I have seen the Eisntein summation notation before:

$$\mathbf{a} \cdot \mathbf{b} \equiv a_\mu b^\mu$$

A. Yes and I'm comfortable with it
B. Yes, but I'm just a little rusty with it
C. Yes, but I don't remember it it all
D. Nope

ANNOUNCEMENTS

- Poster printing (Free!)
  - Send your poster (PDF or PPT) to coeprint@msu.edu
  - Tell them you are in PHY 482
  - Make sure to give a couple of days for the print! (No weekends)
- Last Quiz (this Friday)
  - Use special relativity to effects of particle decay

True or False: The dot product (in 3 space) is invariant to rotations.

$$\mathbf{a} \cdot \mathbf{b} \equiv a_\mu b^\mu$$

A. True

B. False

C. No idea

Displacement is a defined quantity

$$\Delta x^{\mu} \equiv \left(x_A^{\mu} - x_B^{\mu}\right)$$

Is the displacement a contravariant 4-vector?

A. Yes
B. No
C. Umm...don't know how to tell
D. None of these.

Be ready to explain your answer.

The displacement between two events Δx^{μ} is a contravariant 4-vector.

Is $5\Delta x^{\mu}$ also a 4-vector?

A. Yes

B. No

The displacement between two events Δx^{μ} is a contravariant 4-vector.

Is $\Delta x^{\mu}/\Delta t$ also a 4-vector (where Δt is the time between in events in some frame)?

A. Yes

B. No

The displacement between two events Δx^{μ} is a contravariant 4-vector.

Is $\Delta x^{\mu}/\Delta\tau$ also a 4-vector (where $\Delta\tau$ is the proper time)?

A. Yes
B. No

The displacement between two events Δx^μ is a contravariant 4-vector.

Is $\Delta x^\mu / \Delta\tau$ also a 4-vector (where $\Delta\tau$ is the proper time)?

A. Yes
B. No

Which of the following equations is the correct way to write out the Lorentz scalar product?

A. $a \cdot b = -a^0 b^0 + a^1 b^1 + a^2 b^2 + a^3 b^3$

B. $a \cdot b = a_0 b^0 + a_1 b^1 + a_2 b^2 + a_3 b^3$

C. $a \cdot b = a_\nu b^\nu$

D. None of these

E. All three are correct

Velocity is a defined quantity:

$$\mathbf{u} = \frac{\Delta \mathbf{r}}{\Delta t} = \langle \frac{\Delta x}{\Delta t}, \frac{\Delta y}{\Delta t}, \frac{\Delta z}{\Delta t} \rangle$$

In another inertial frame, seen to be moving to the right, parallel to x, observers see:

$$\mathbf{u}' = \frac{\Delta \mathbf{r}'}{\Delta t'} = \langle \frac{\Delta x'}{\Delta t'}, \frac{\Delta y'}{\Delta t'}, \frac{\Delta z'}{\Delta t'} \rangle$$

Is velocity a 4-vector?

A. Yes

B. No

Imagine this quantity:

$$u^{\mu} \equiv \begin{pmatrix} c \\ \frac{\Delta x}{\Delta t} \\ \frac{\Delta y}{\Delta t} \\ \frac{\Delta z}{\Delta t} \end{pmatrix}$$

Is this quantity a 4-vector?

A. Yes, and I can say why.

B. No, and I can say why.

C. None of the above.

Imagine this quantity:

$$\eta^{\mu} \equiv \frac{1}{\Delta\tau}\begin{pmatrix} ct \\ \Delta x \\ \Delta y \\ \Delta z \end{pmatrix}$$

Is this quantity a 4-vector?

A. Yes, and I can say why.
B. No, and I can say why.
C. None of the above.

In my frame (S) I measure two events which occur at the same place, but different times t_1 and t_2 (they are NOT simultaneous)

Might you (in frame S') measure those SAME two events to occur simultaneously in your frame?

A. Possibly, if he’s in the right frame!
B. Not a chance
C. Definitely need more info!
D. ???

Two events have a timelike separation. In a "1+1"-dimensional spacetime (Minkowski) diagram (x horizontal, ct vertical), the magnitude of the slope of a line connecting the two events is

A. Greater than 1
B. Equal to 1
C. Less than 1