

Title: Enrichment presentation on Black Holes and the Global Positioning System (General Relativity)

Date: Jul 08, 2006 09:00 AM

URL: <http://pirsa.org/06070017>

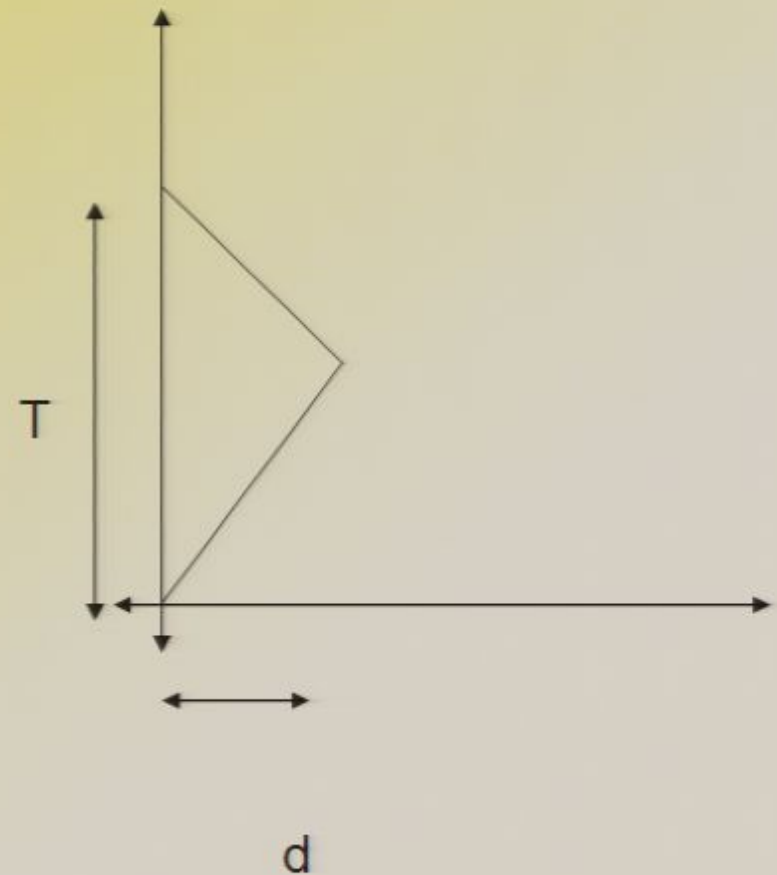
Abstract:

# Twin paradox

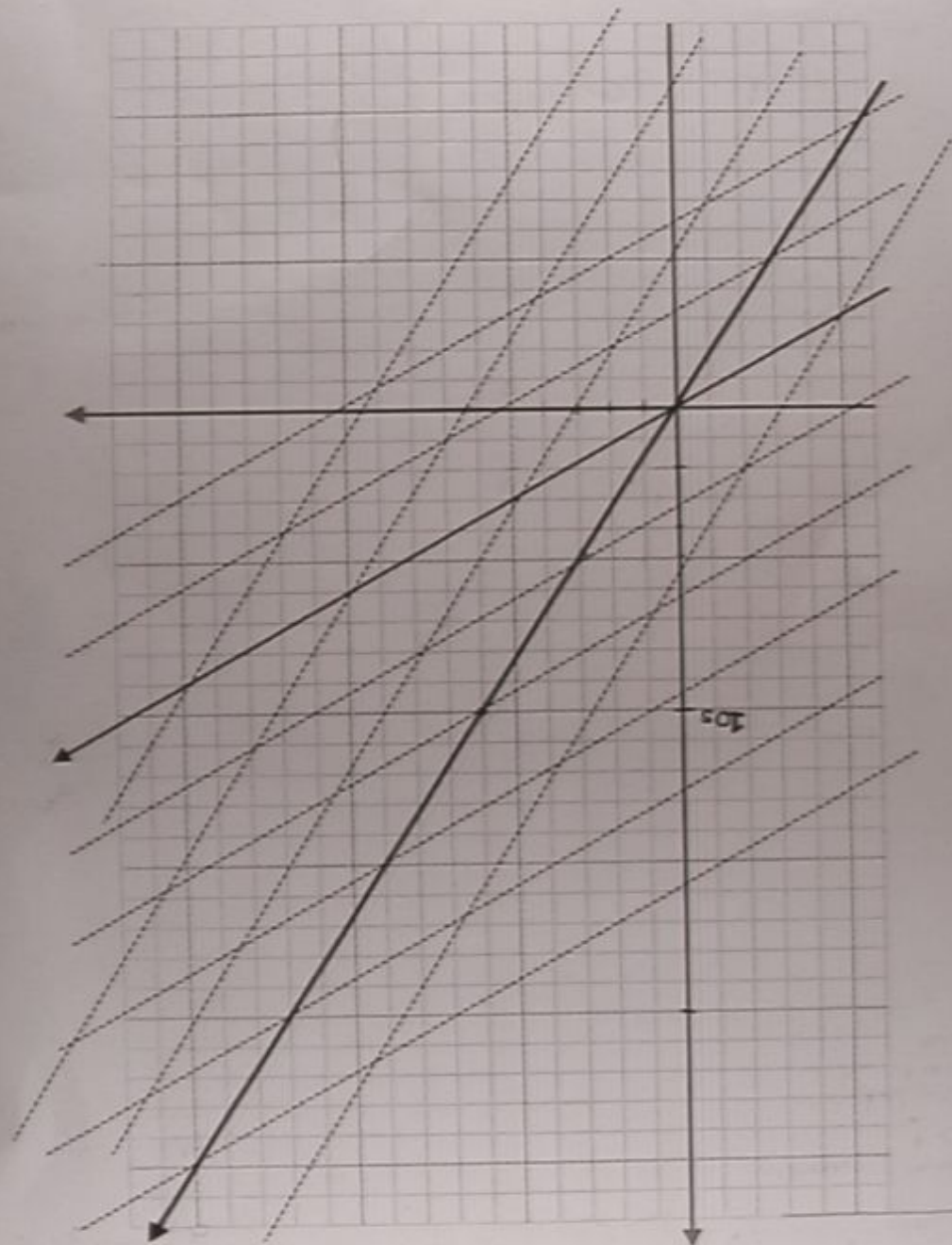
Consider two twins. One day, one of them decides to go on

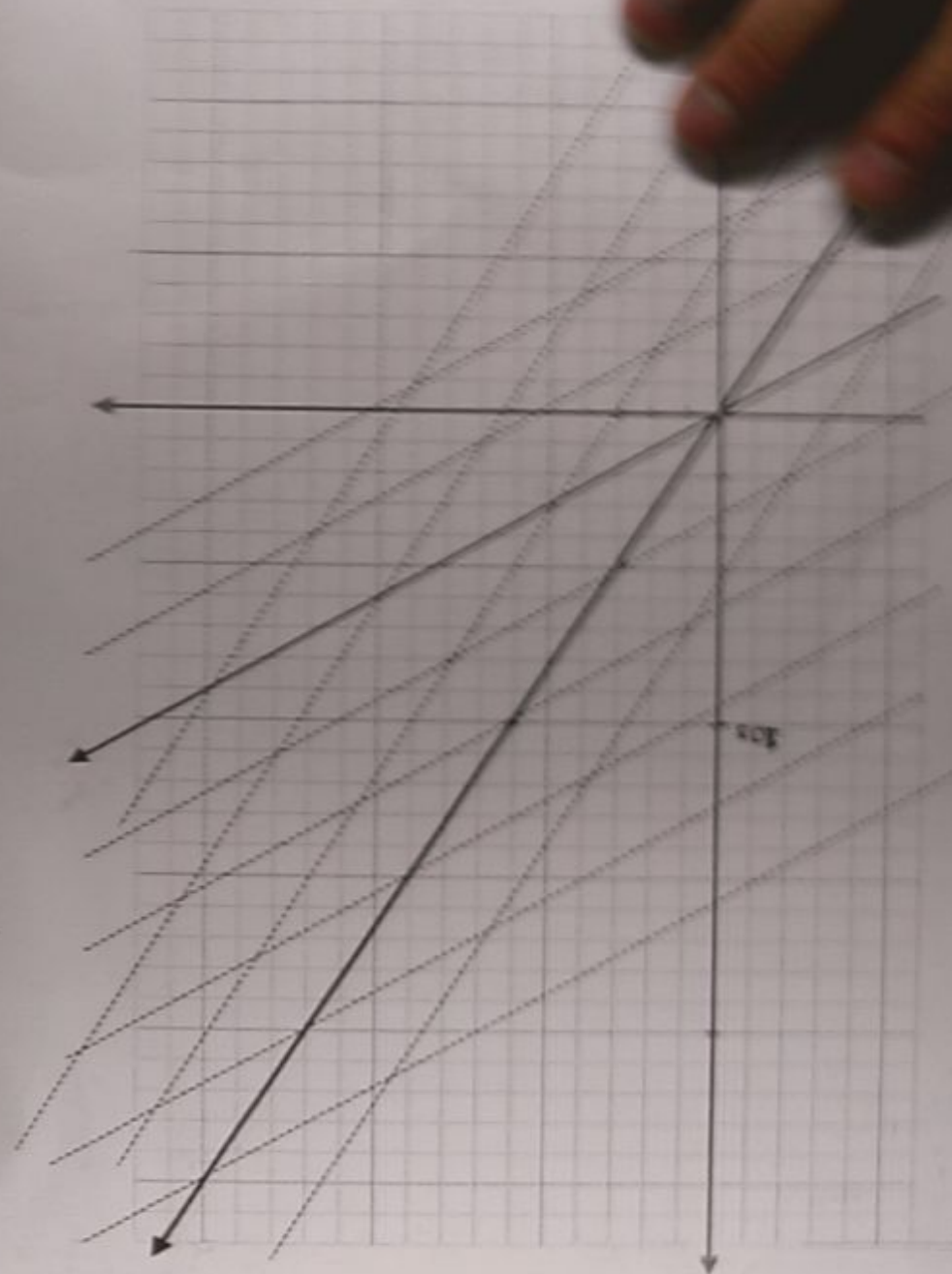
What are the spacetime intervals for the two paths?

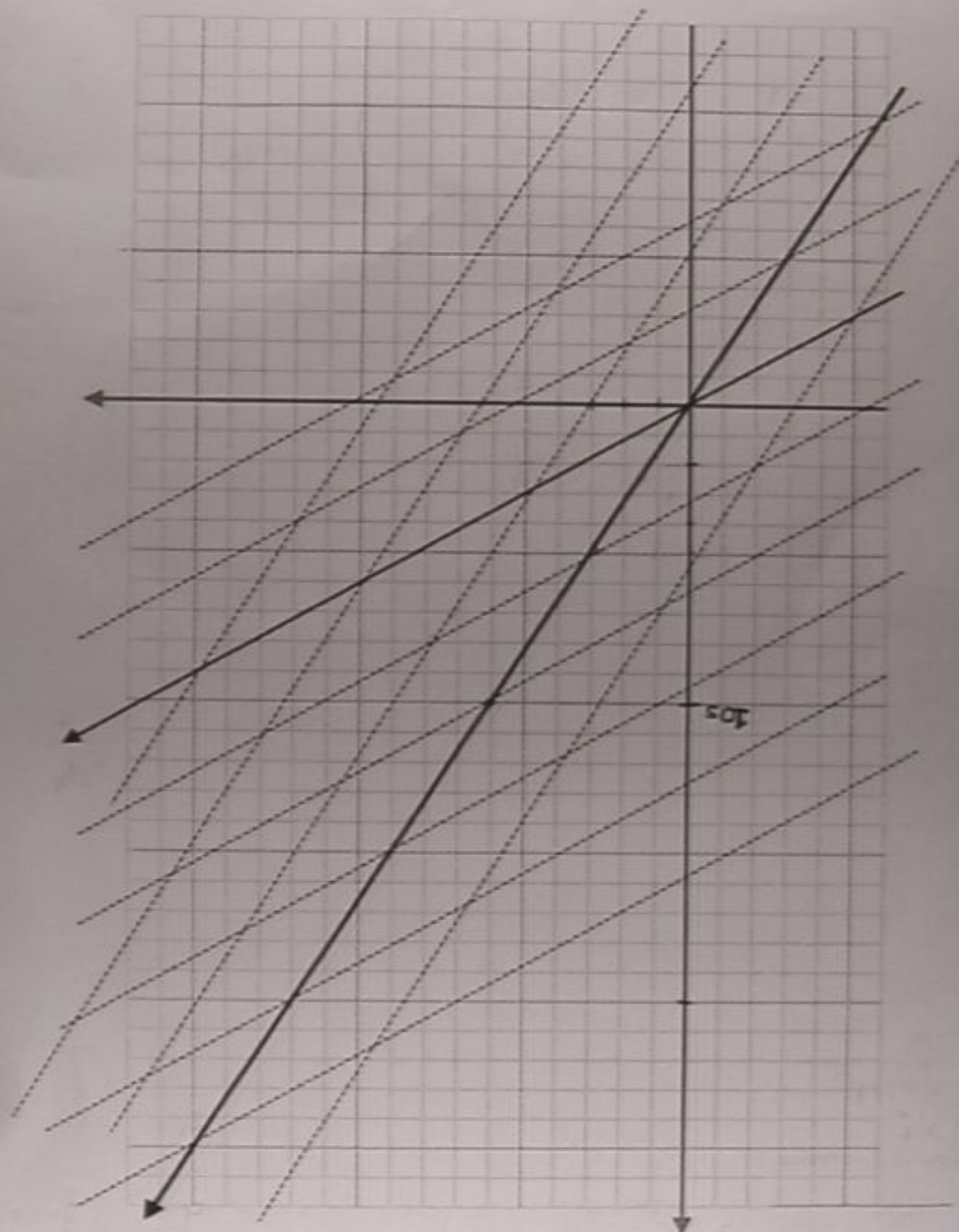
$$\begin{aligned} s &= cT \\ s' &= 2\sqrt{\left(\frac{cT}{2}\right)^2 - d^2} \\ &= cT\sqrt{1 - \left(\frac{2d}{cT}\right)^2} \end{aligned}$$

