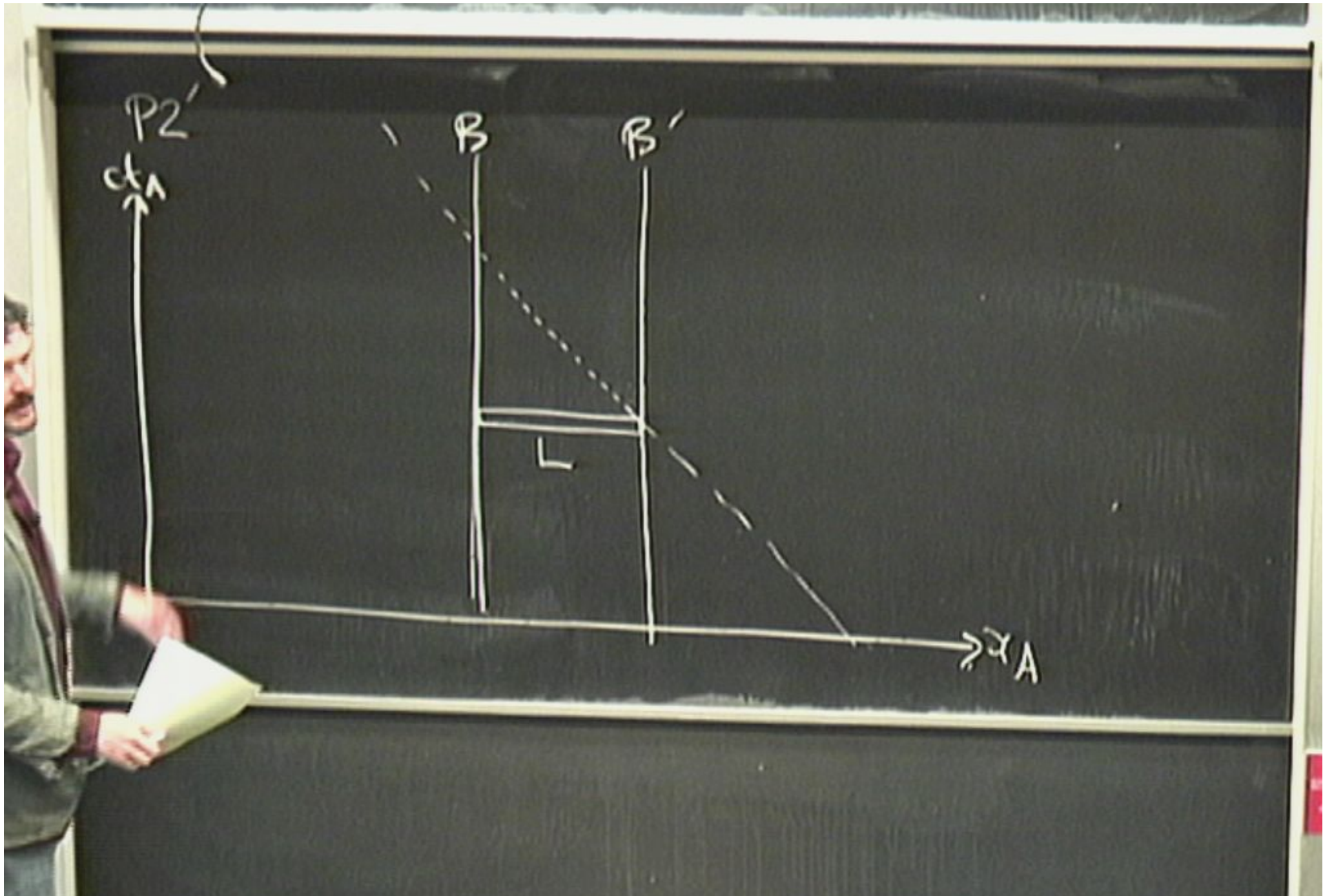
# Geometry

P2'

