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

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

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

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.