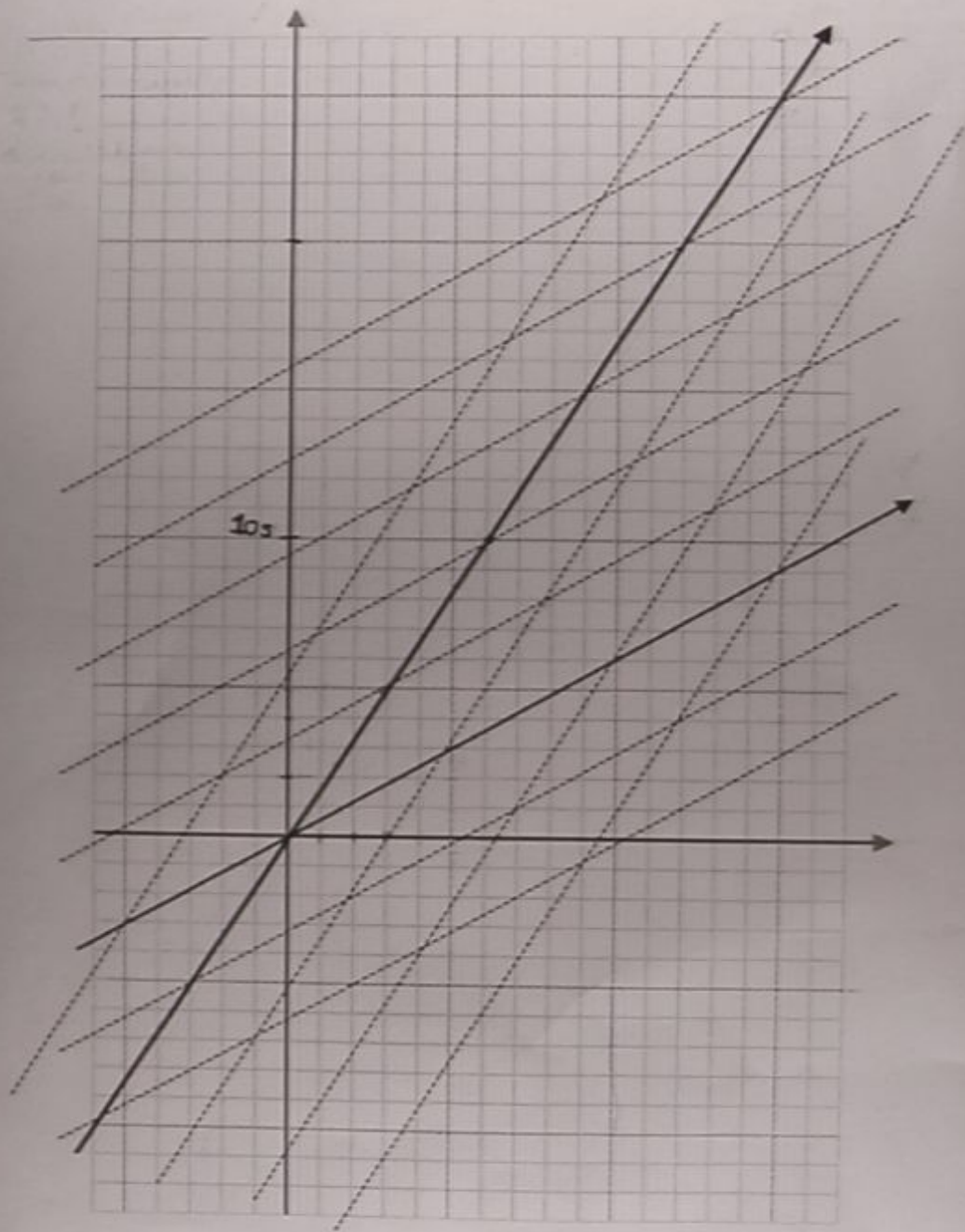




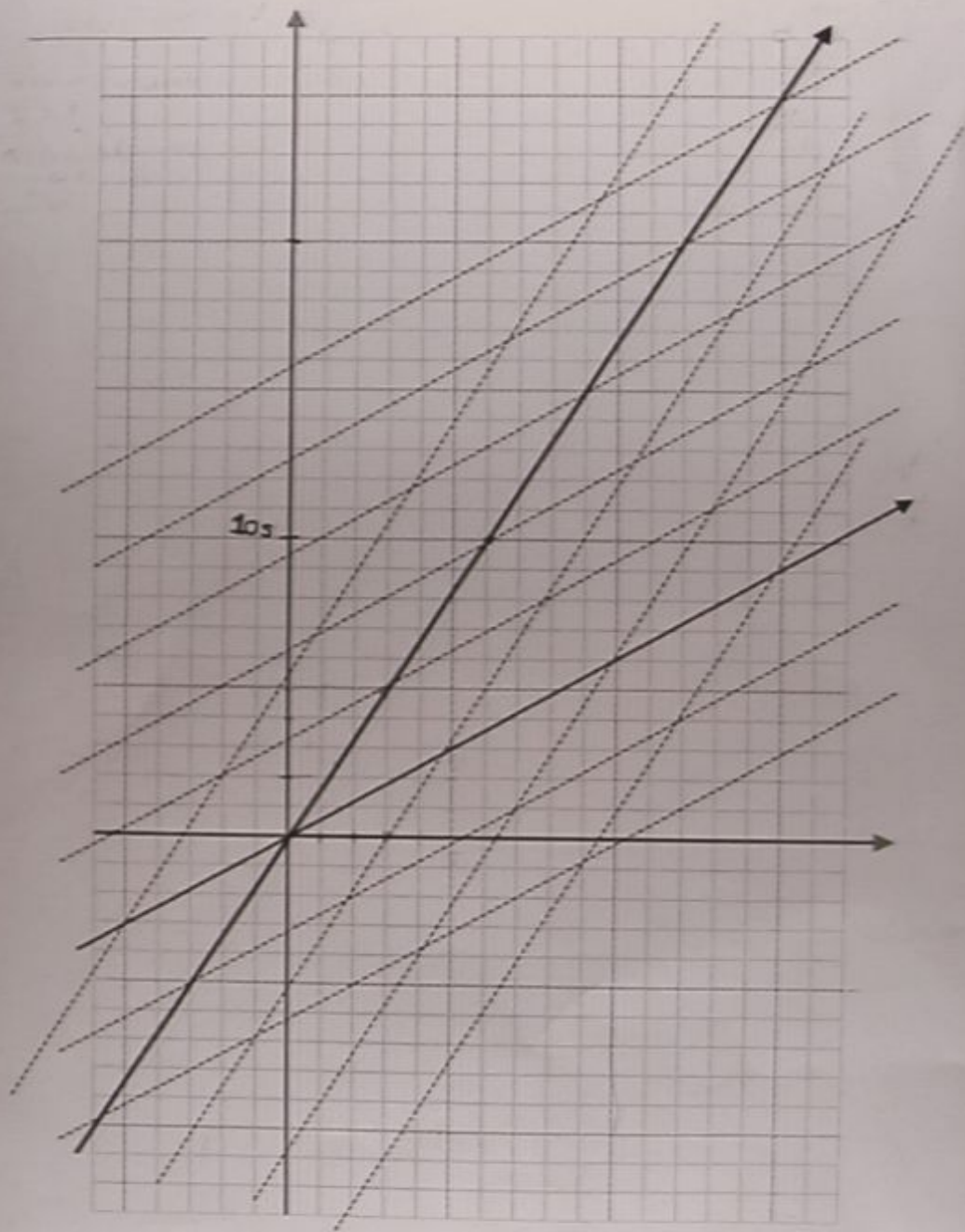




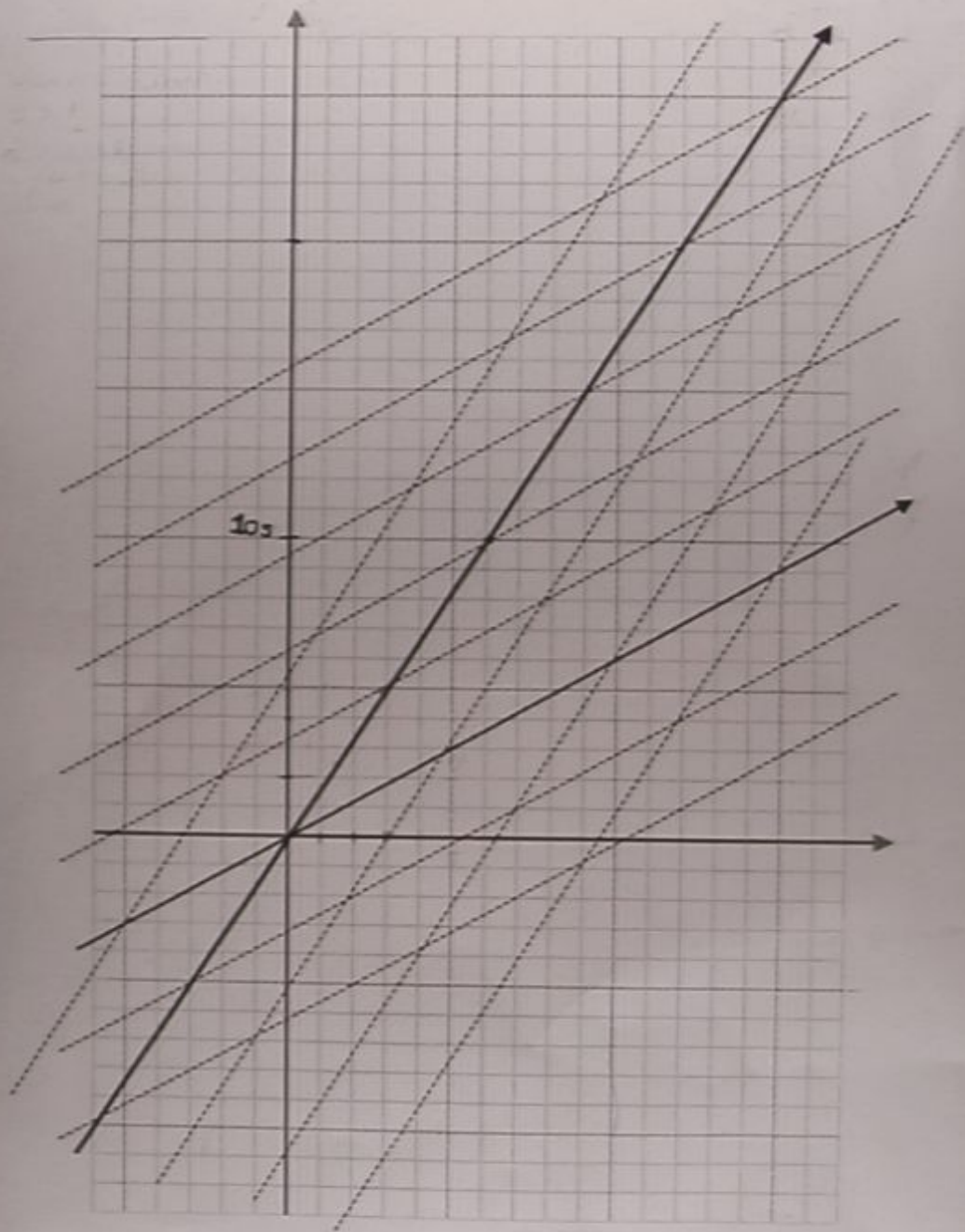


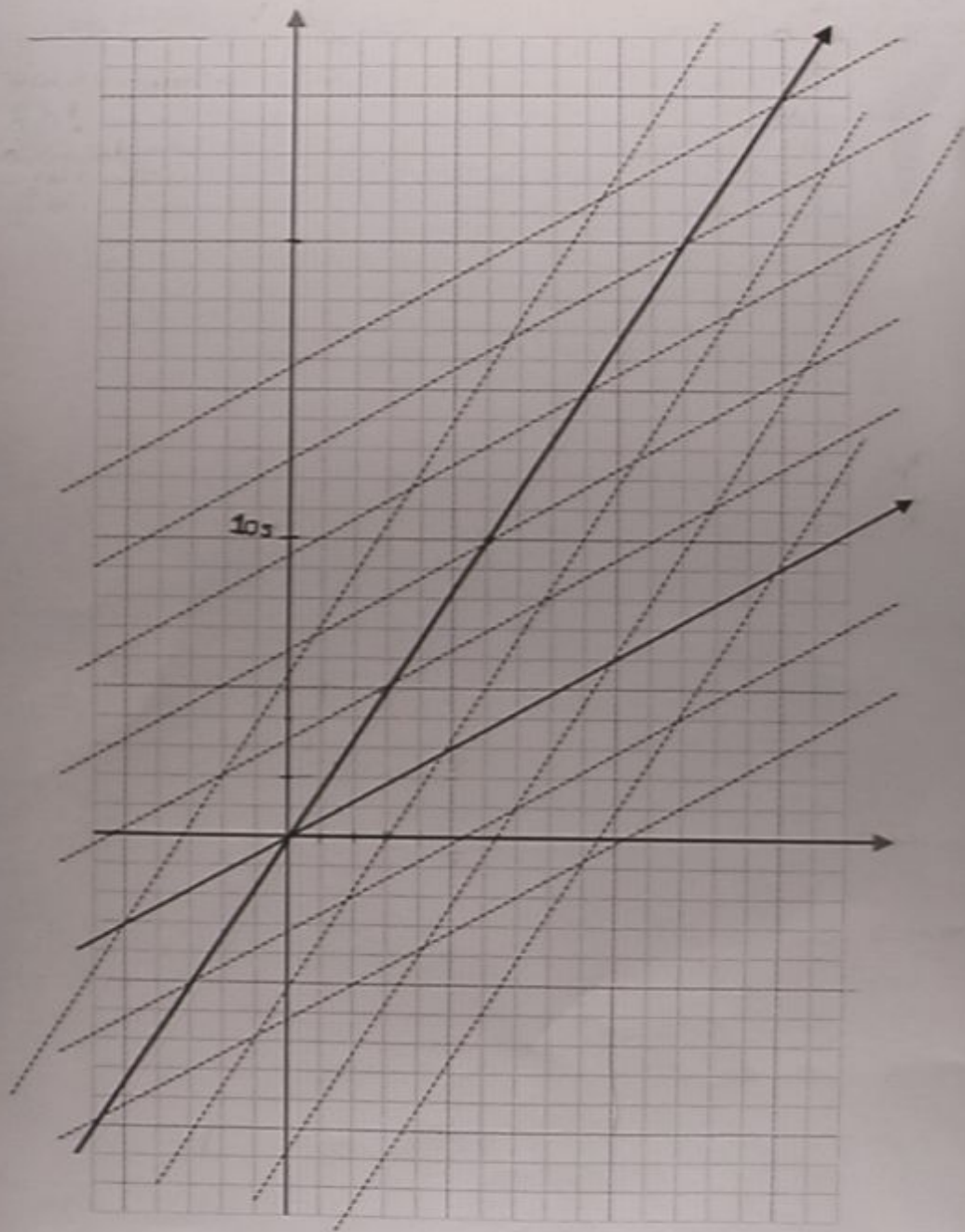


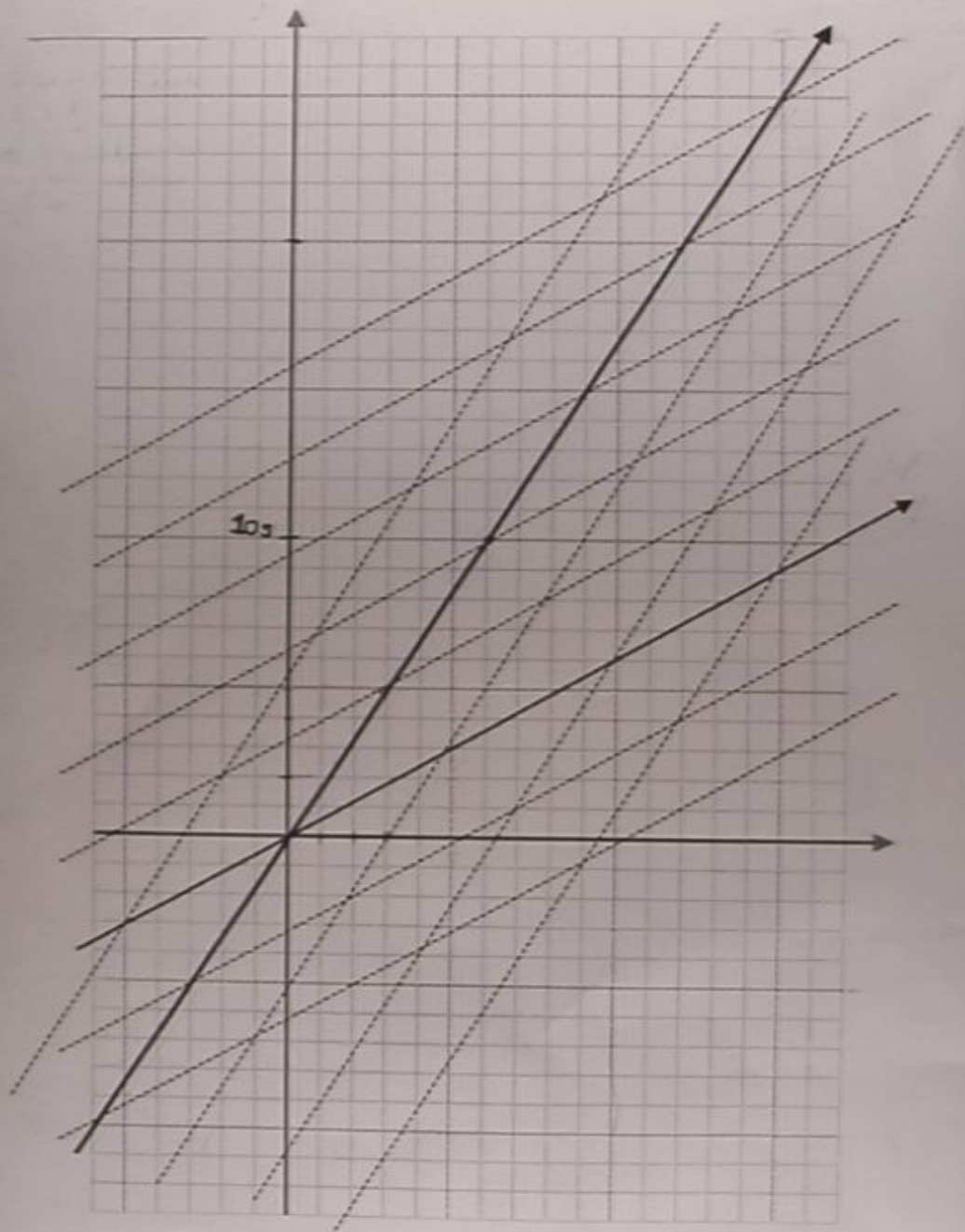


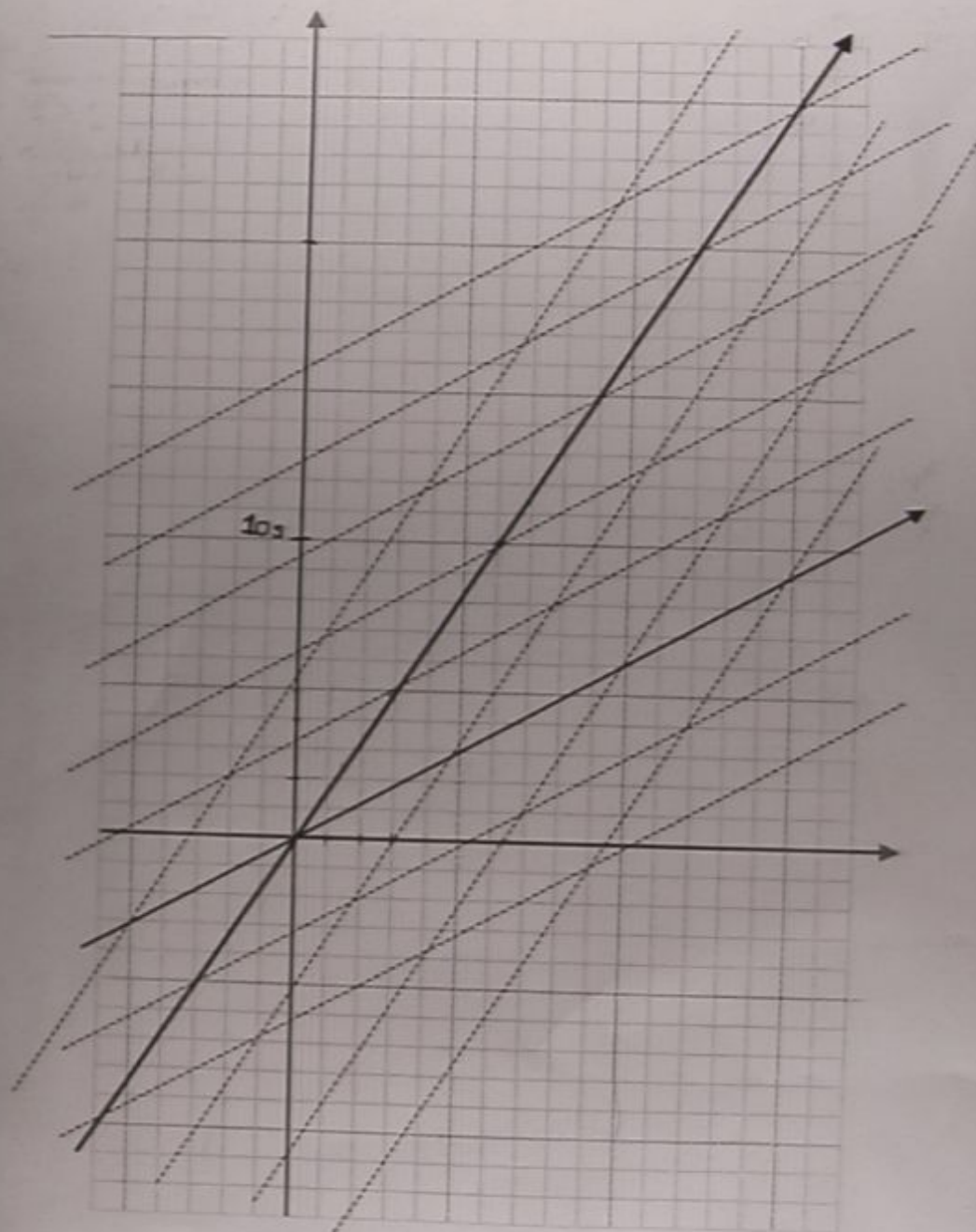




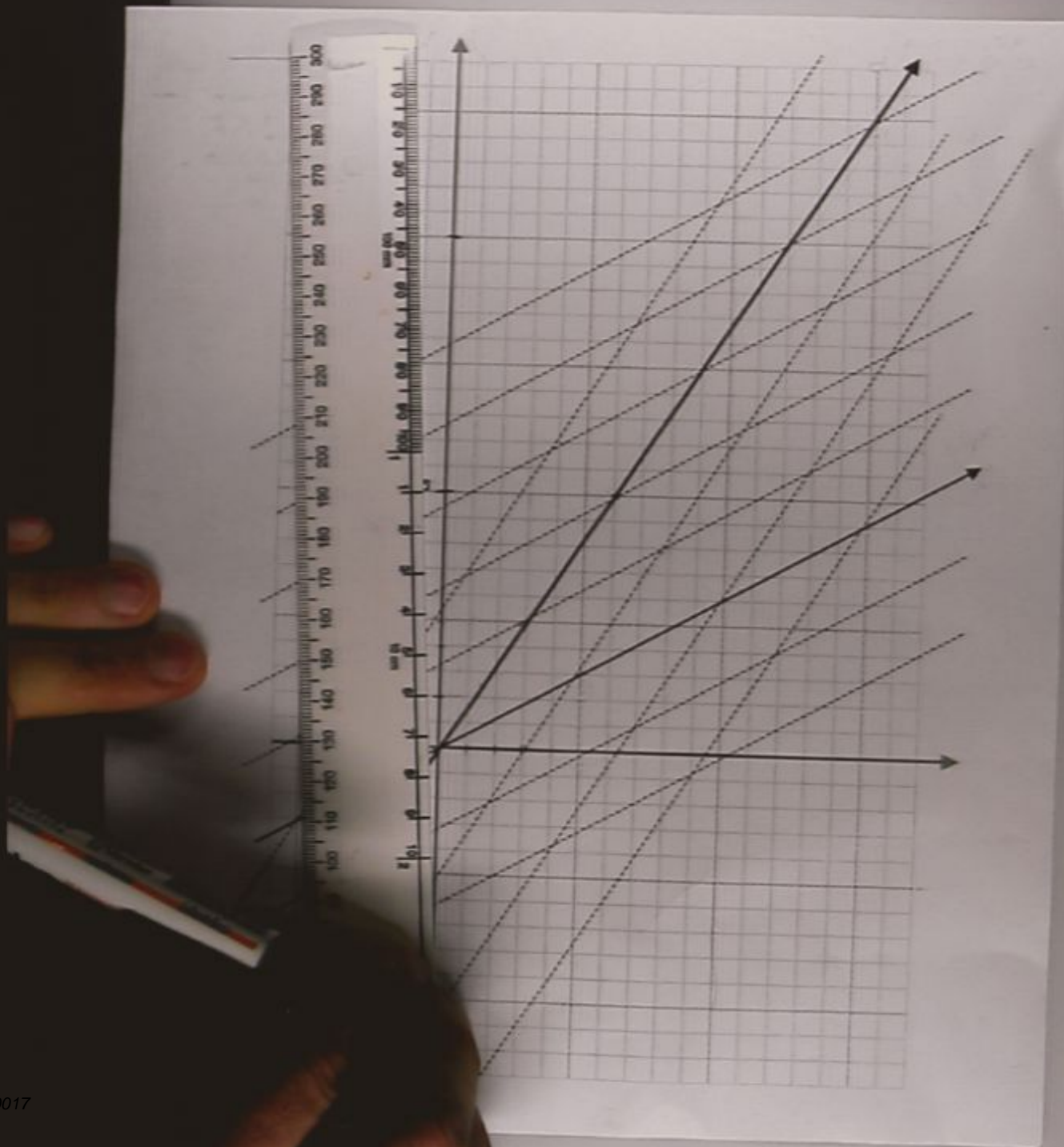


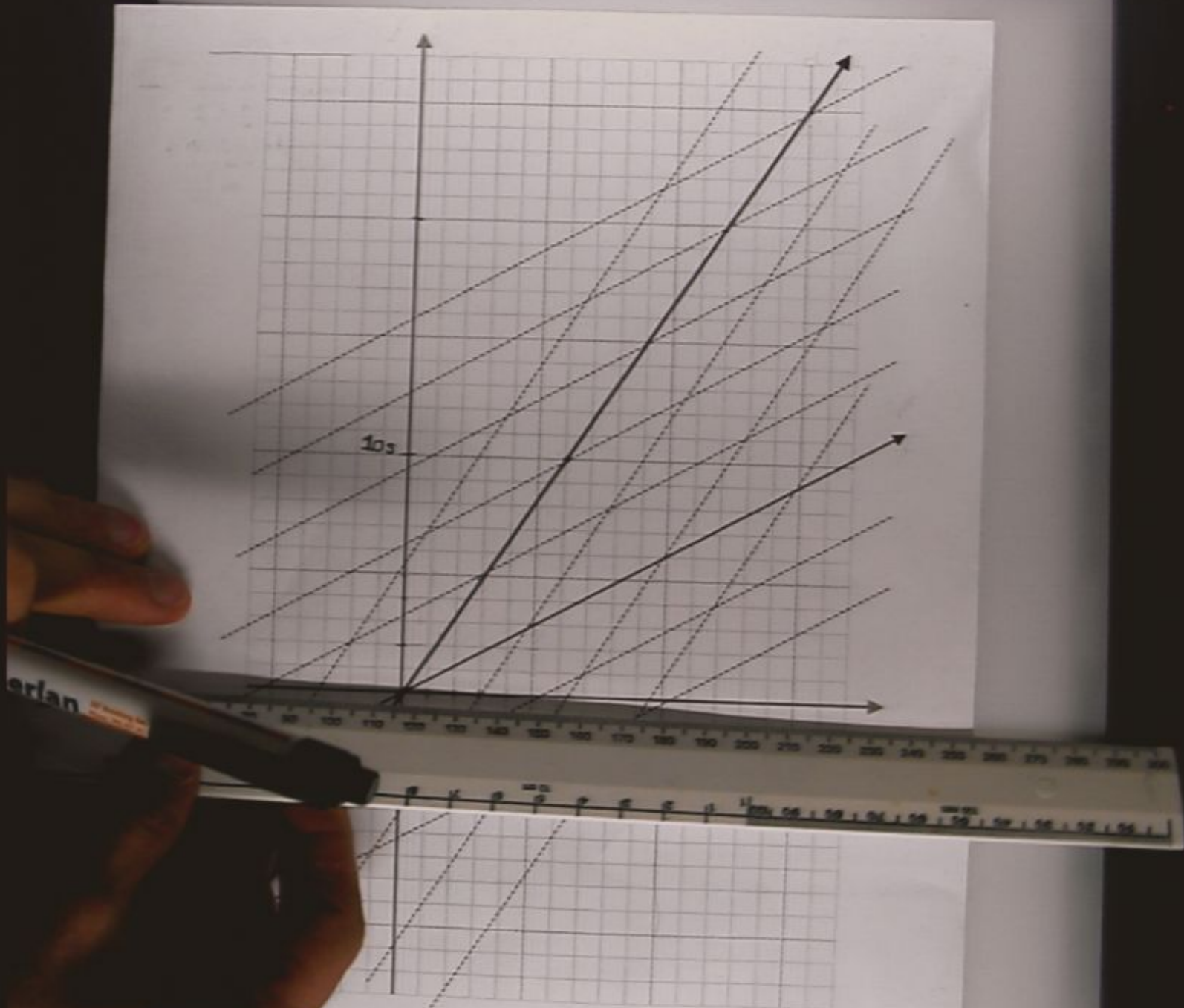