## Length









P2

$ct_A$

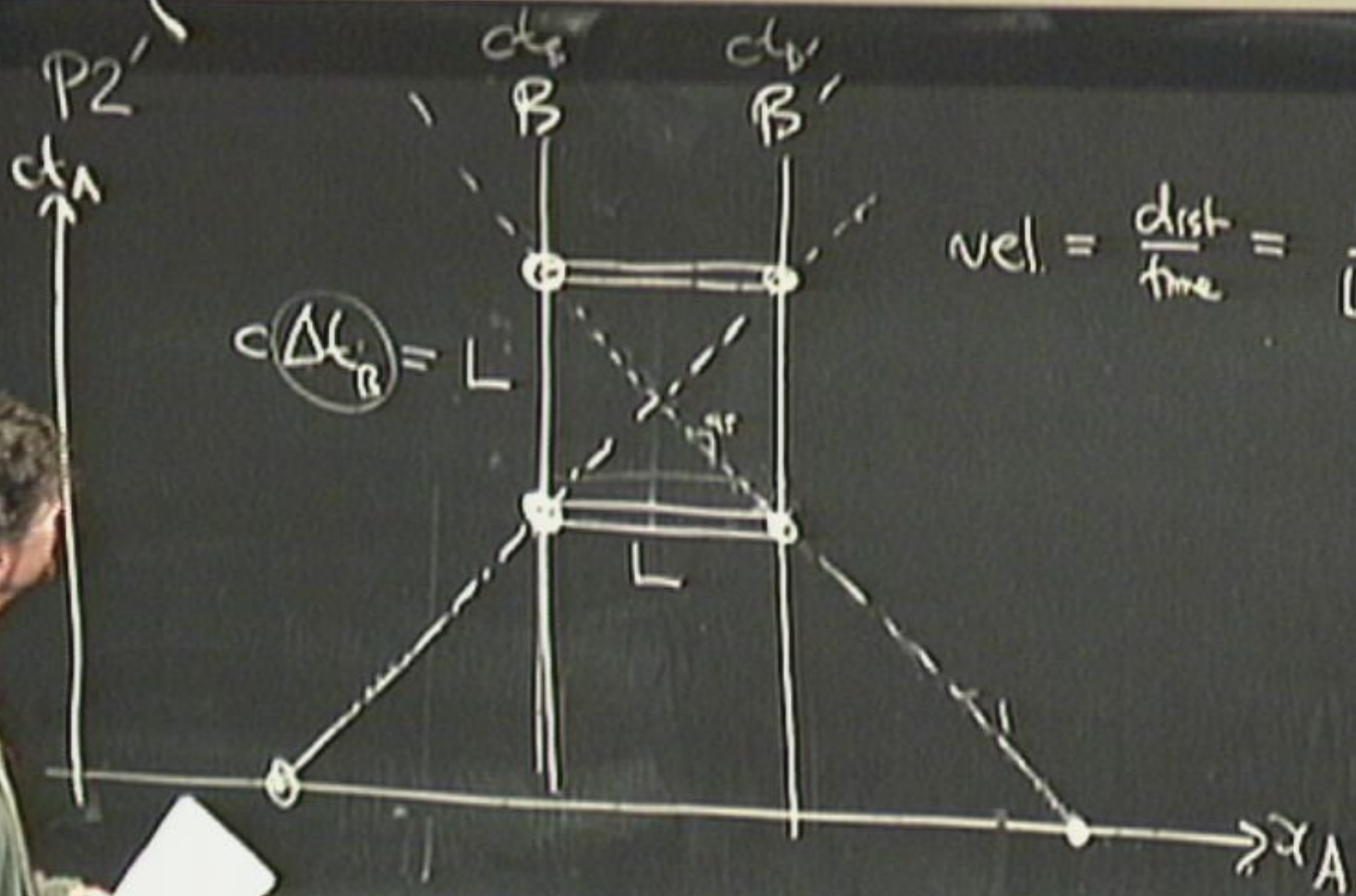
$$c\Delta t_B = L$$

$ct_B$

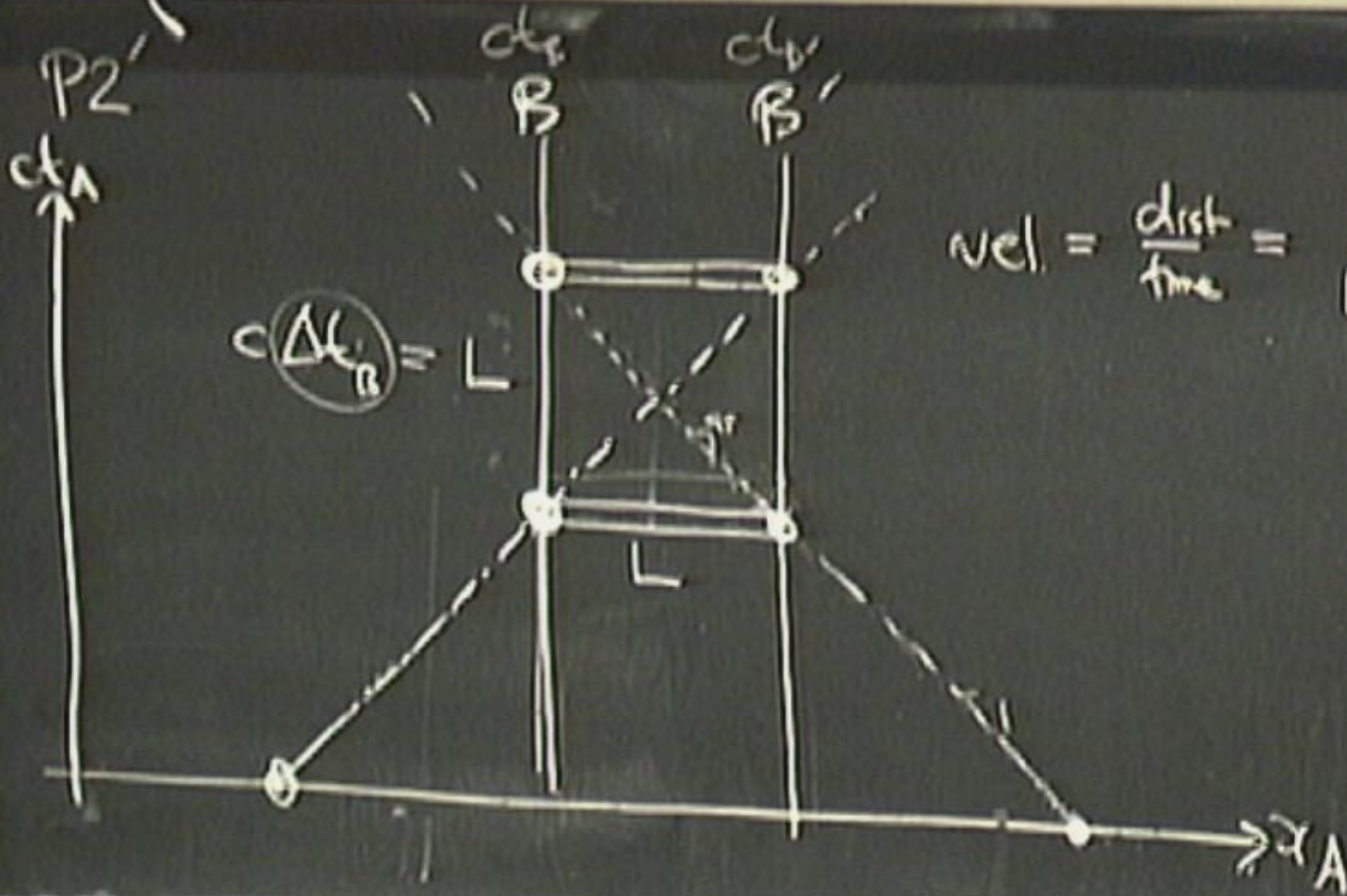
$ct_{B'}$

$$vel. = \frac{drst}{time} = \underline{L}$$

$x_A$



$$vel. = \frac{drst}{time} = \frac{L}{L/c} = c$$



$$vel = \frac{dist}{time} = \frac{L}{L/c} = c$$

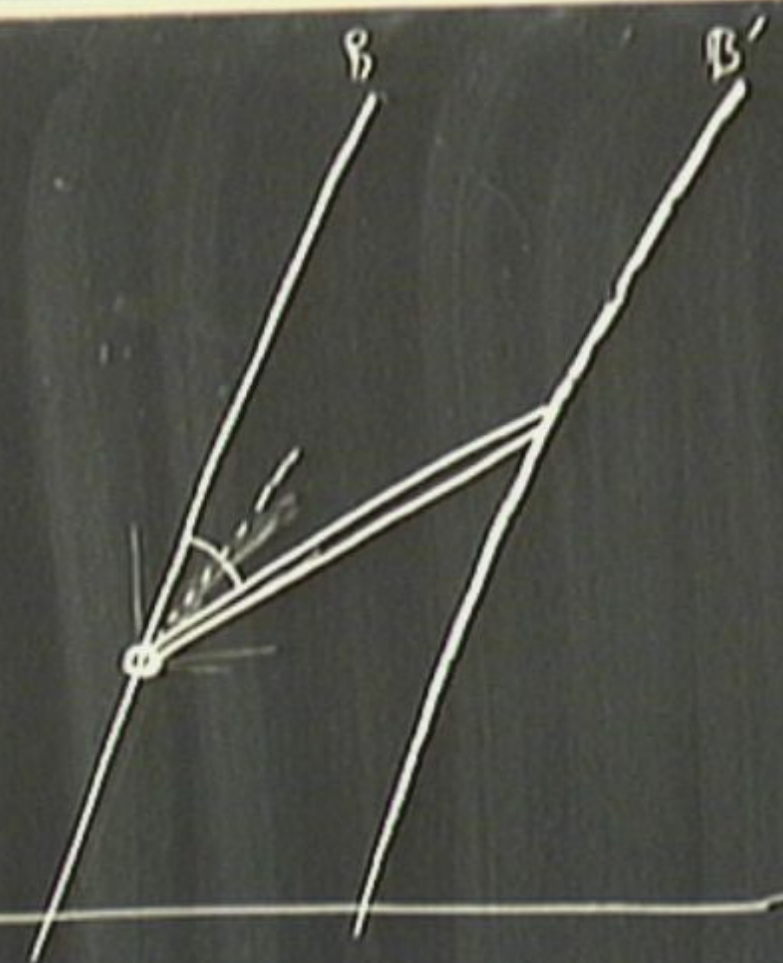
$\alpha_A$

B

B'