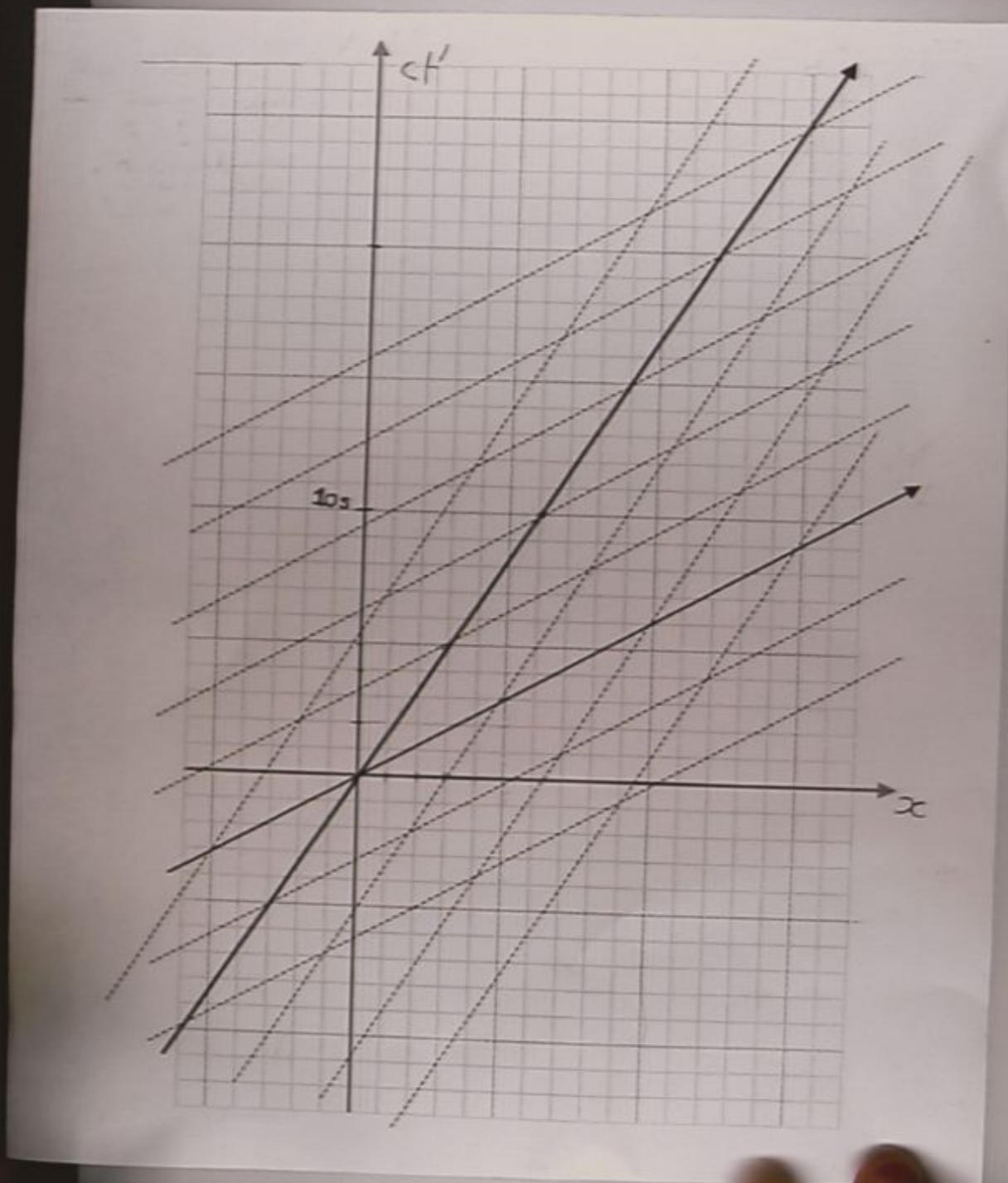




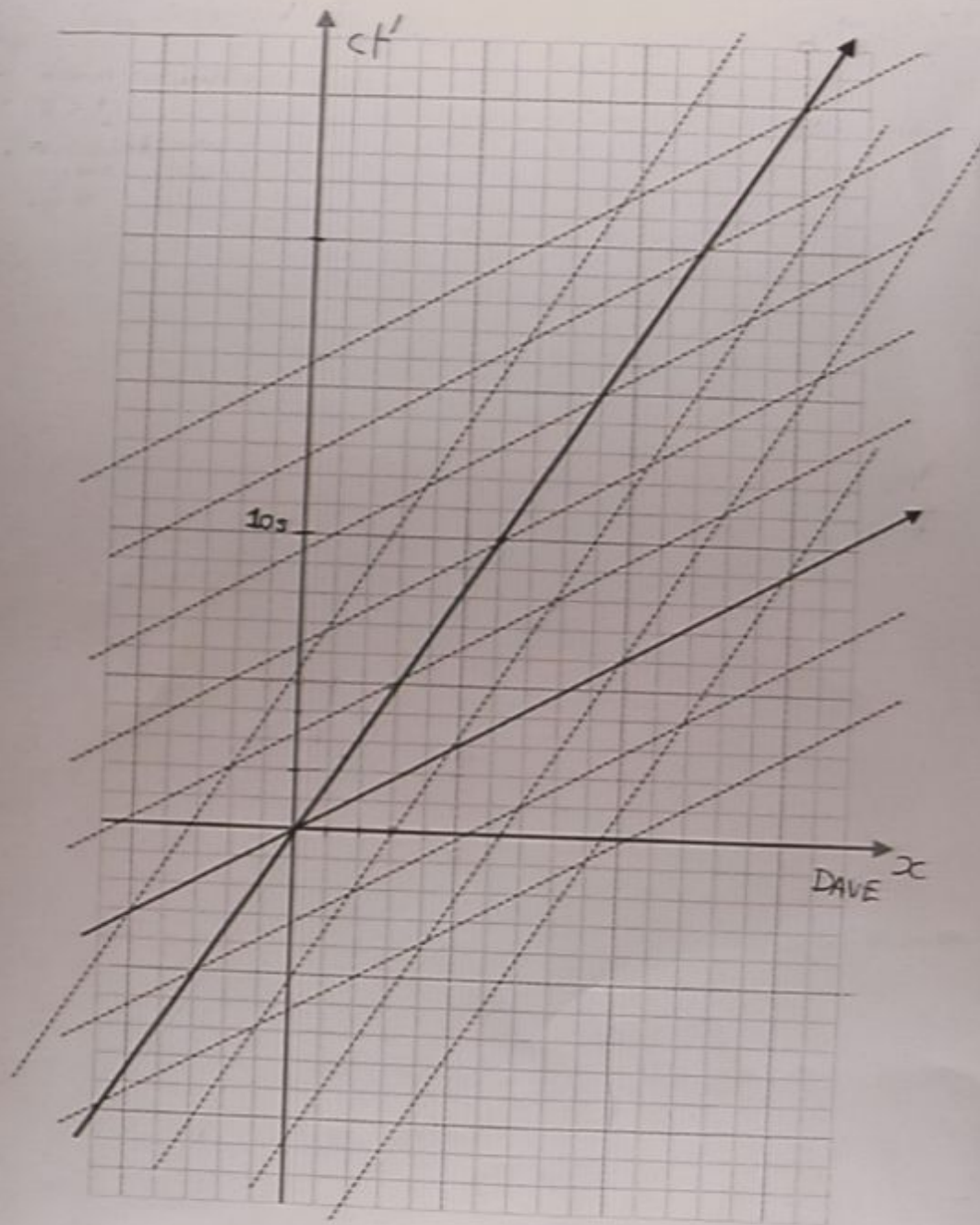


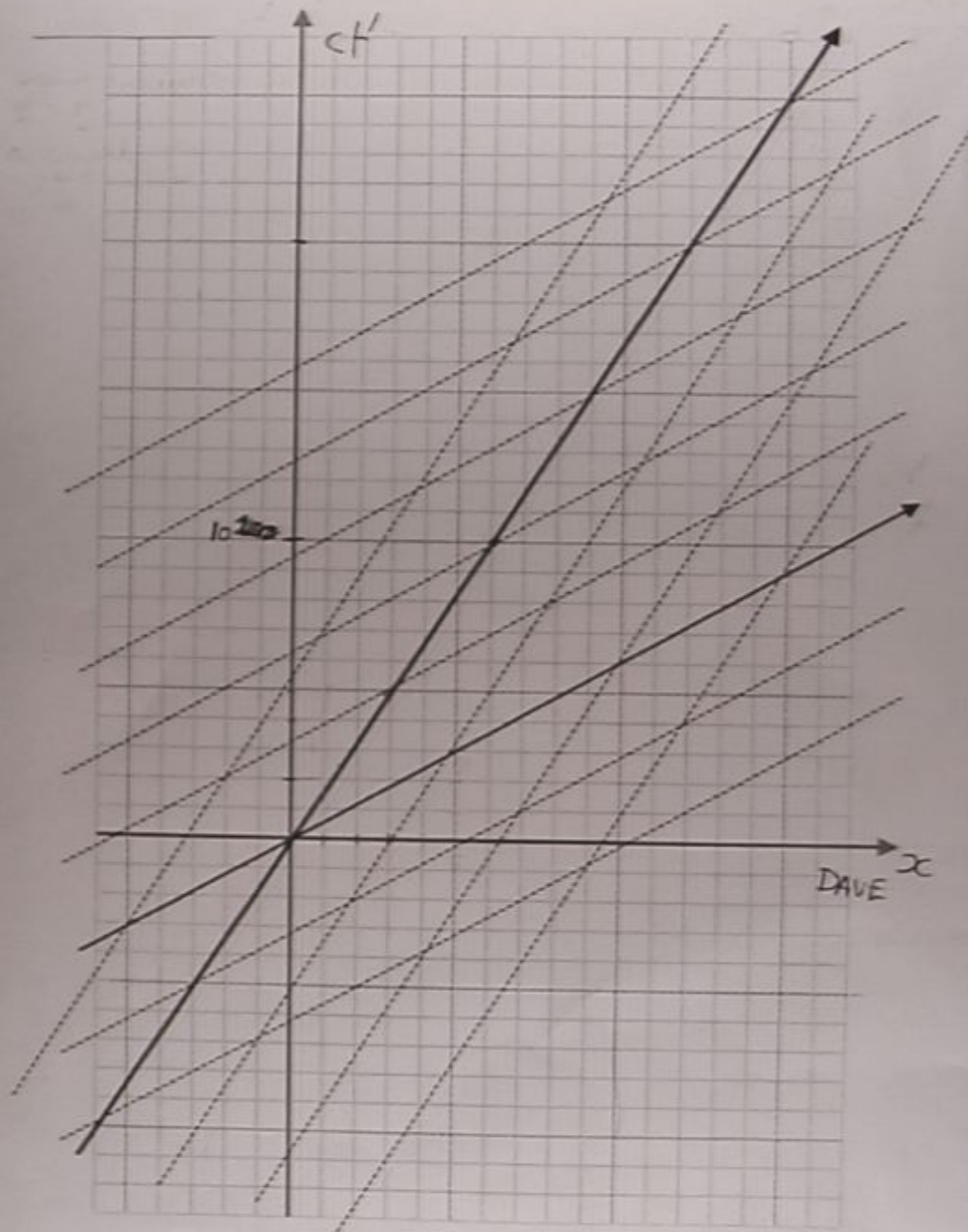


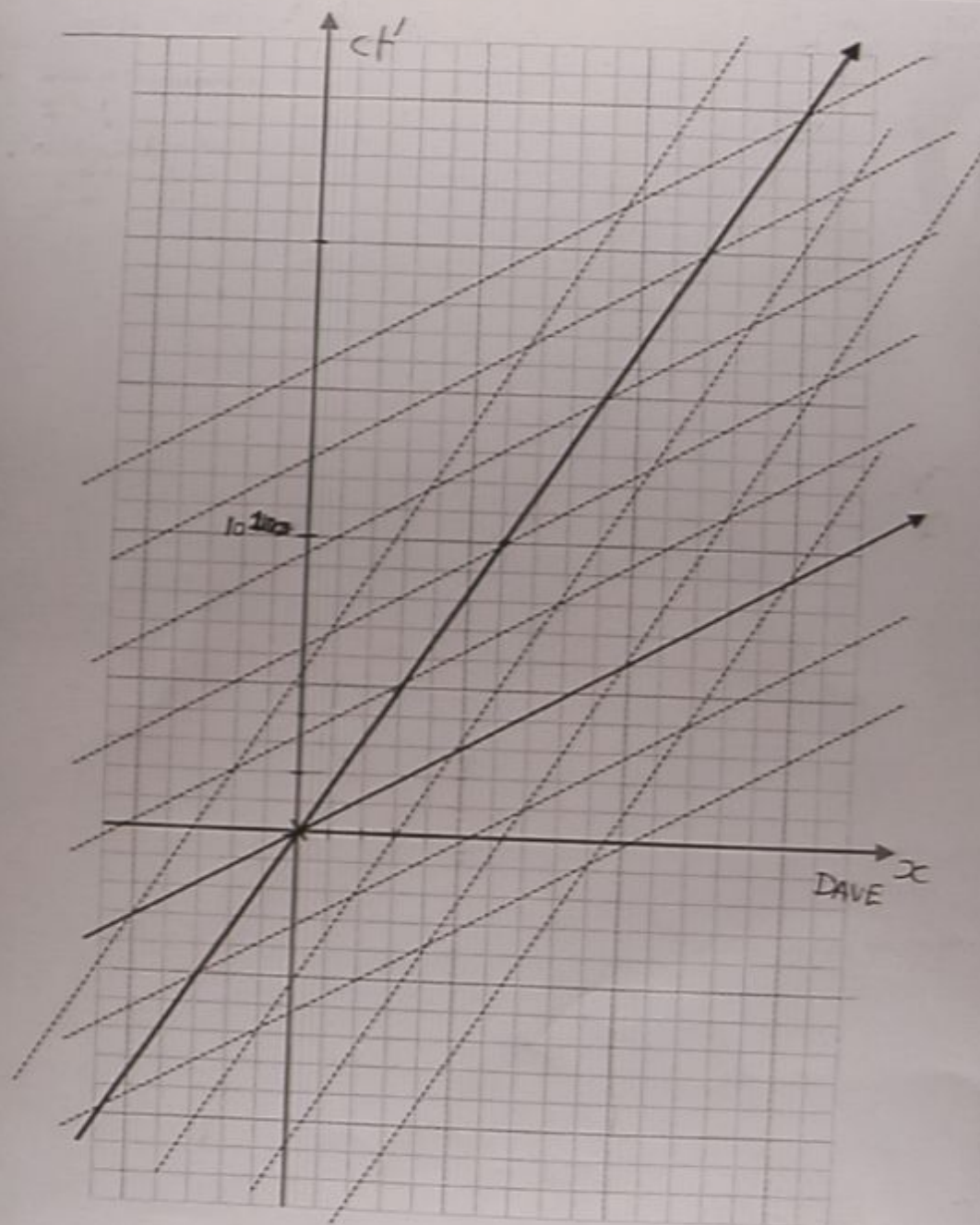


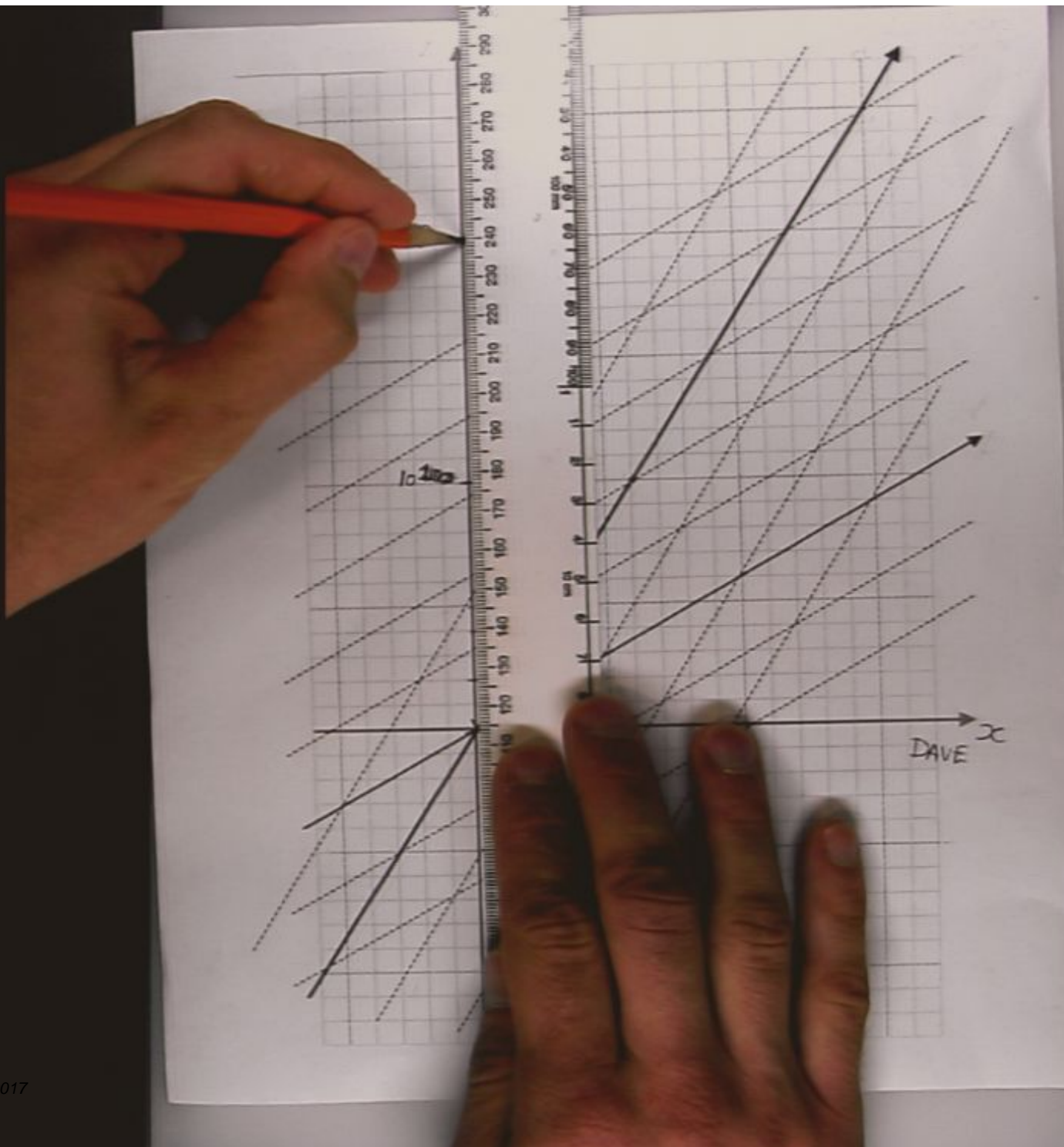




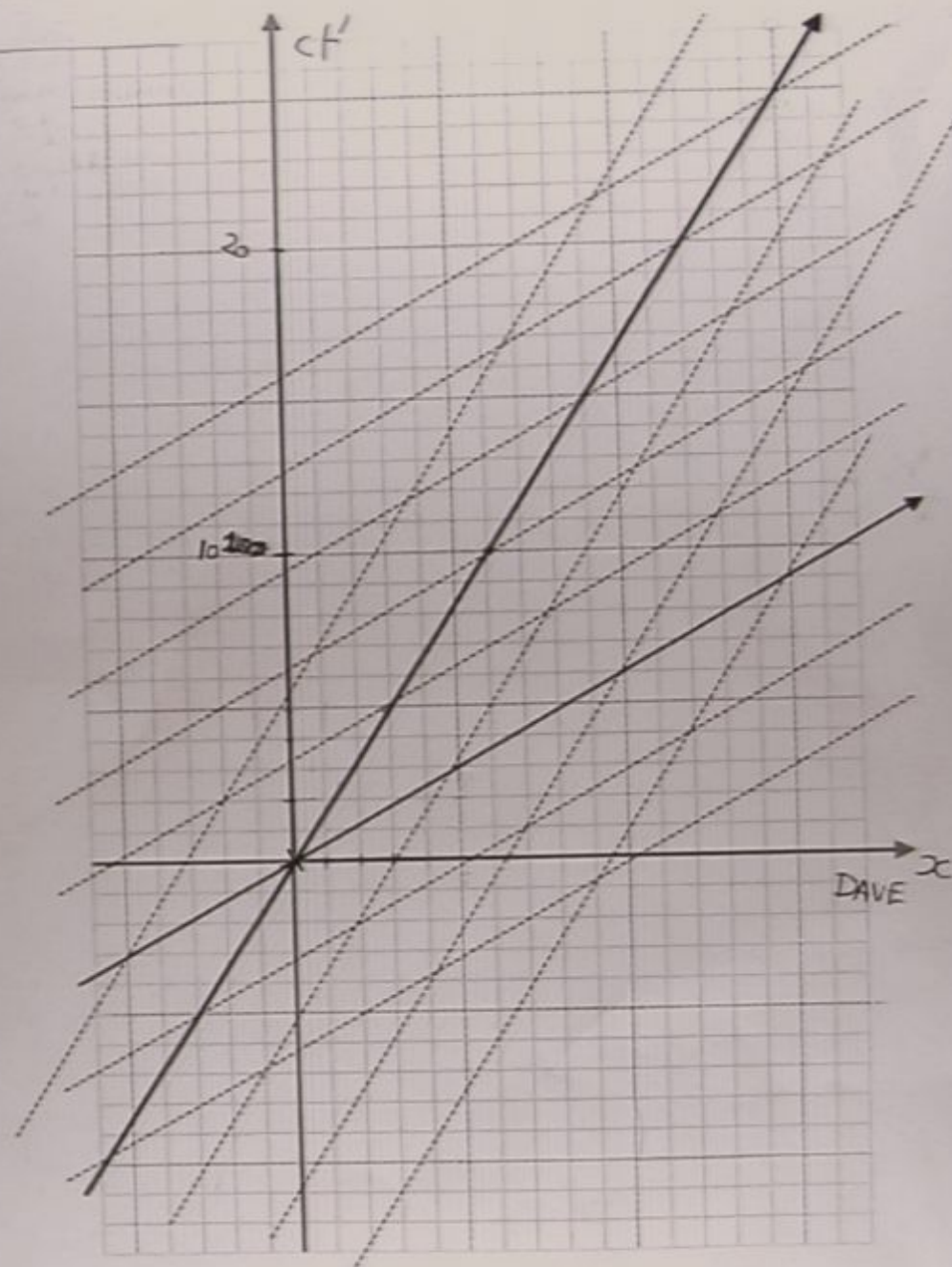


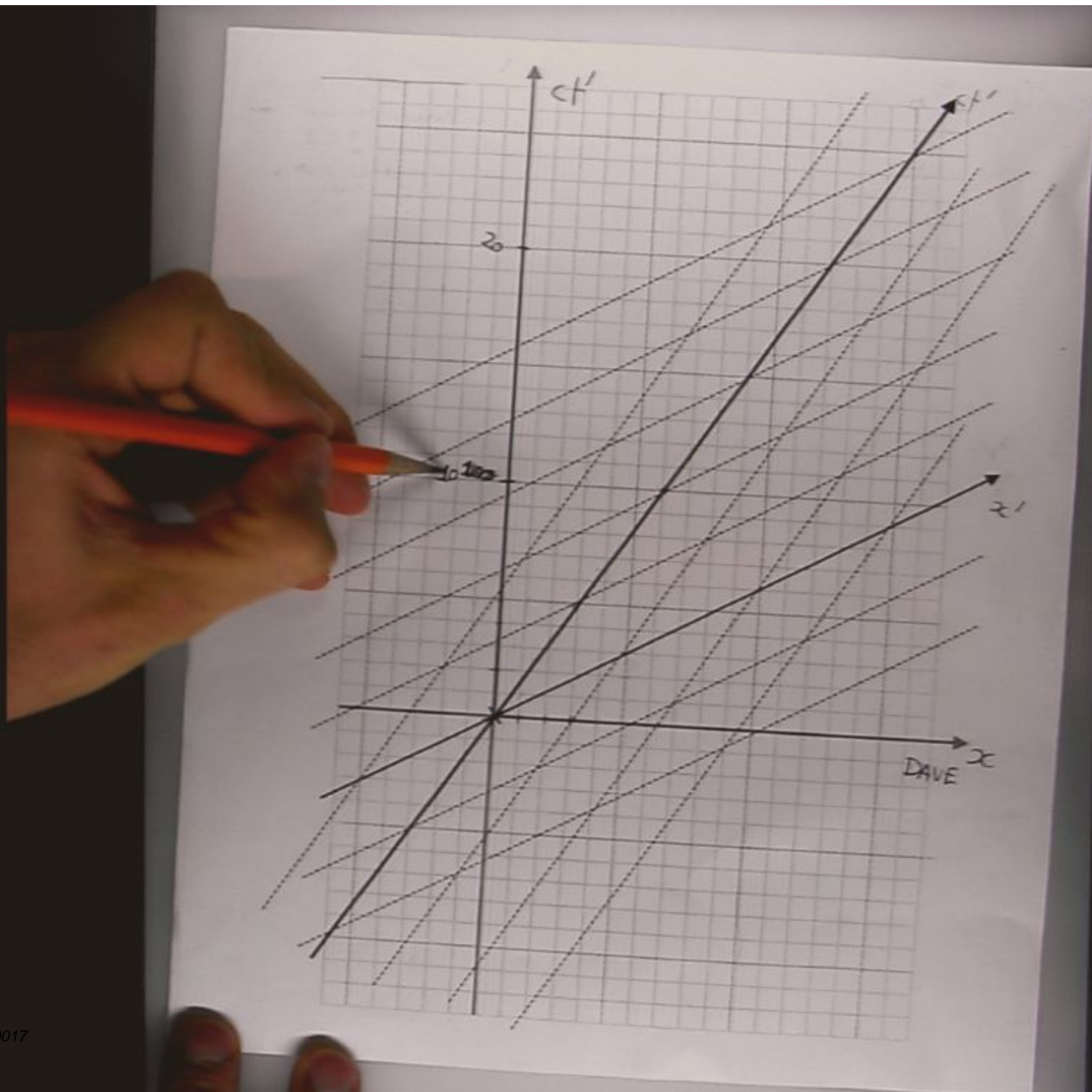


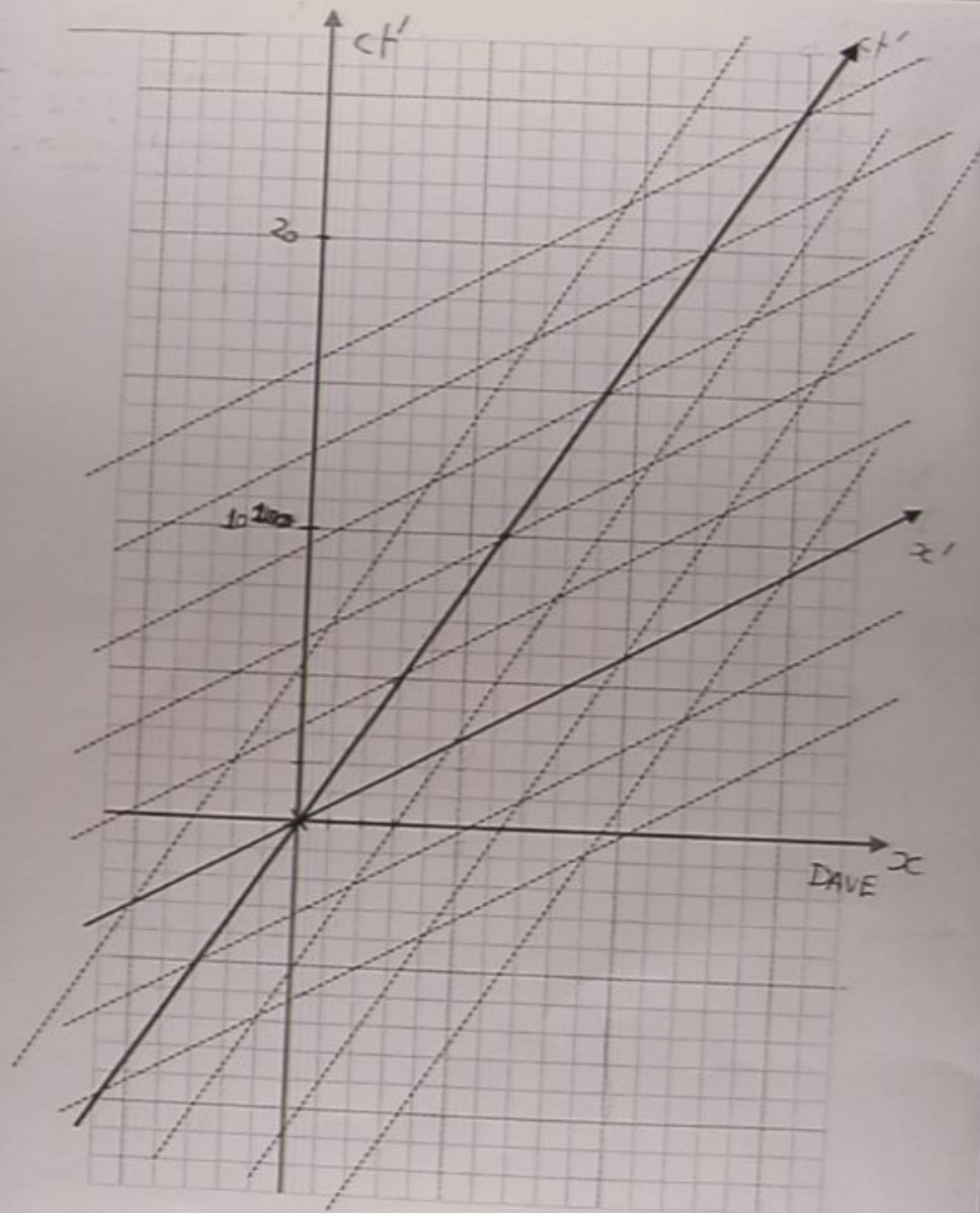




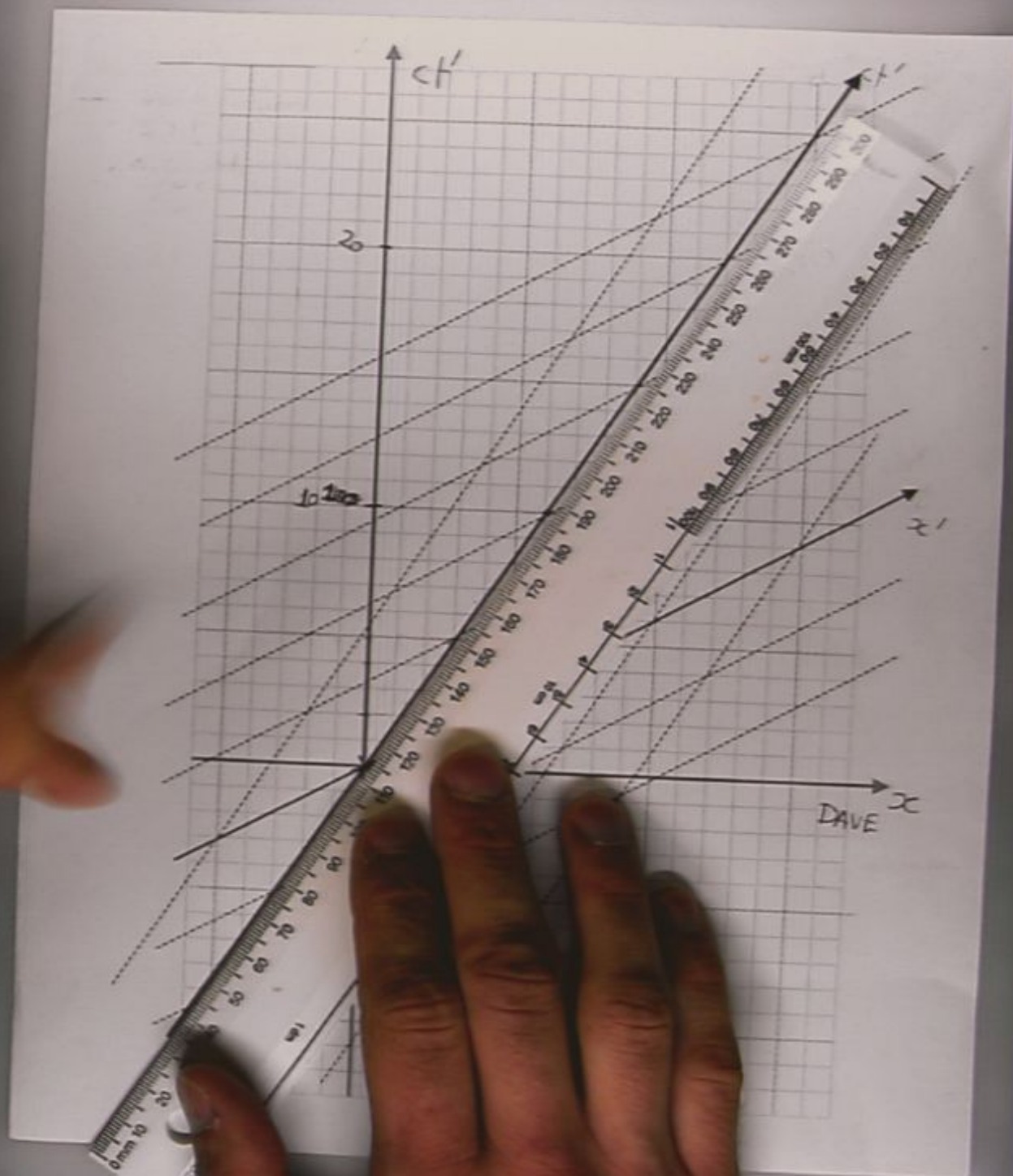