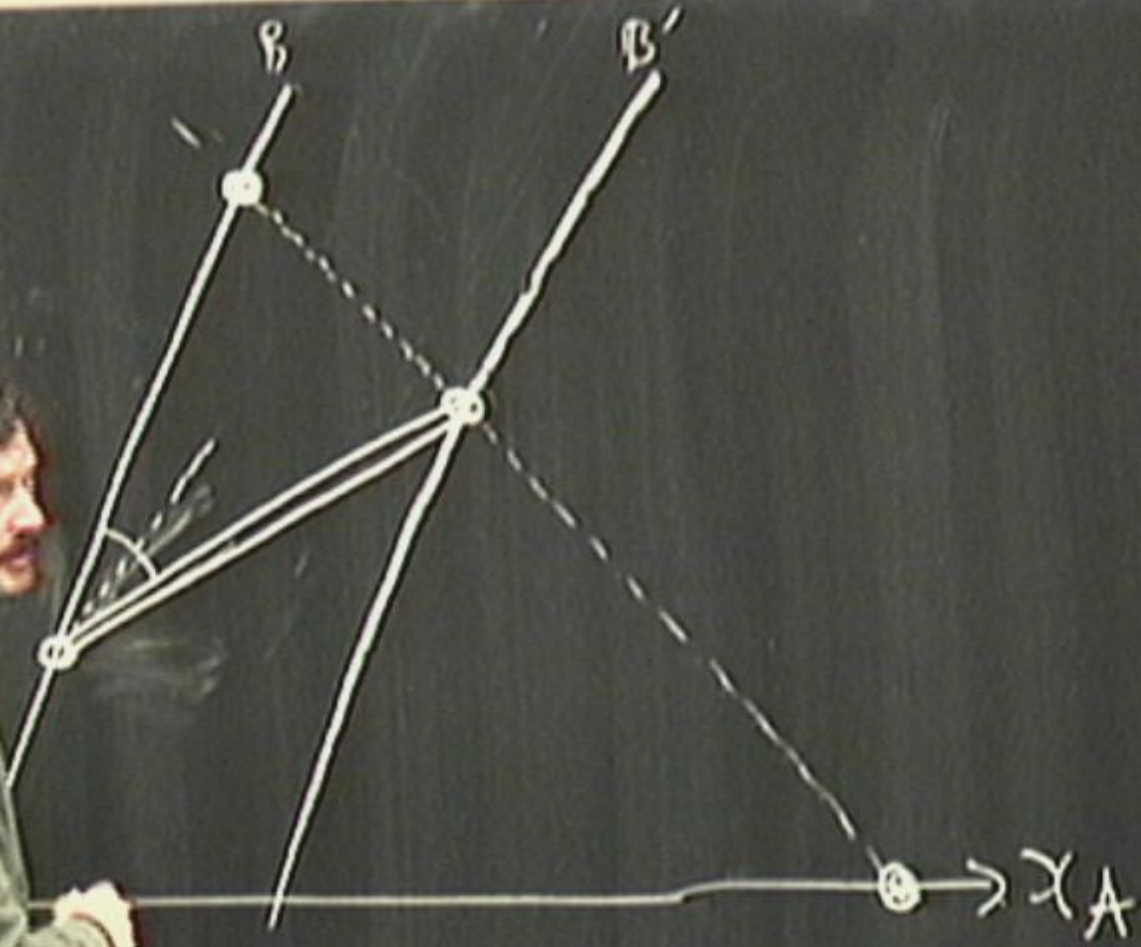
$\chi_A$

$\alpha_A$

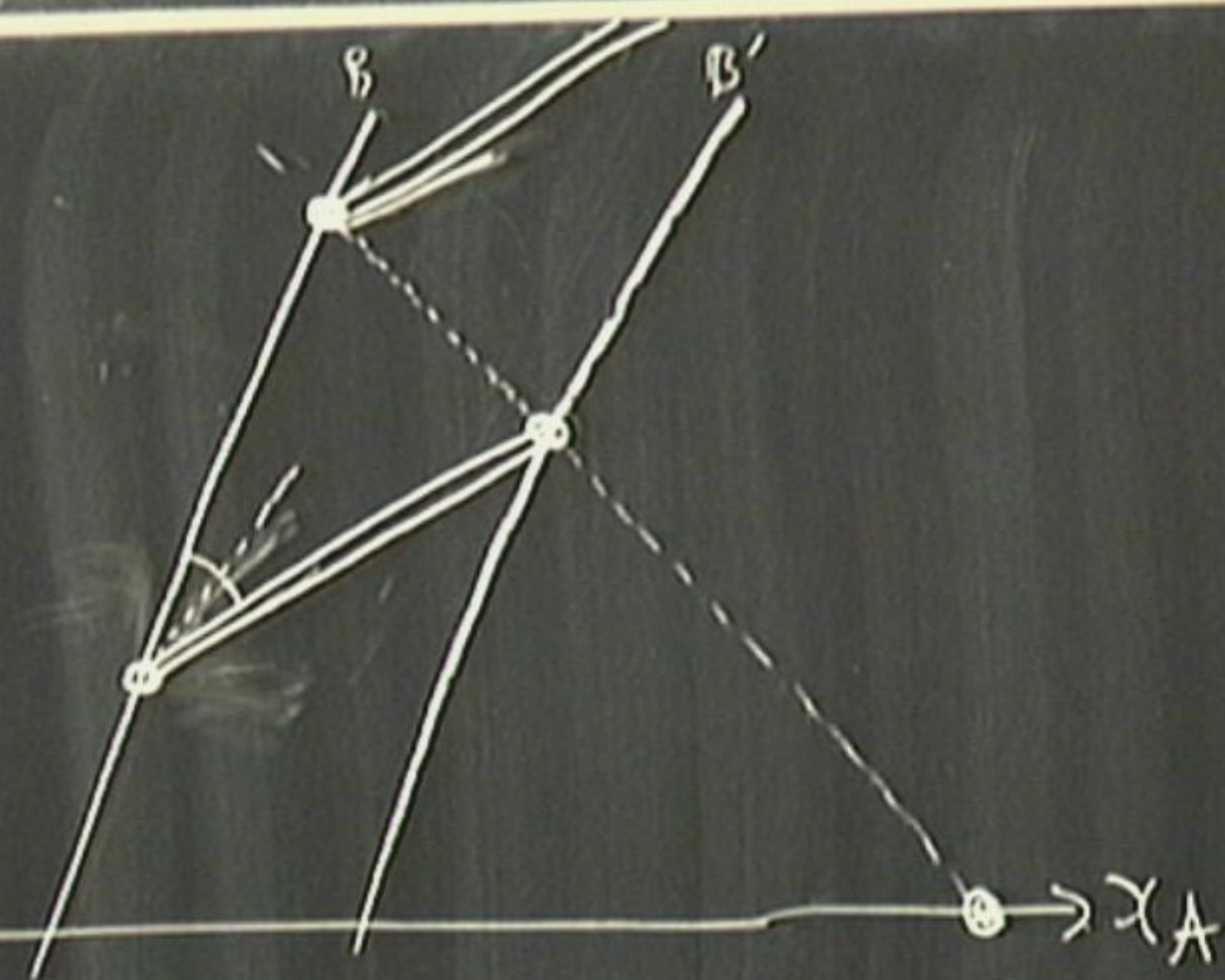


$\chi_A$

$\alpha_A$