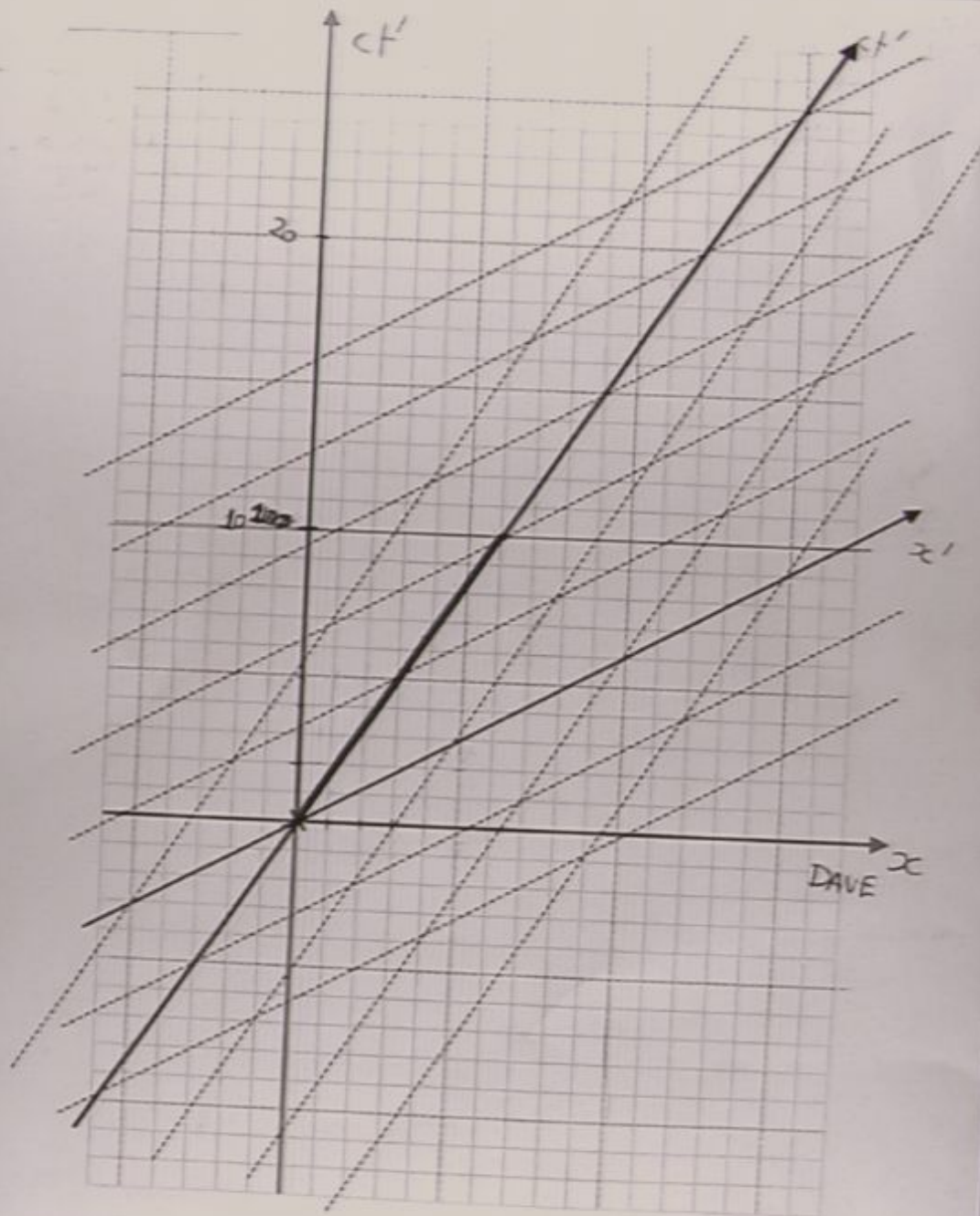


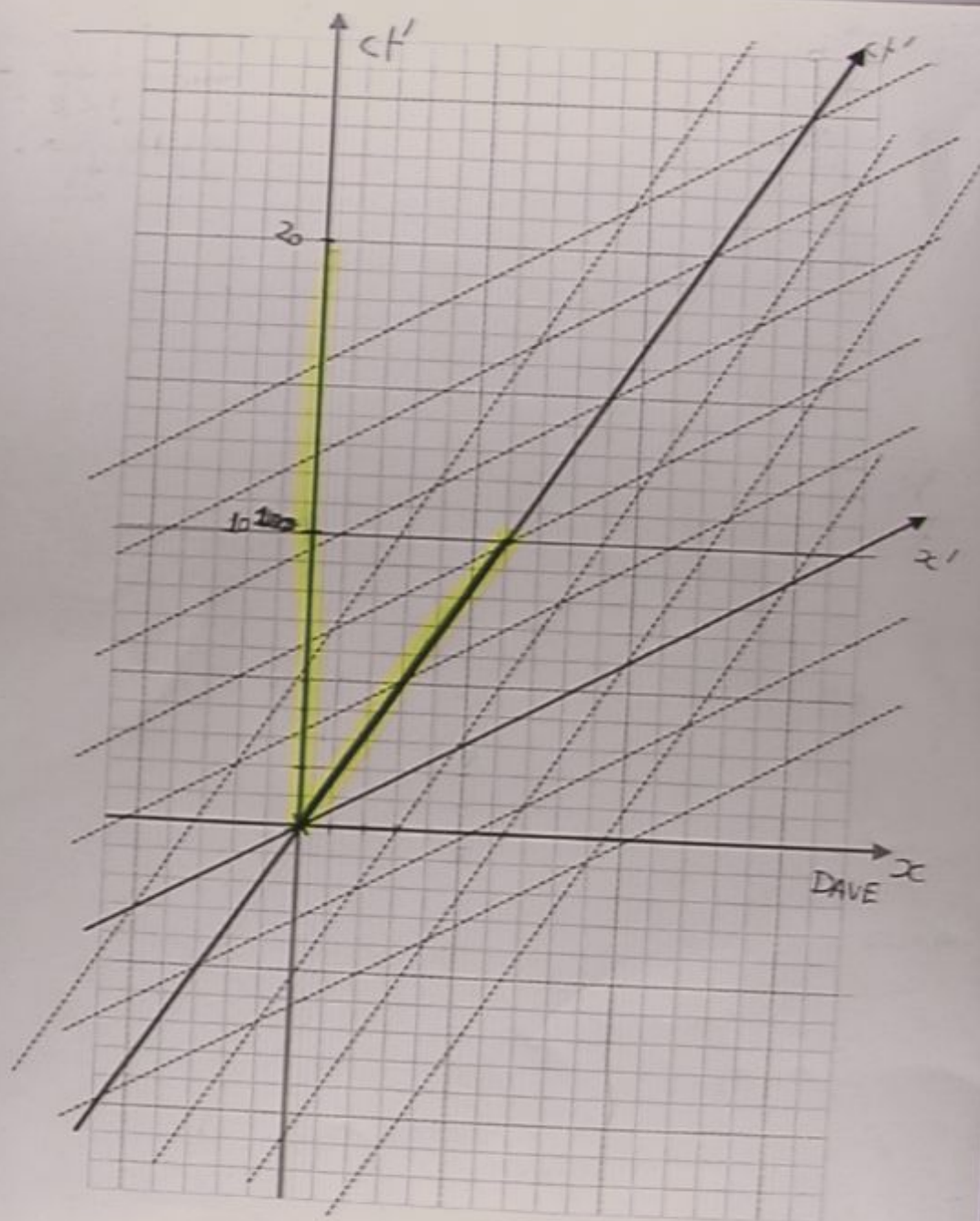


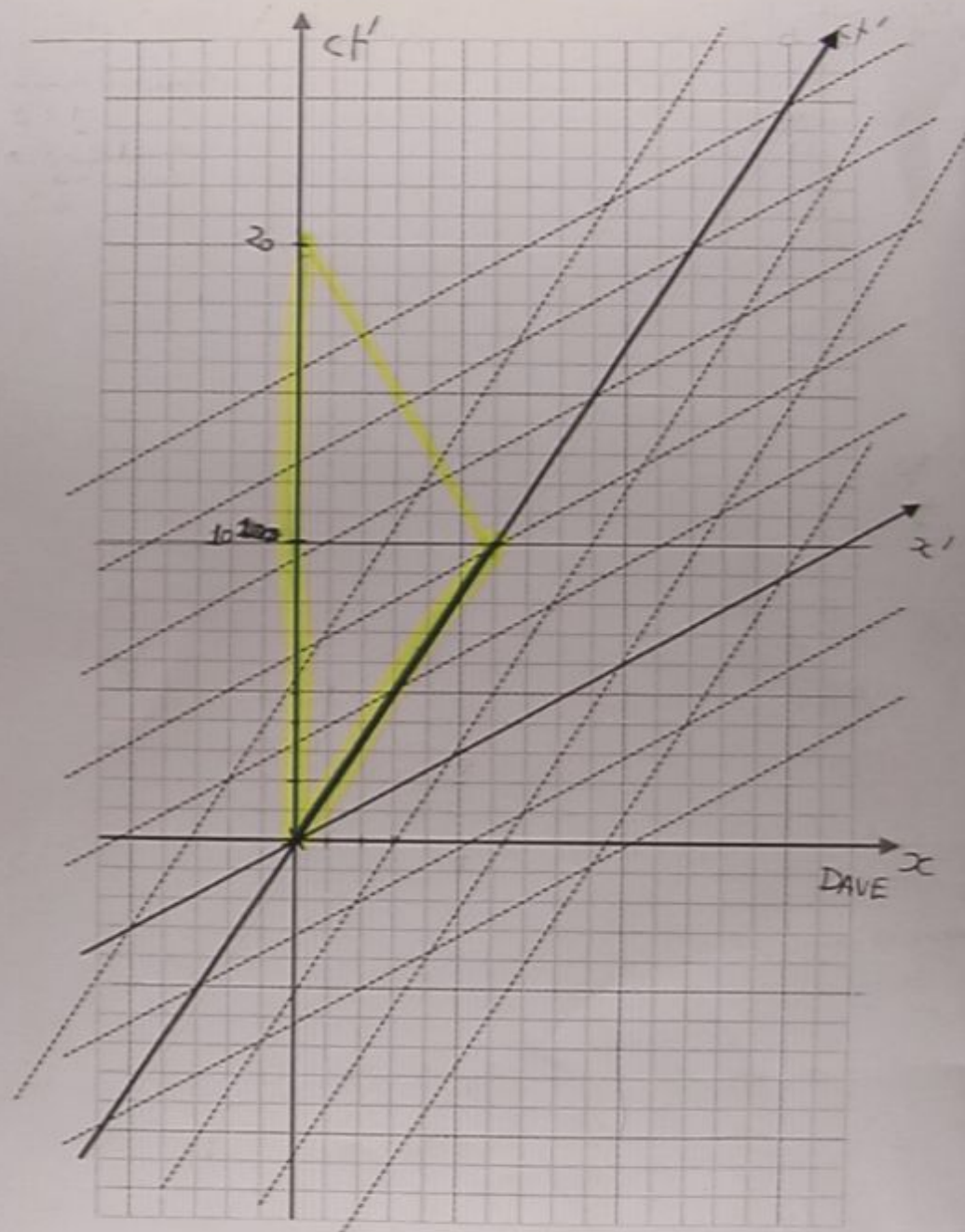




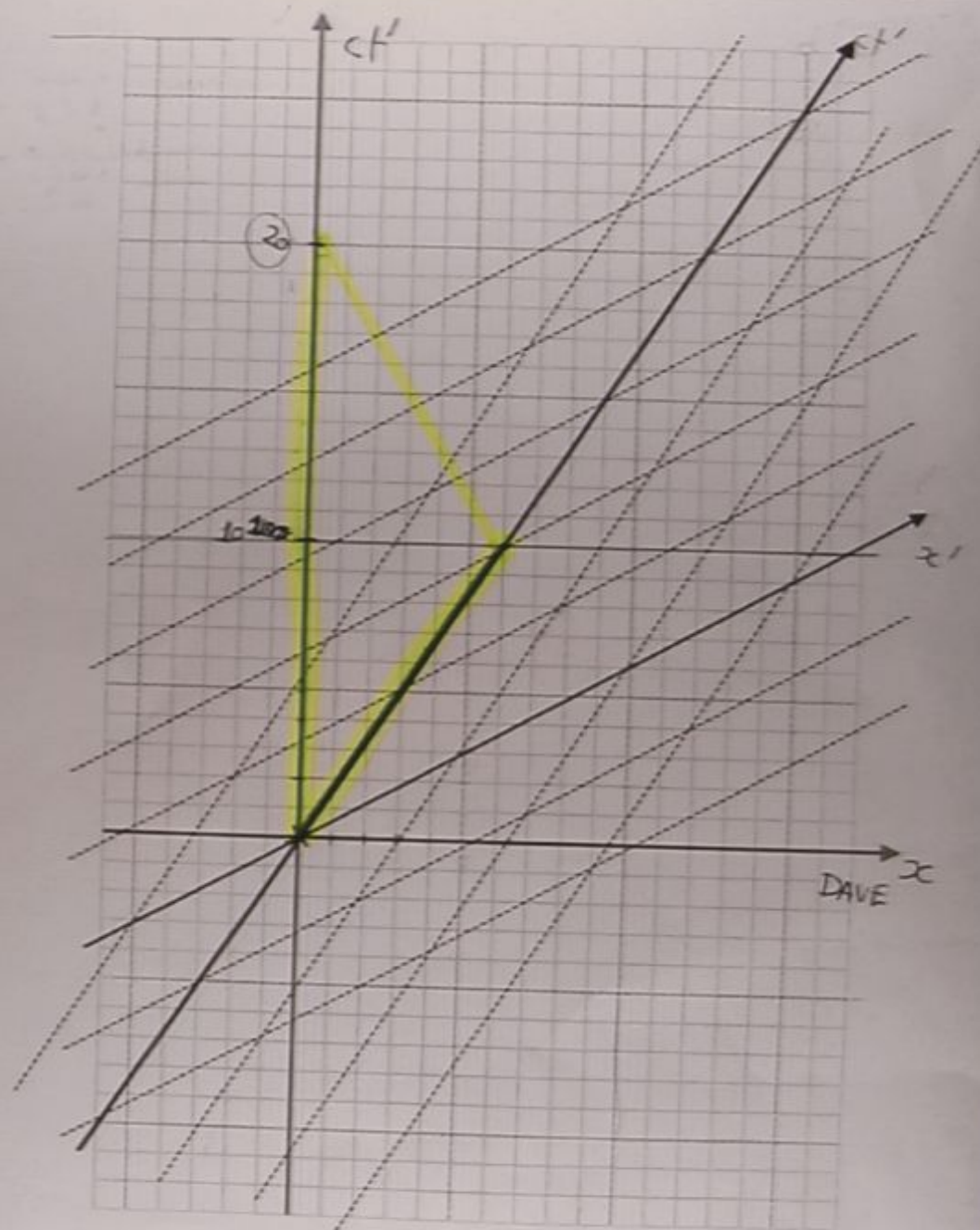


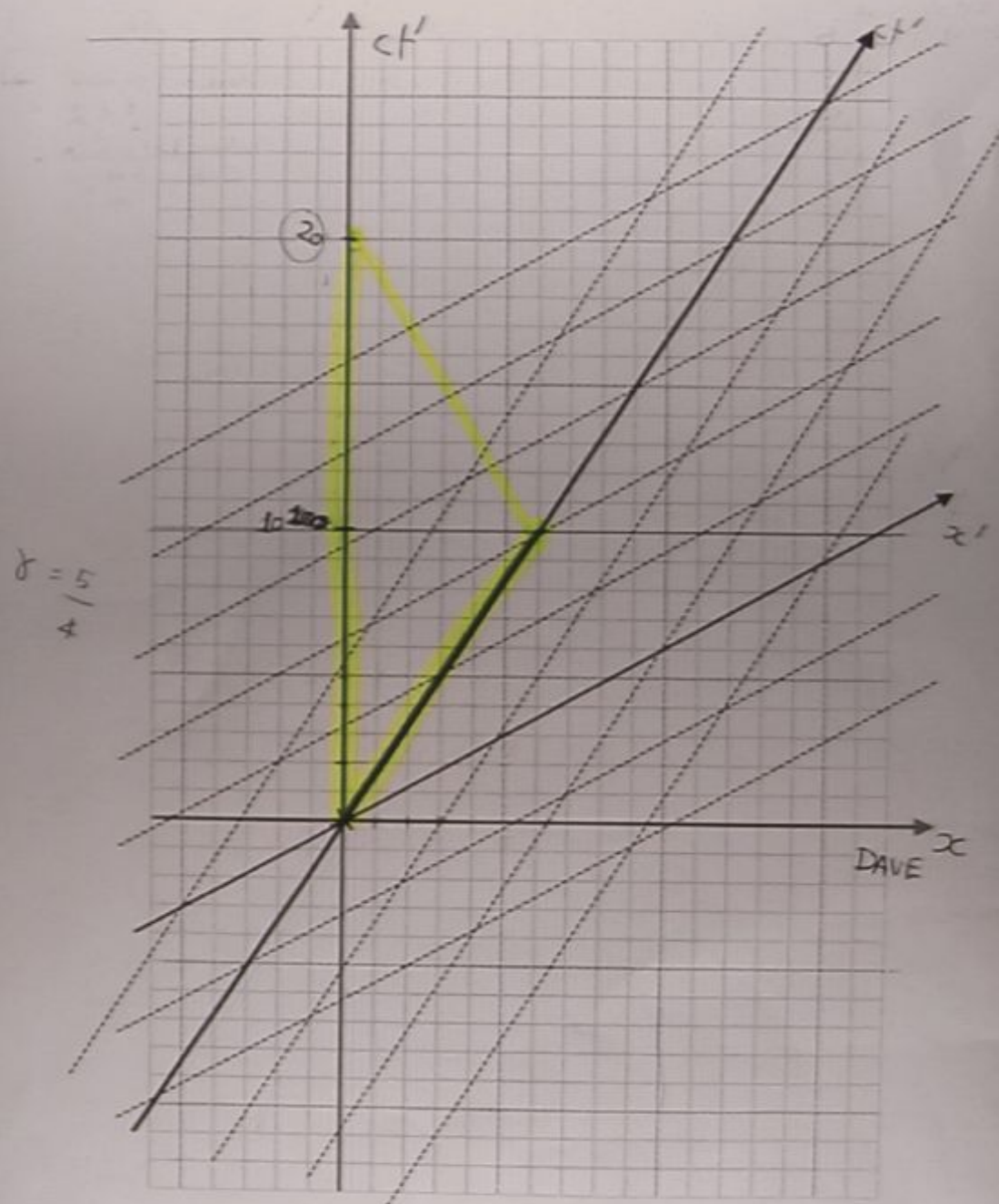




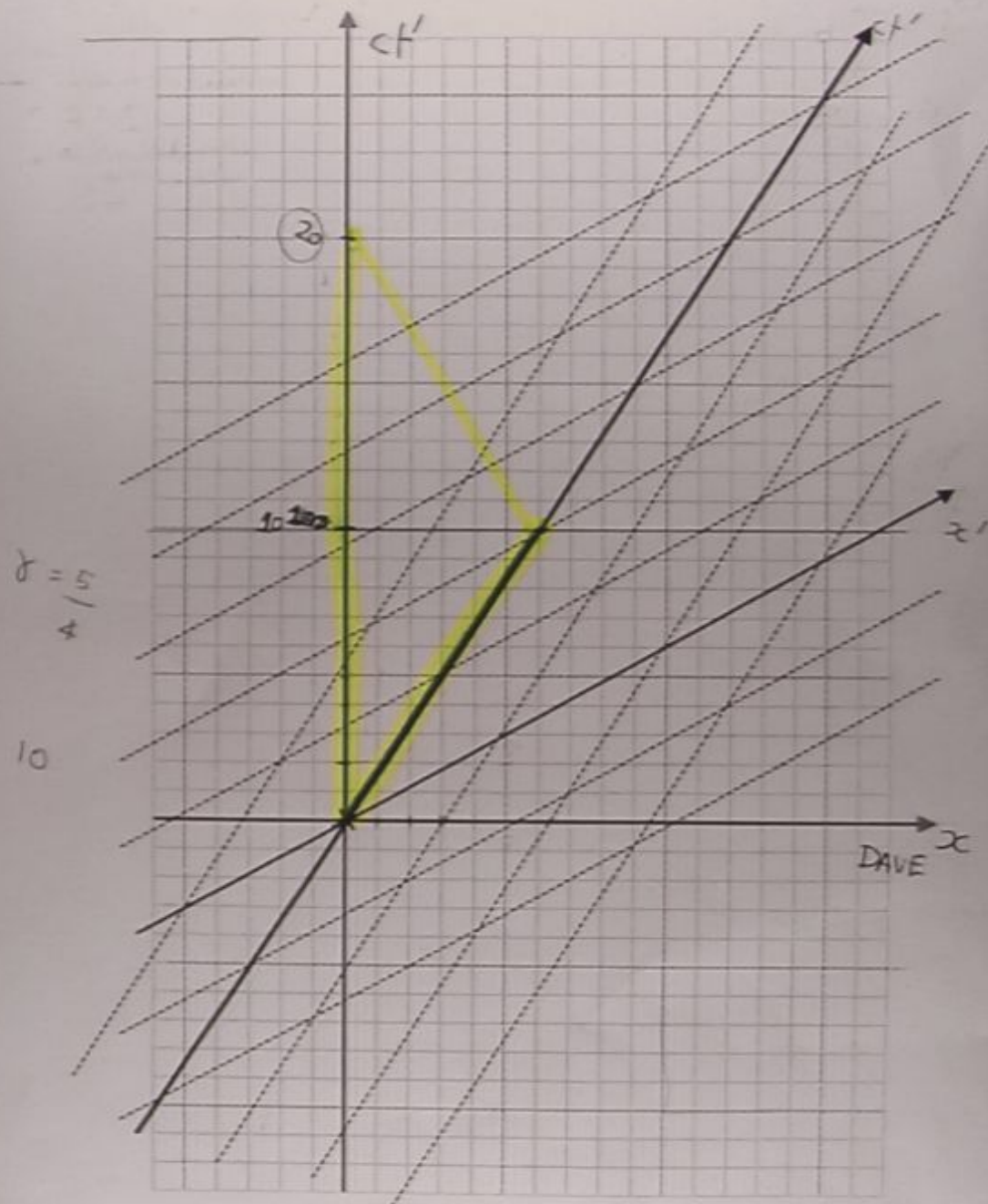








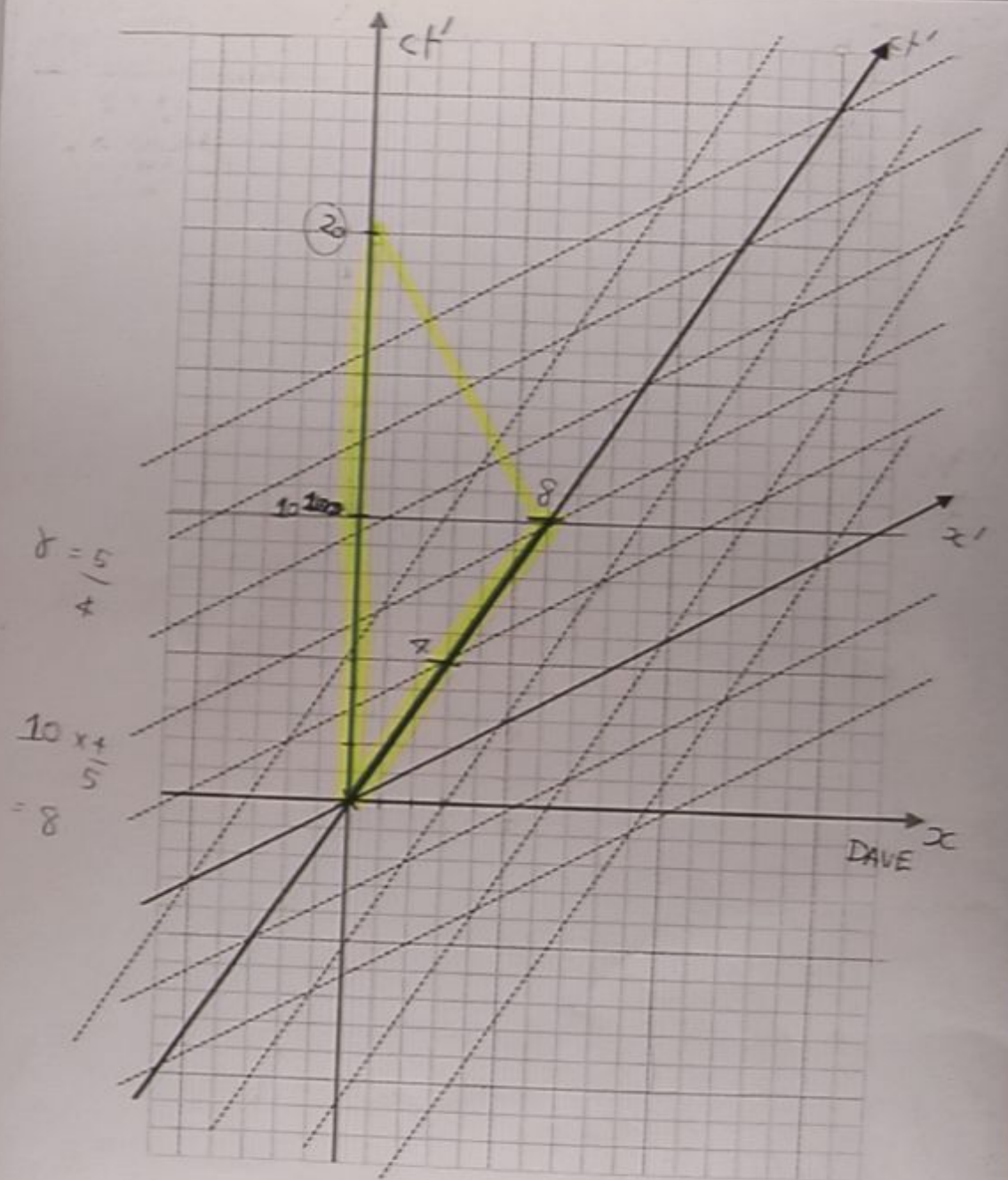
$$\delta = \frac{5}{4}$$

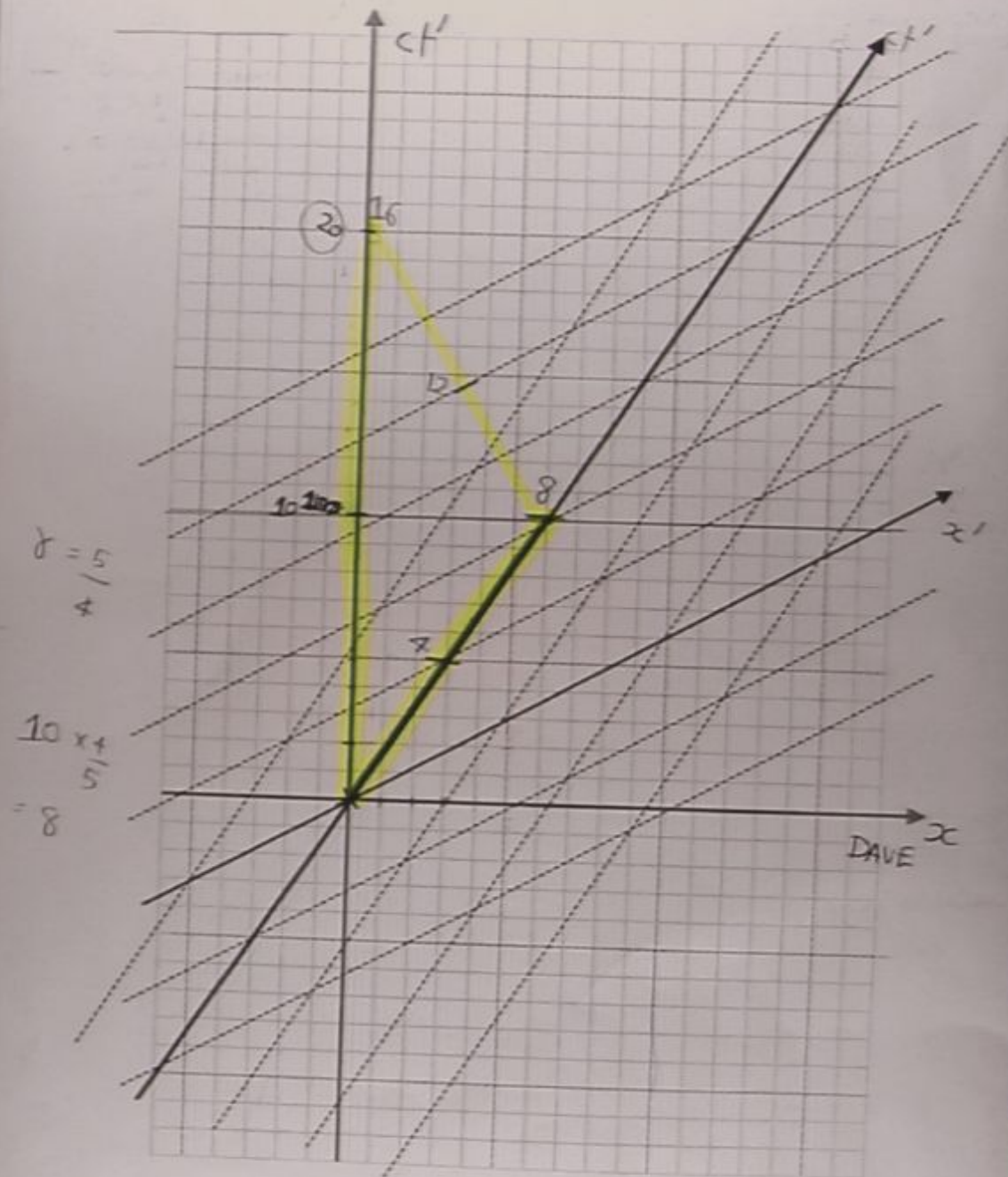


$$\delta = \frac{5}{4}$$

10





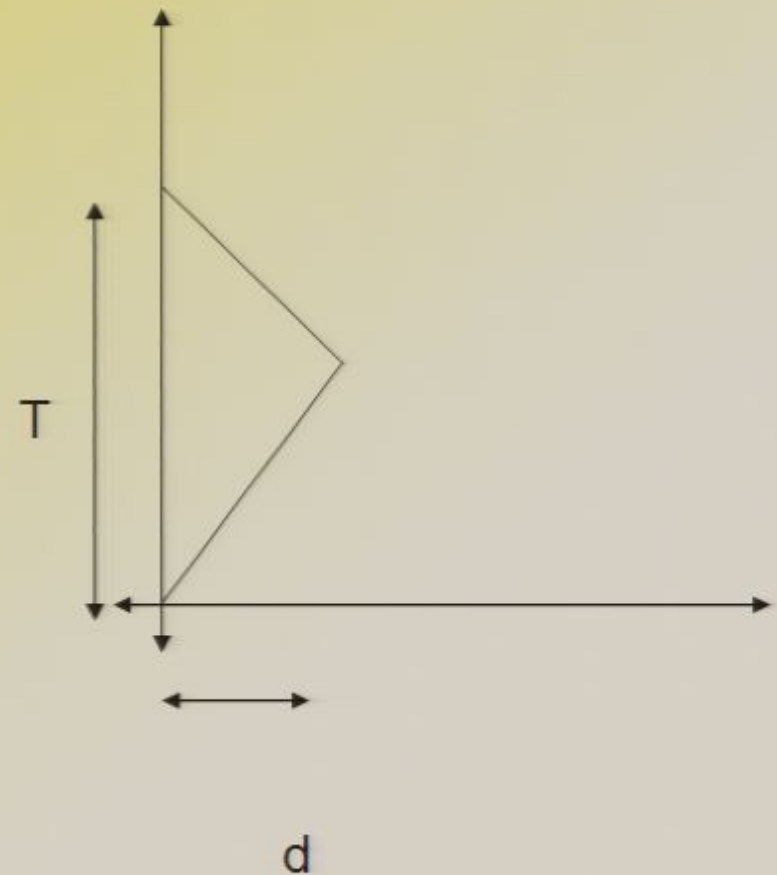


# Twin paradox

Consider two twins. One day, one of them decides to go on

What are the spacetime intervals for the two paths?

$$\begin{aligned} s &= cT \\ s' &= 2\sqrt{\left(\frac{cT}{2}\right)^2 - d^2} \\ &= cT\sqrt{1 - \left(\frac{2d}{cT}\right)^2} \end{aligned}$$