$\alpha_A$





$\alpha_A$

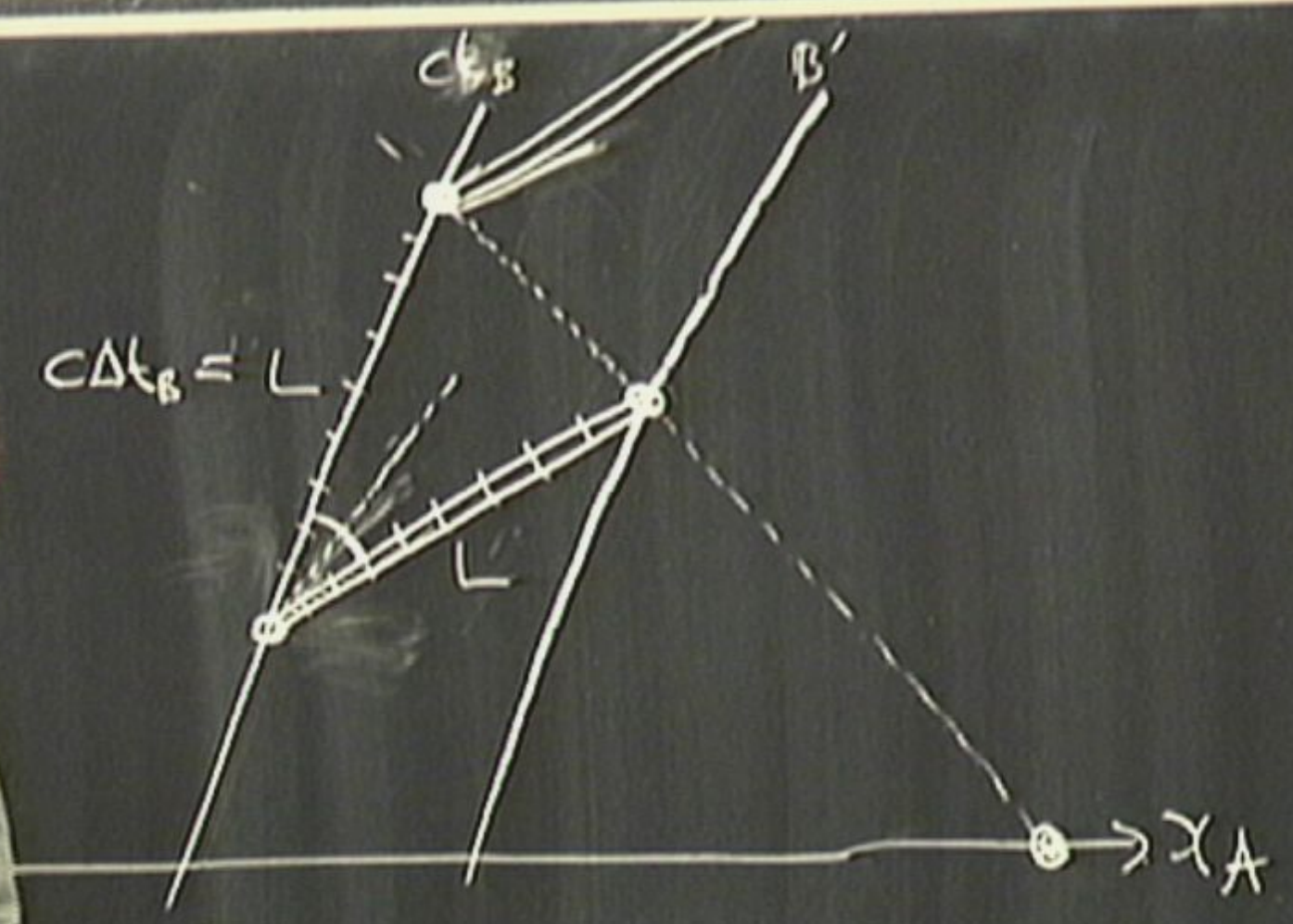
$C\Delta t_B = L$

$Ct_B$

$B'$

$L$

$\alpha_A$



$\alpha_A$