$$S^2 = (c \Delta t)^2 - \Delta x^2$$

= 0

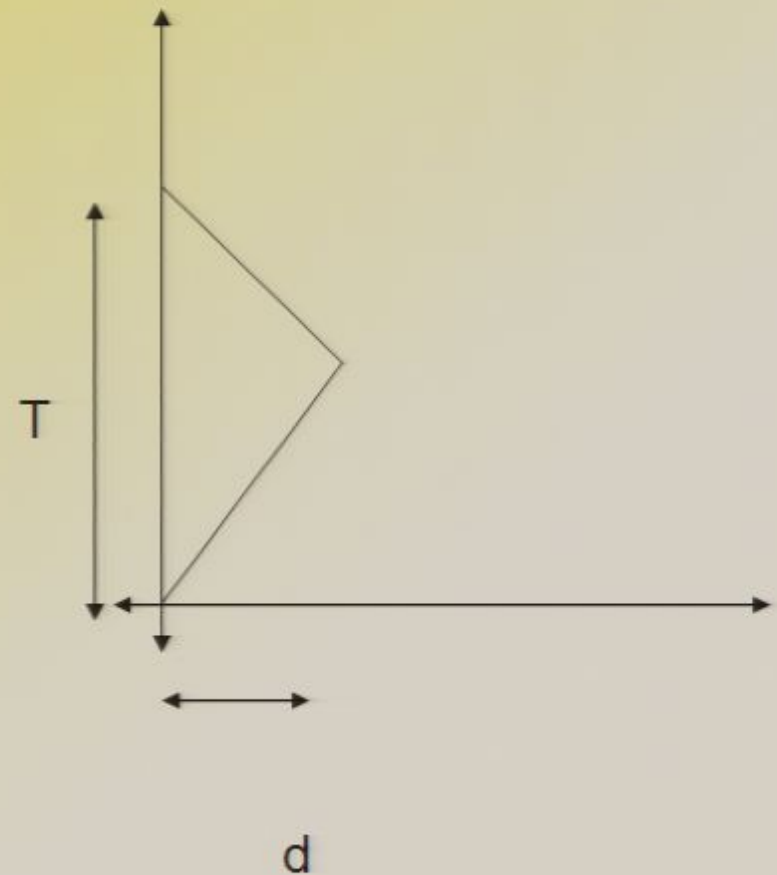
$$S = ct = 20 \text{ years} \times c$$

# Twin paradox

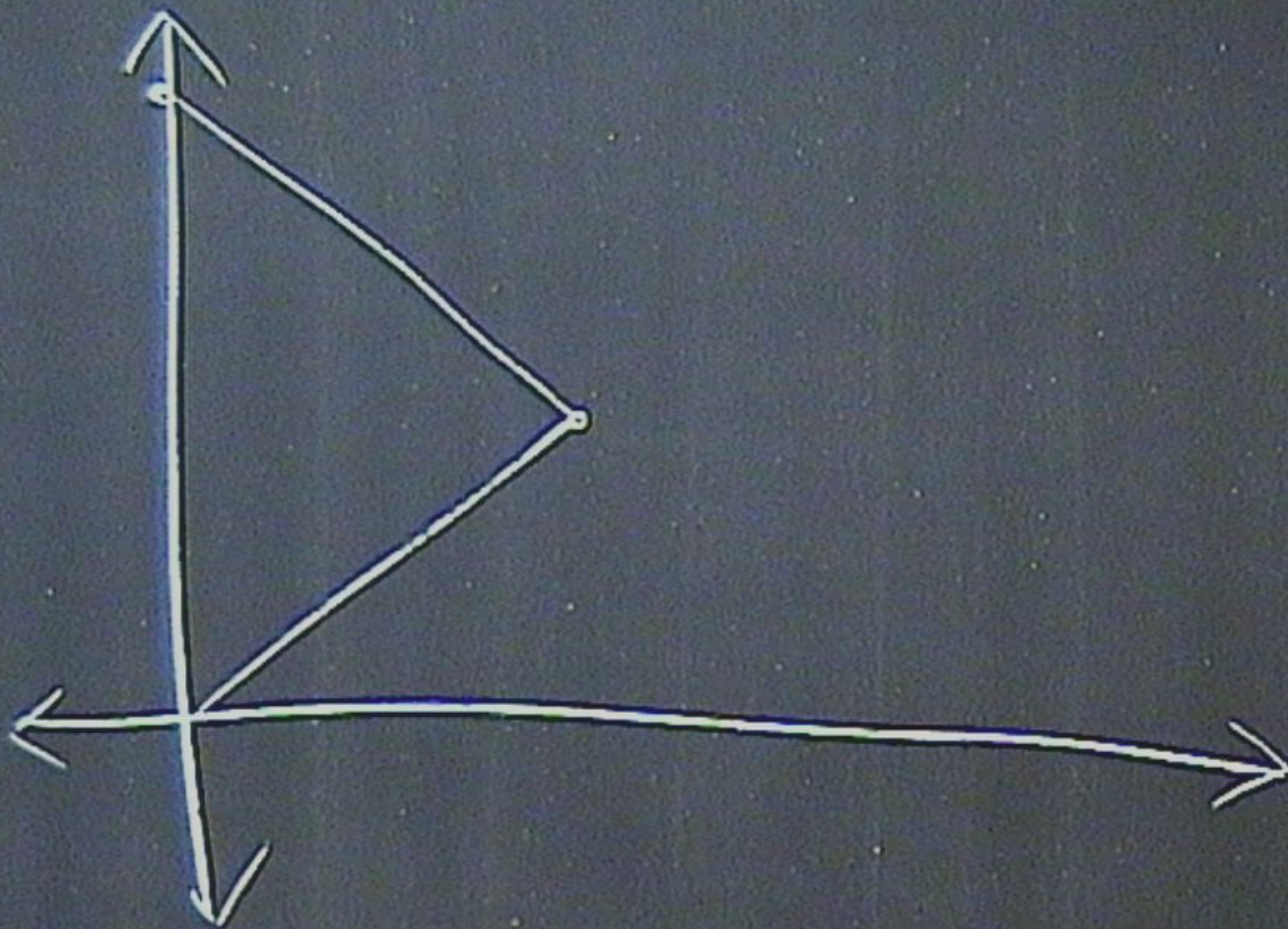
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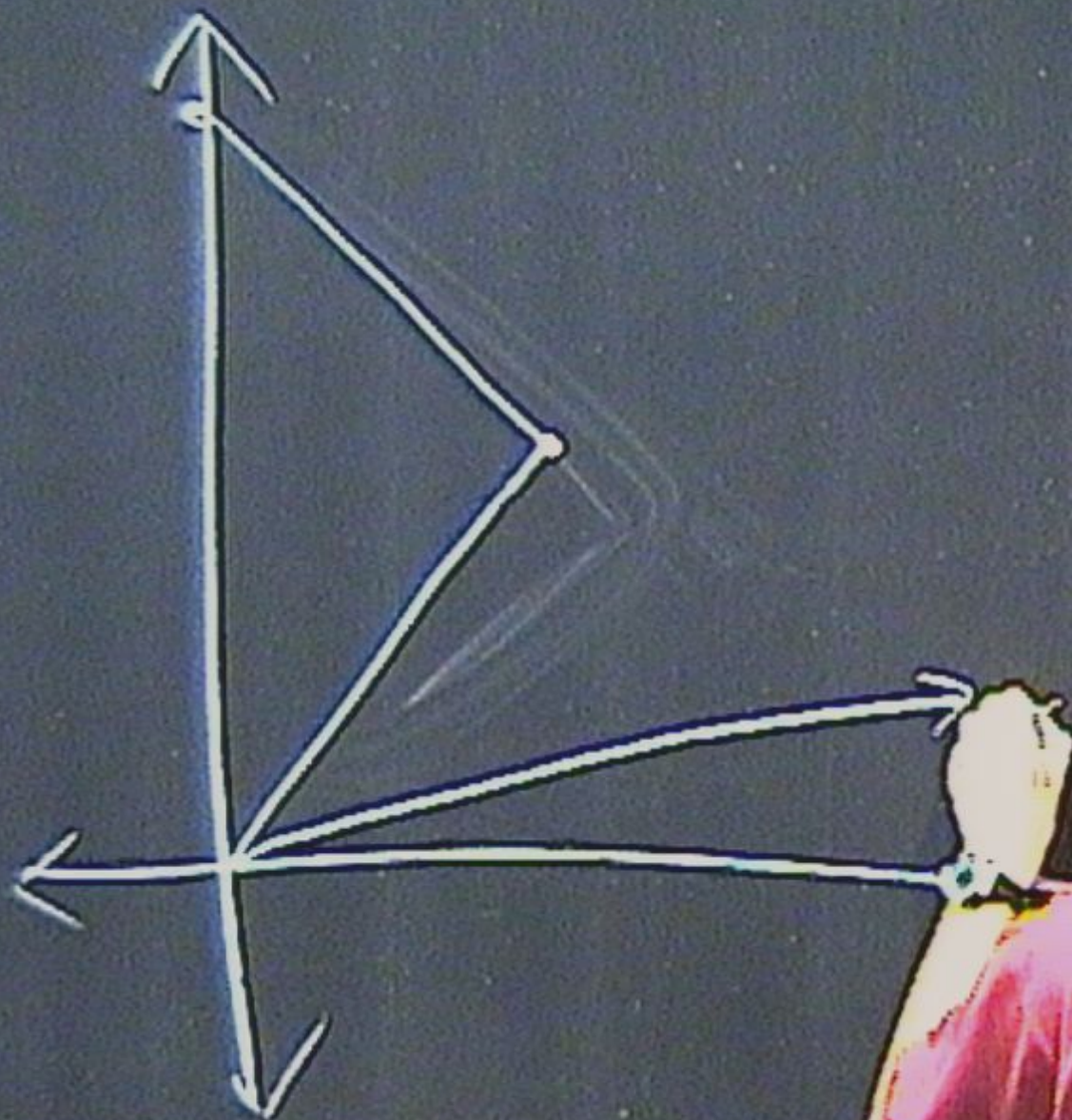
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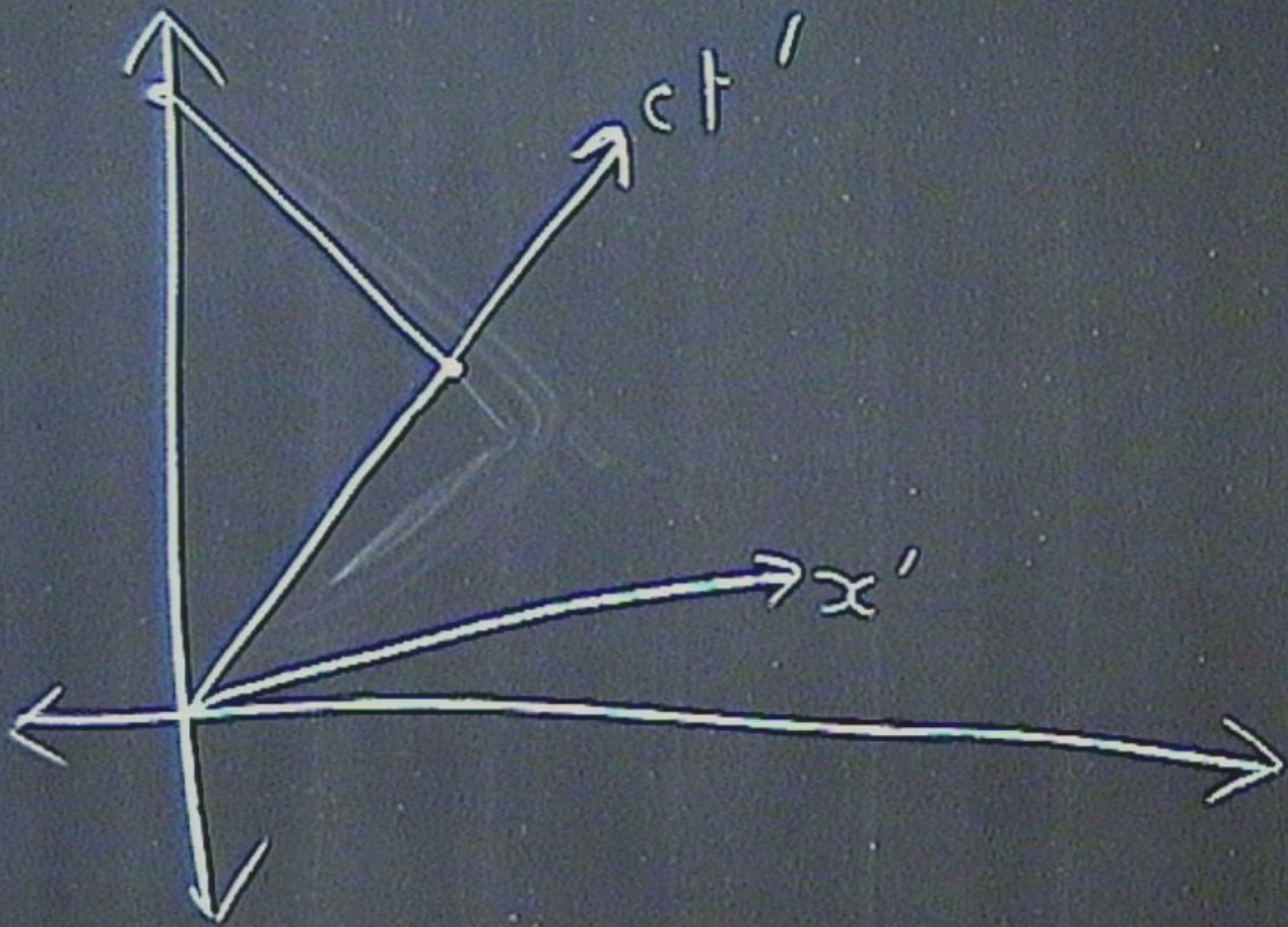




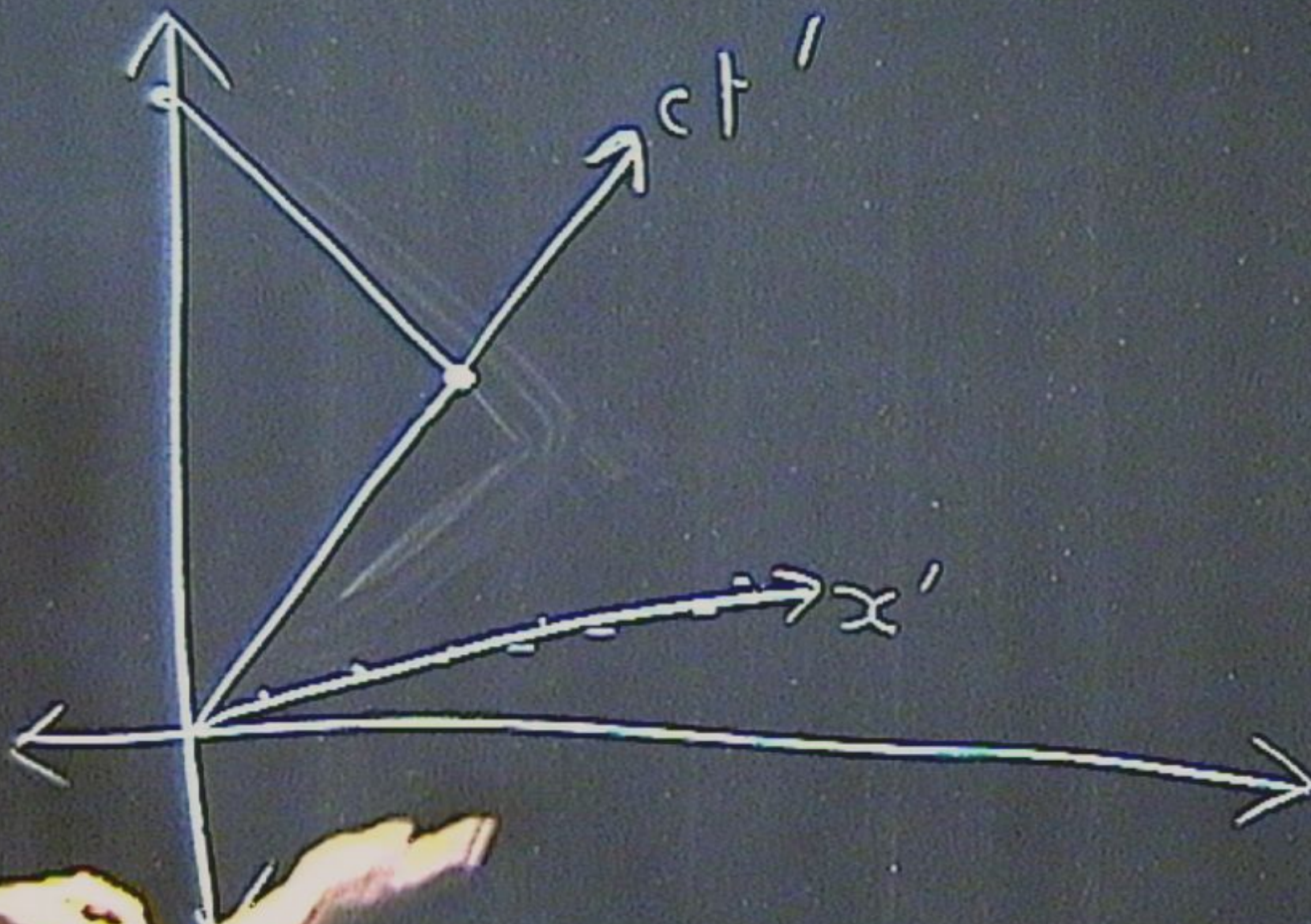




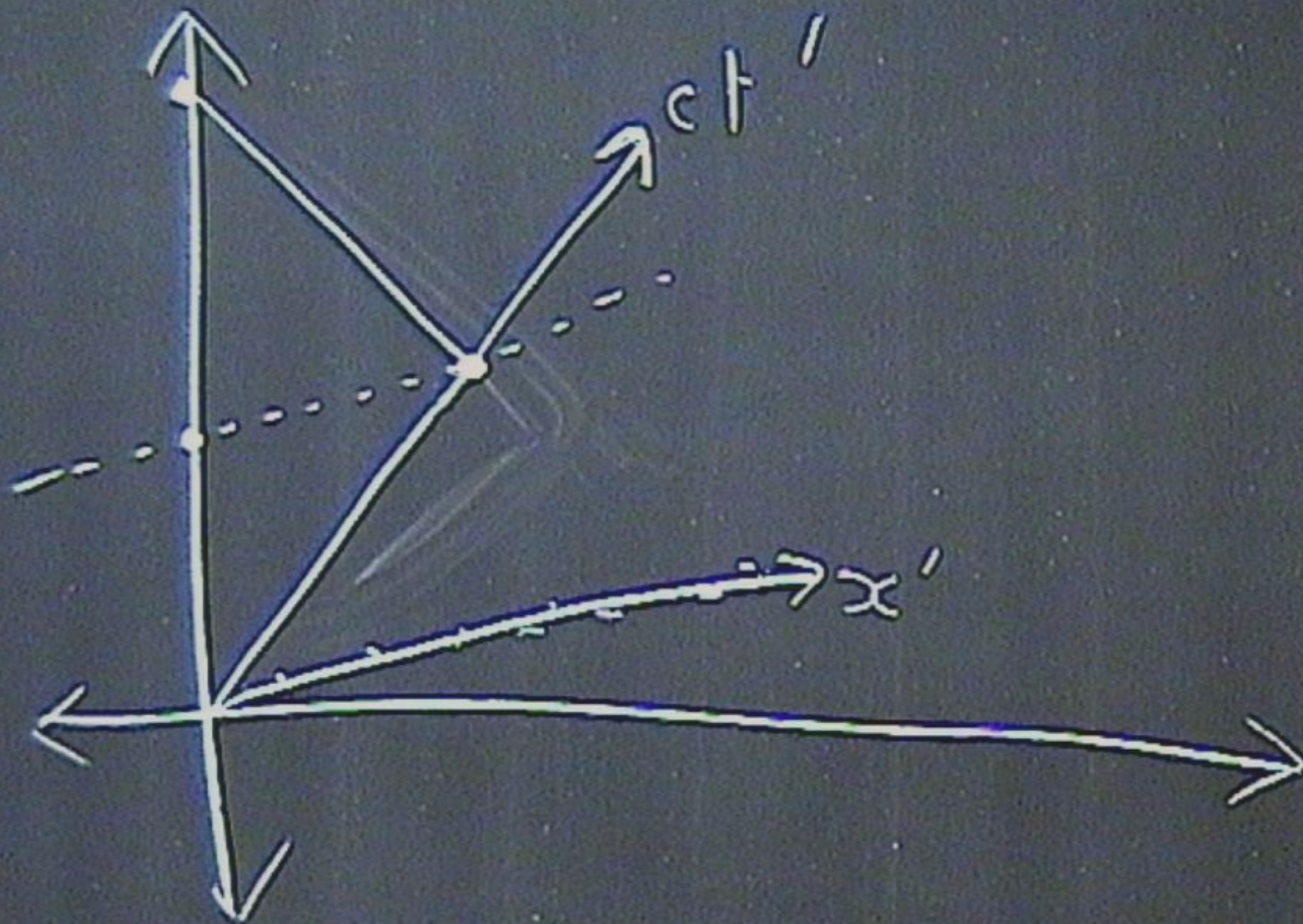




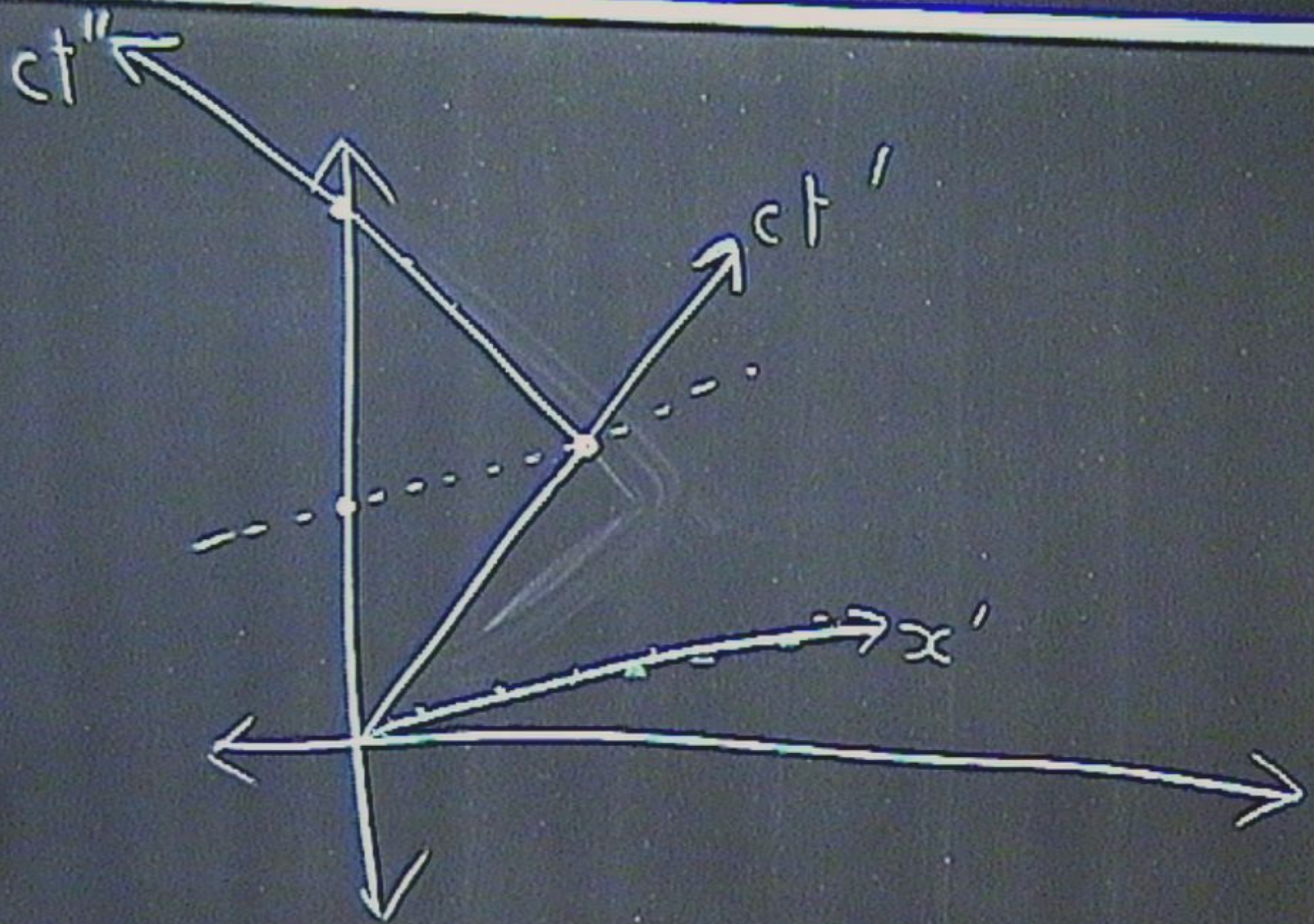




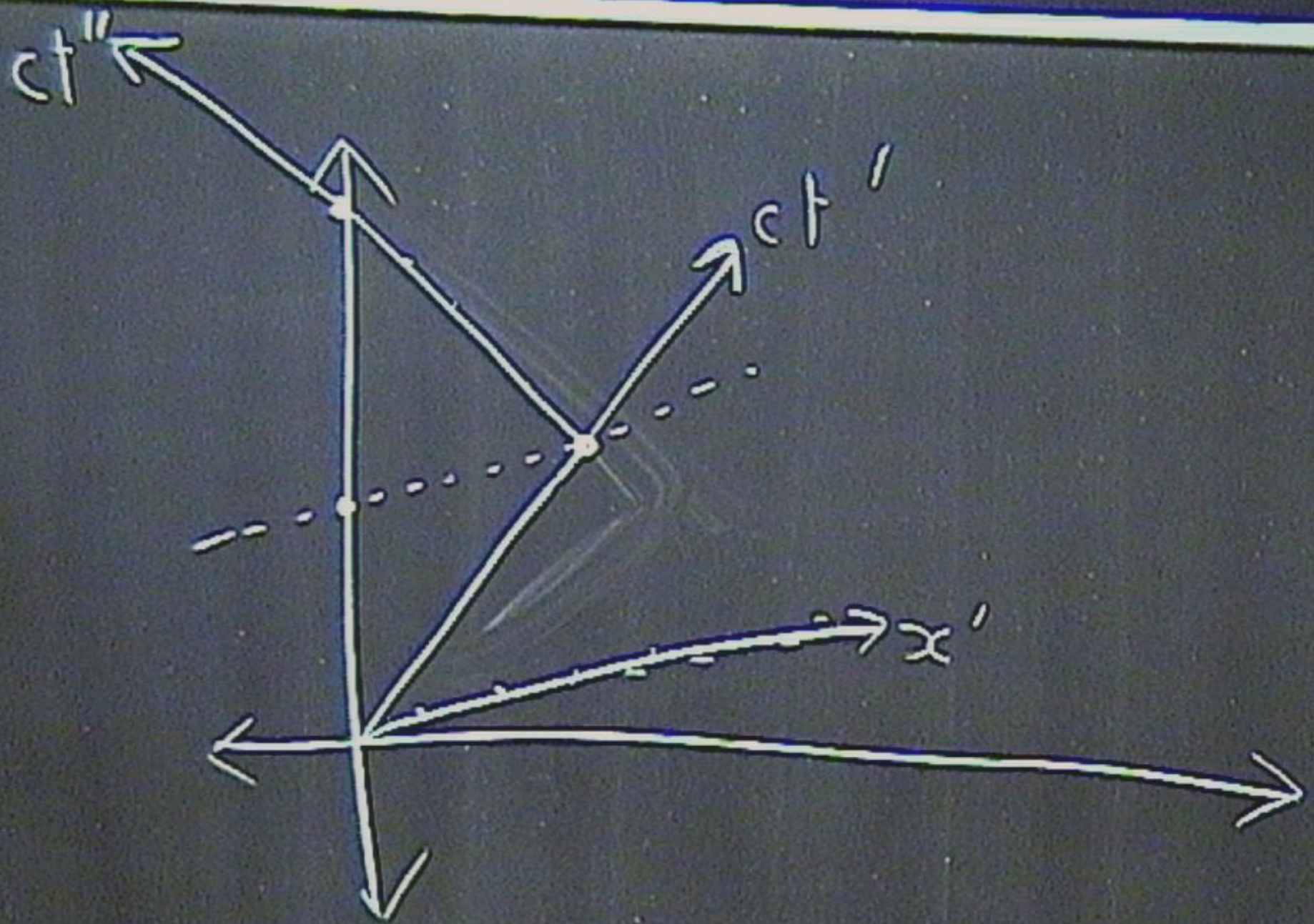




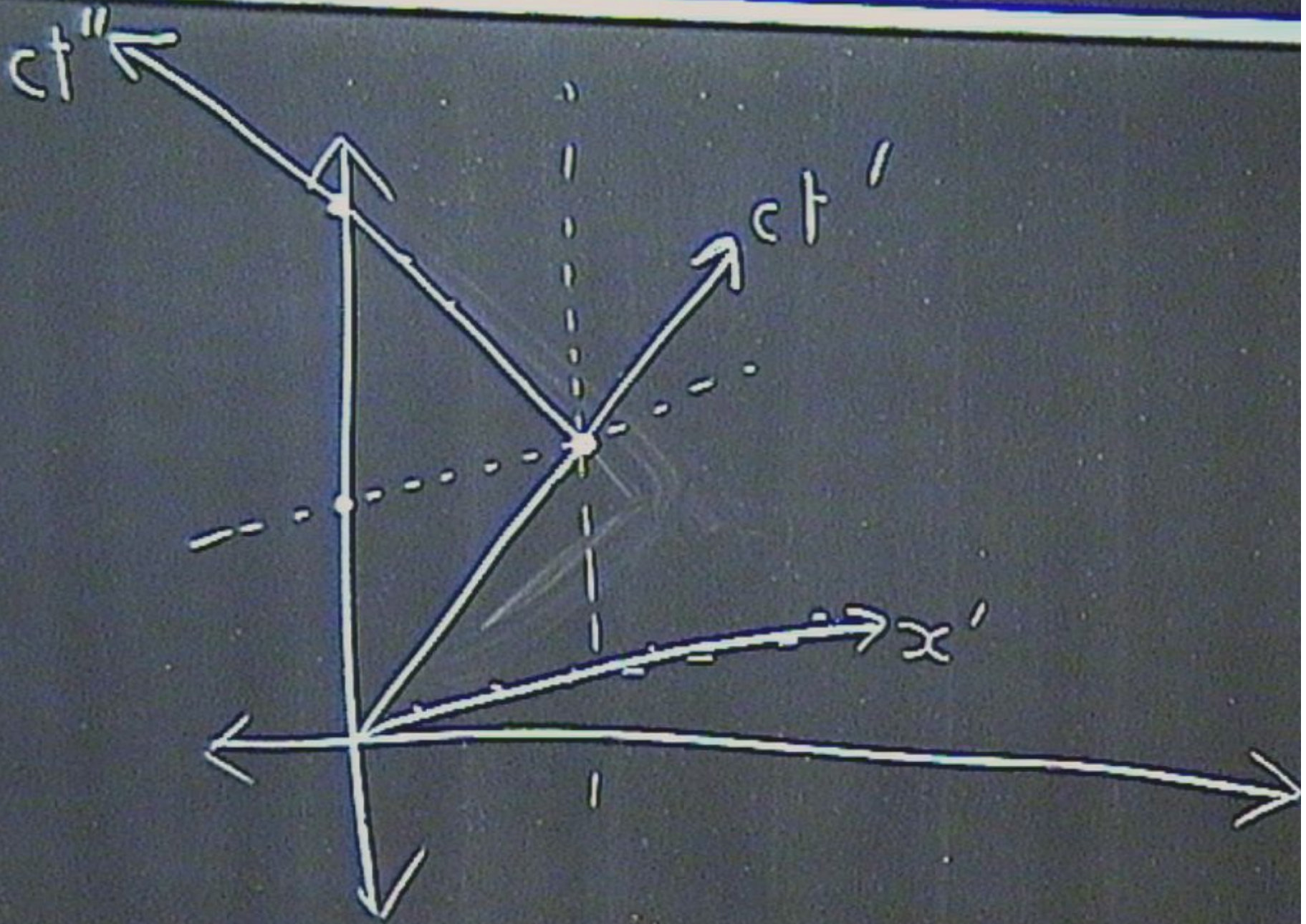




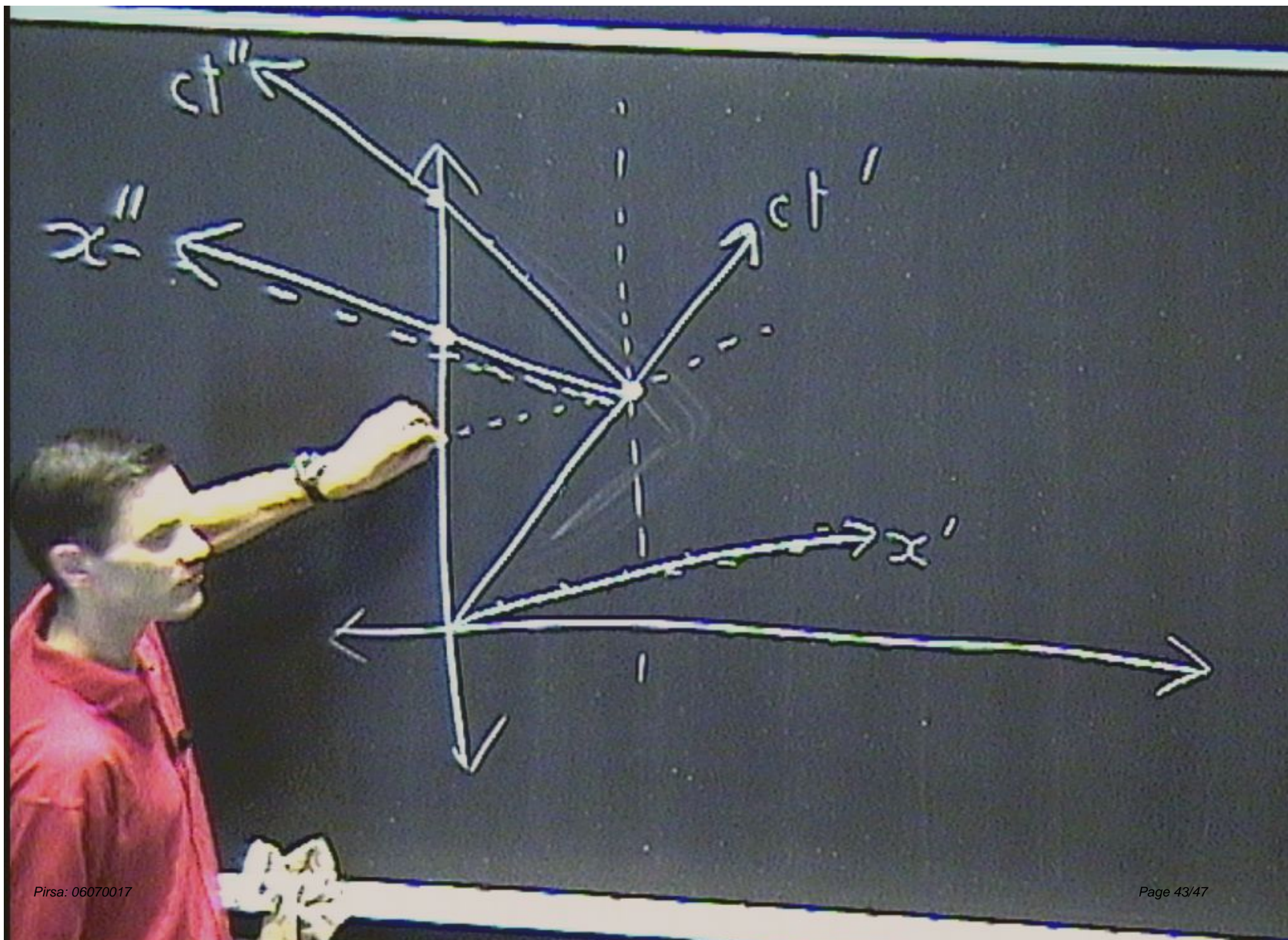




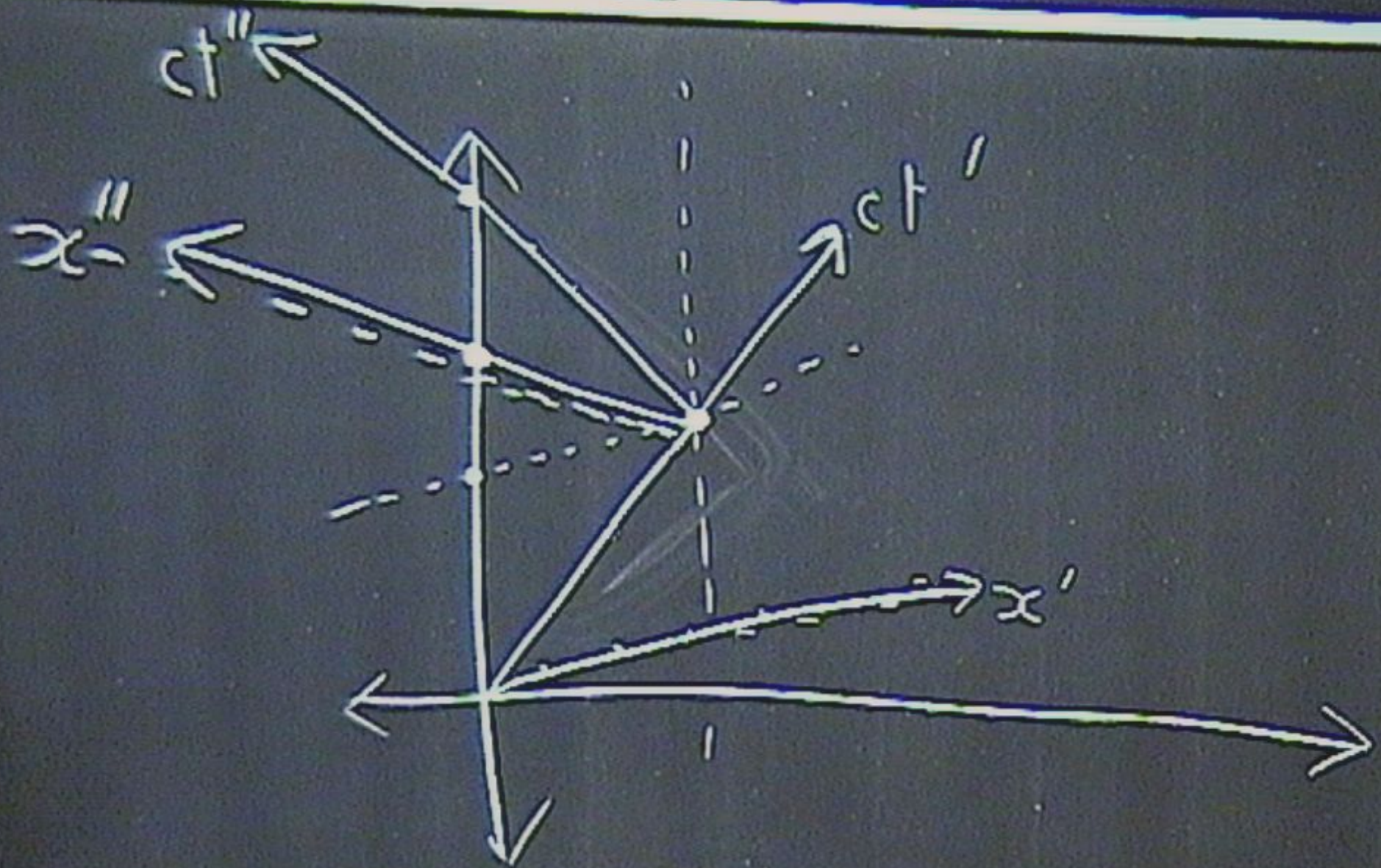




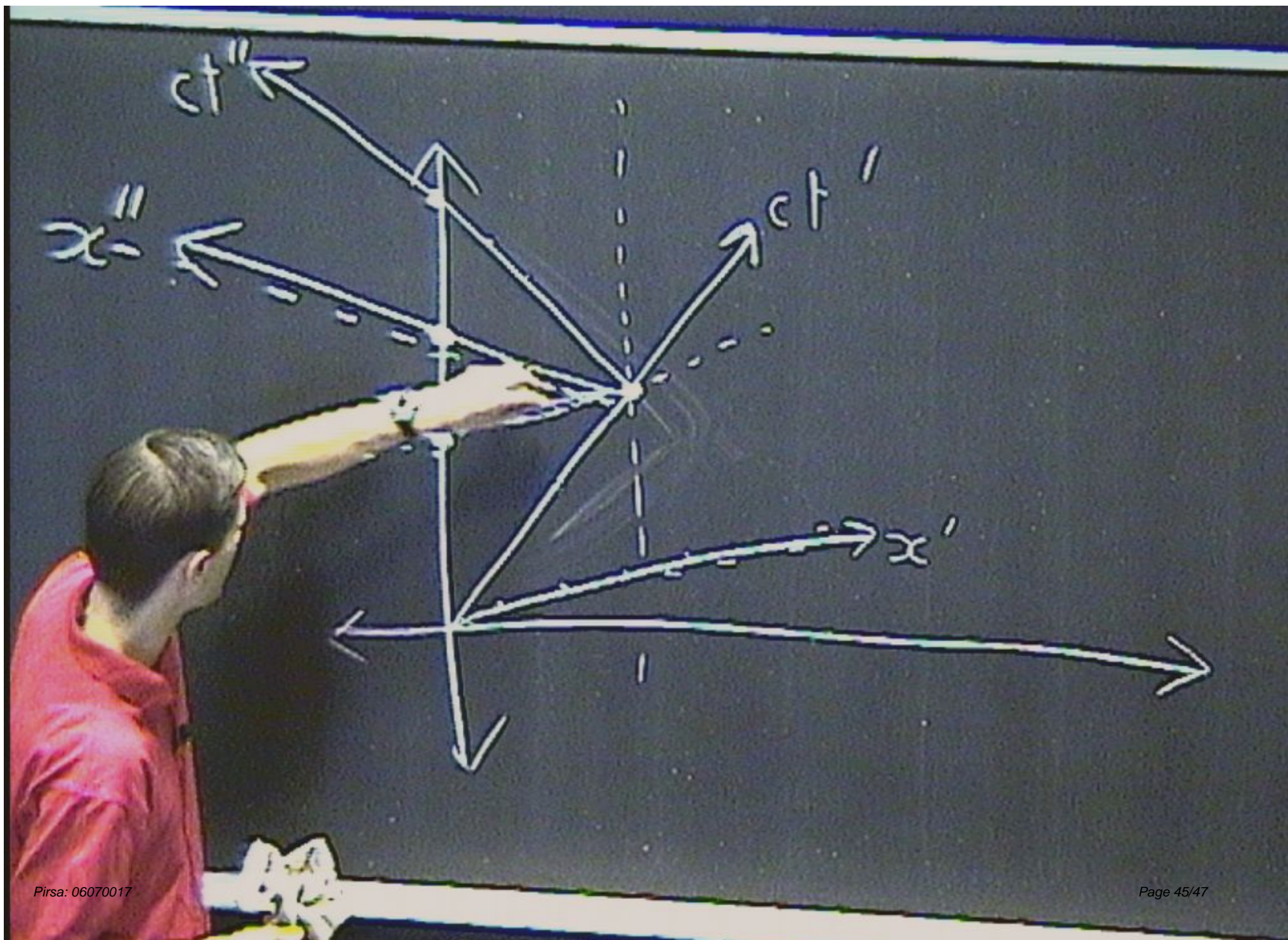




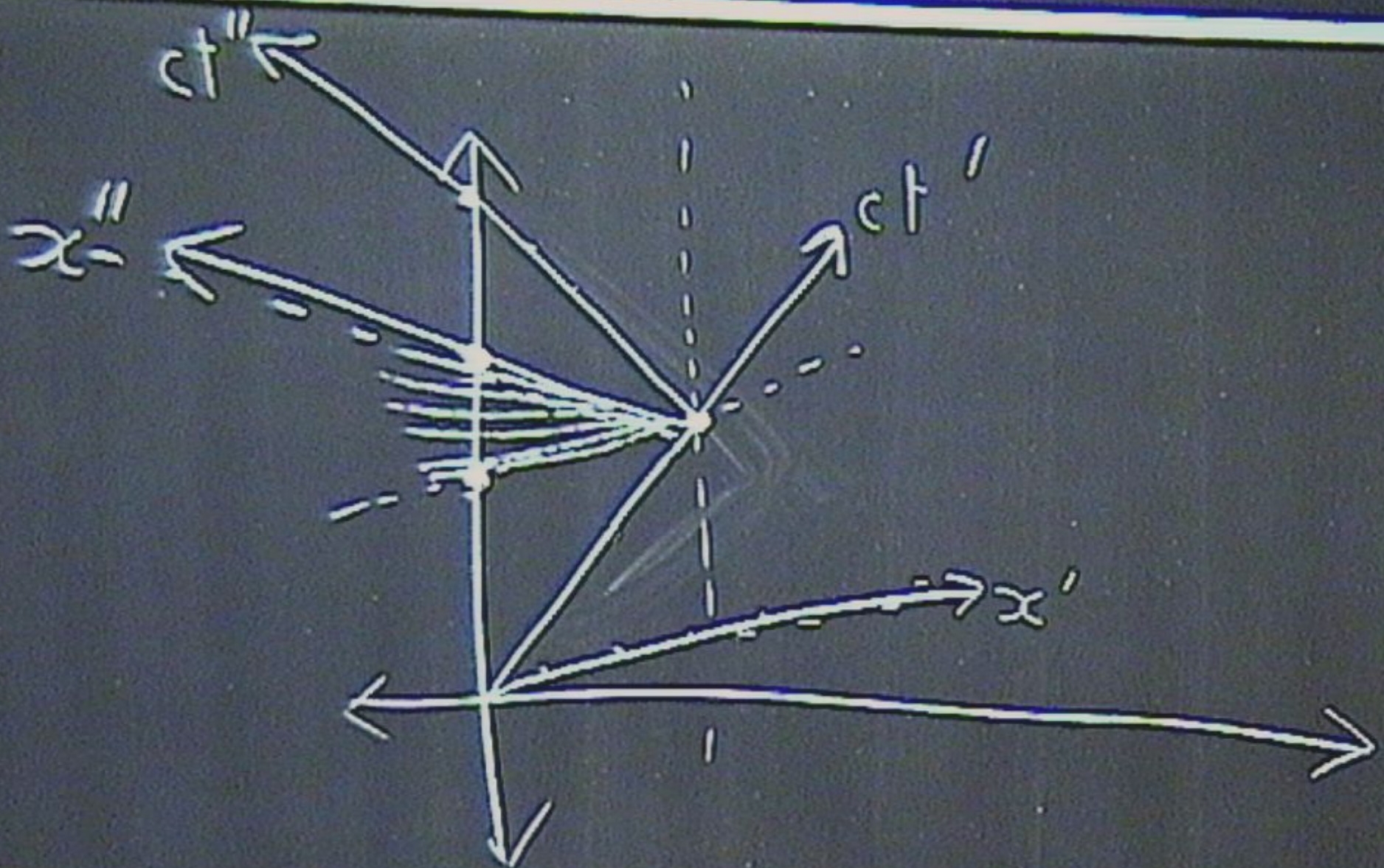














73

Einstein Plus  
Teachers' workshop on Modern Physics

Post-program survey

How would you rate your understanding of the following topics?

*Quantum Physics*

Please circle: (Not at all) 0...1...2...3...4...5...6...7...8...9...10 (Completely)

*Special relativity*

Please circle: (Not at all) 0...1...2...3...4...5...6...7...8...9...10 (Completely)

*General relativity*

Please circle: (Not at all) 0...1...2...3...4...5...6...7...8...9...10 (Completely)

How confident do you feel about teaching the following topics in your classes?

*Quantum Physics*

Please circle: (Not at all) 0...1...2...3...4...5...6...7...8...9...10 (Completely)

*Special relativity*

Please circle: (Not at all) 0...1...2...3...4...5...6...7...8...9...10 (Completely)

How would you rate your level of motivation in relation to teaching modern physics to your students?

Please circle: (Minimal) 0...1...2...3...4...5...6...7...8...9...10 (Highly motivated)

How important do you think it is to teach your students some modern physics?

Please circle: (Completely unimportant) 0...1...2...3...4...5...6...7...8...9...10  
(Incredibly important)

Did you gain what you had hoped from the Einstein Plus workshop?

Any other comments?