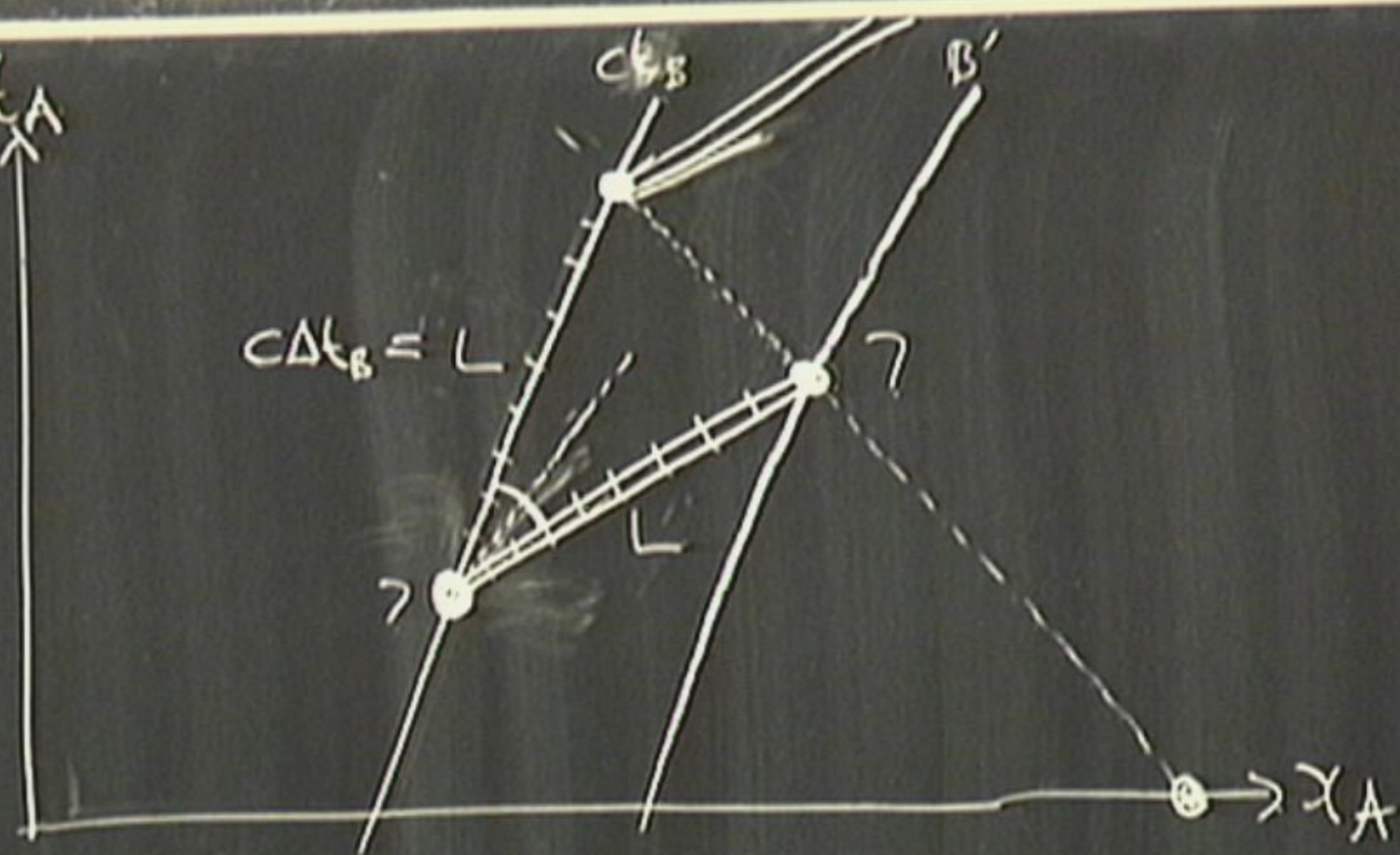
$\alpha_B$

$B'$

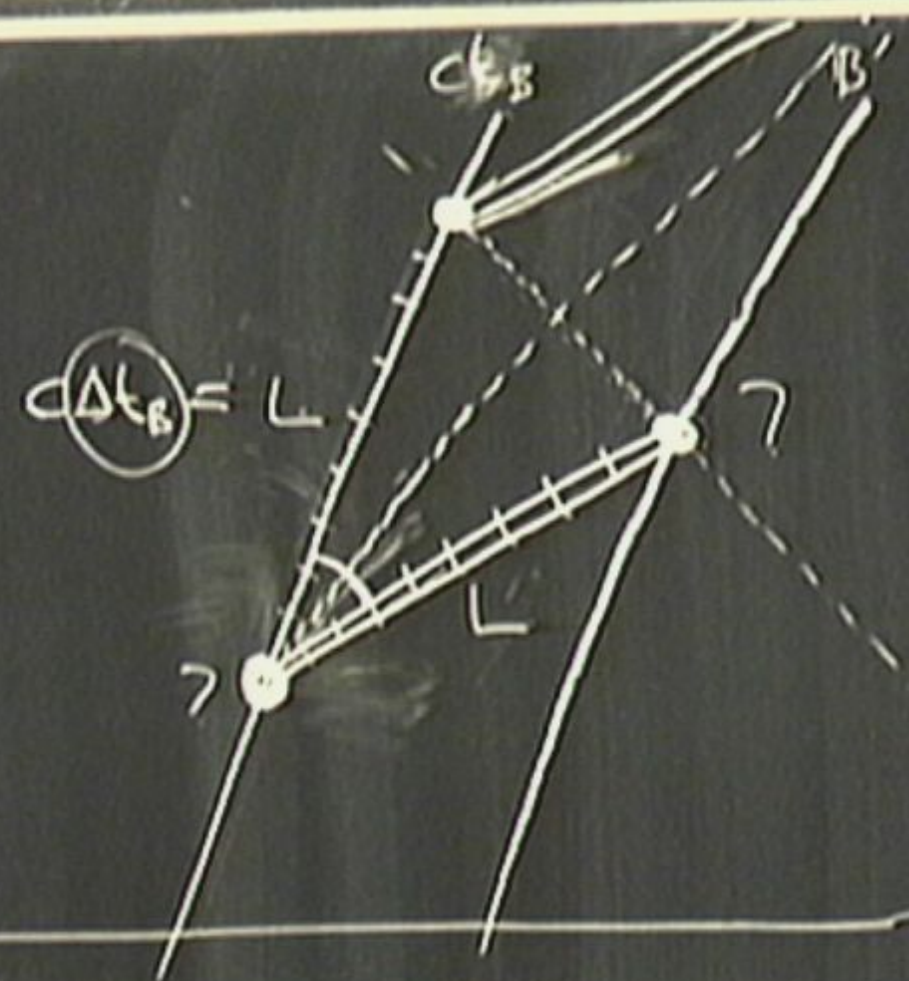
$C\Delta t_B = L$

$L$

$\alpha_A$

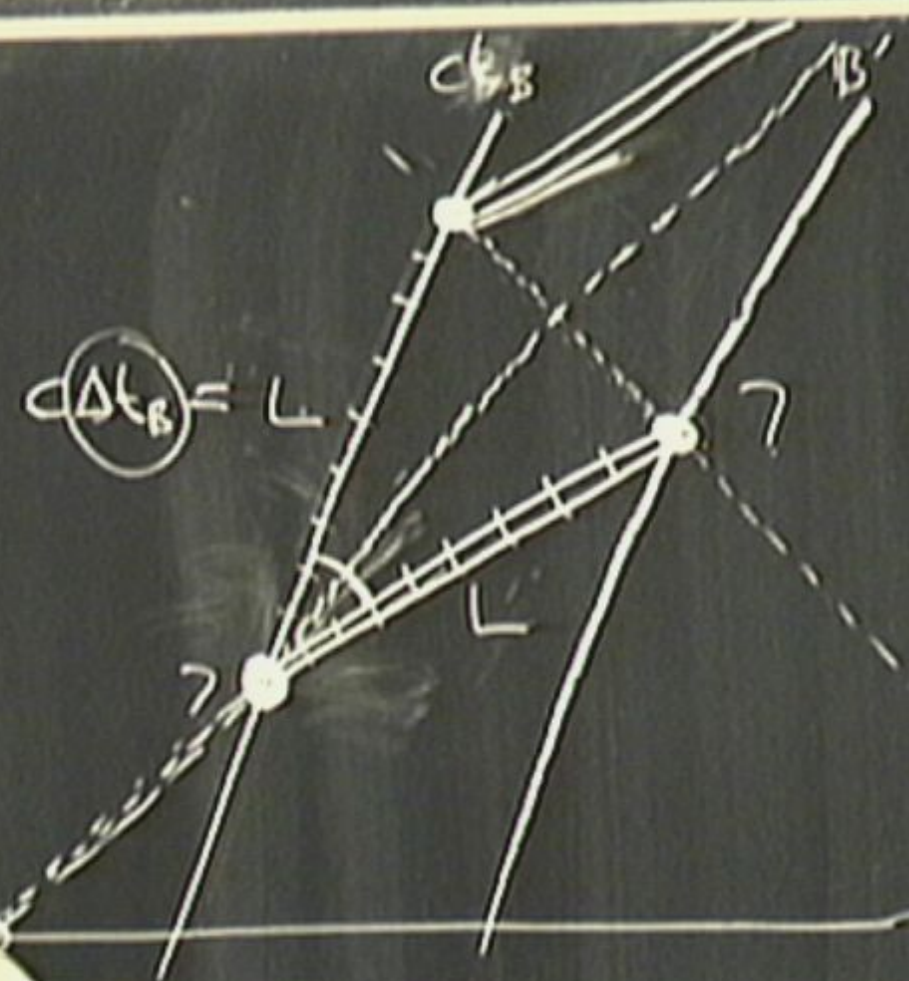


$x_A$



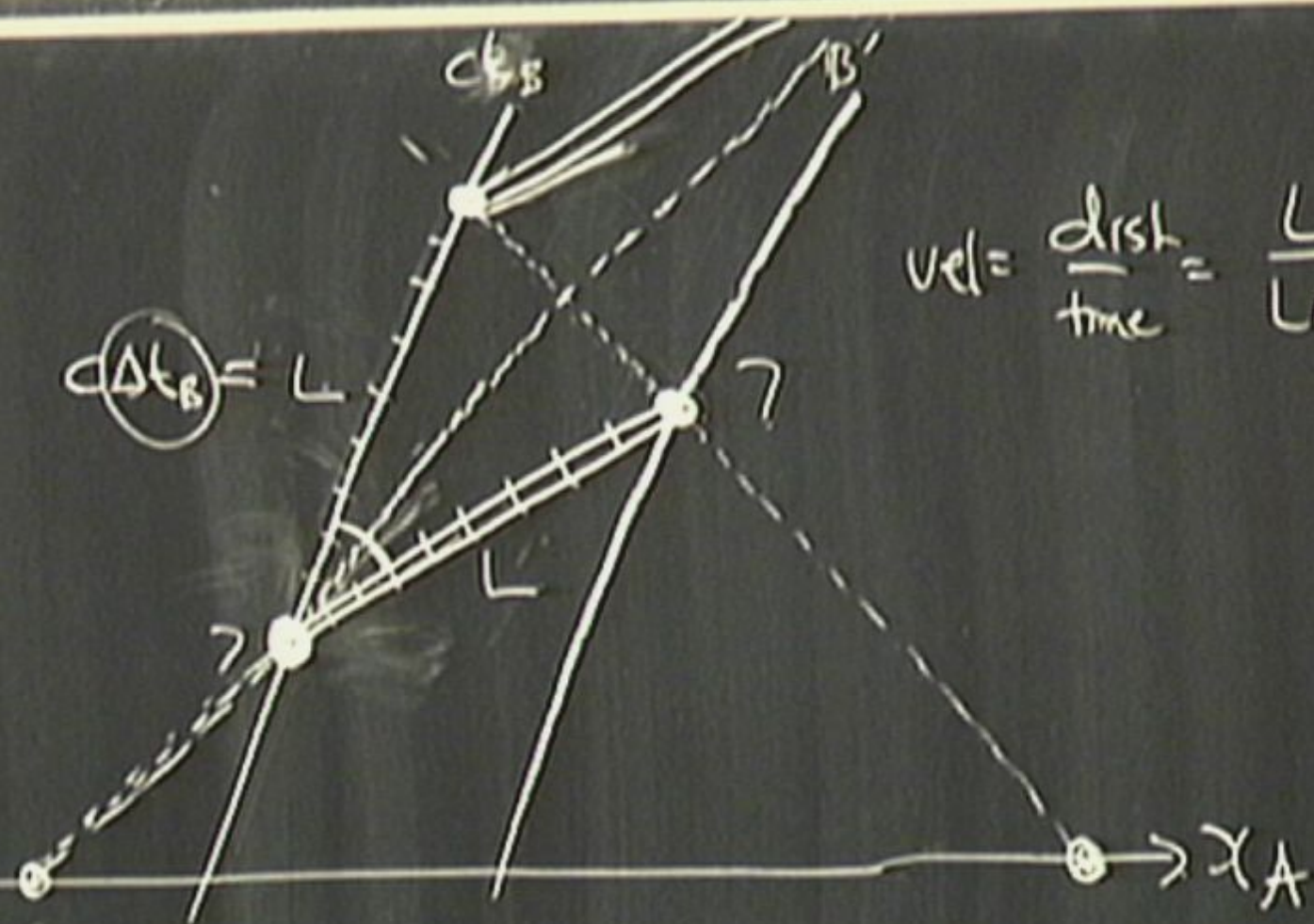
$$vel = \frac{dist}{time} = \frac{L}{L/c} = c$$

$c_A$



$$vel = \frac{dist}{time} = \frac{L}{L/c} = c$$

$x_A$



$c\Delta t_B = L$

$vel = \frac{dist}{time} = \frac{L}{L/c} = c$