Lecture Comprehension, Rotation Matrices (Chapter 3.2.1, Part 2 of 2)

TOTAL POINTS 3

1. Which of the following is equivalent to R_{ac}, the representation of the orientation of the {c} frame relative to the {a} frame? Select all that apply. **1 / 1 point**

- [x] $R_{ab}R_{bc}$

  Correct
  This is correct by the subscript cancellation rule.

- [x] $R_{ab}R_{cb}^{\mathrm{T}}$

  Correct
  R_{cb}^{T} is the inverse of R_{cb} which is equivalent to R_{bc}, so this is correct by the subscript cancellation rule.

- [x] $(R_{bc}^{\mathrm{T}}R_{ab}^{\mathrm{T}})^{\mathrm{T}}$

  Correct
  Use the facts that $R_{ab}^{\mathrm{T}} = R_{ba}$ and $(R_1R_2)^{\mathrm{T}} = R_2^{\mathrm{T}}R_1^{\mathrm{T}}$.

- [x] $R_{ad}R_{db}R_{bc}$

  Correct
  This is correct by the subscript cancellation rule.

2. The matrix **1 / 1 point**

$$R = \mathrm{Rot}(\hat{\mathbf{x}}, 90^\circ) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

represents the orientation R_{sa} of a frame {a} that has been achieved by rotating the {s} frame by 90 degrees about its $\hat{\mathbf{x}}$-axis. Now, given a matrix R_{sb} representing the orientation of {b} relative to {s}, which of the following represents the orientation of a frame (relative to {s}) that was initially aligned with {b}, but then rotated about the {b}-frame's $\hat{\mathbf{x}}$-axis by 90 degrees?

- (•) $R_{sb}R$

2. The matrix

1 / 1 point

$$R = \text{Rot}(\hat{\text{x}}, 90^\circ) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

represents the orientation R_{sa} of a frame {a} that has been achieved by rotating the {s} frame by 90 degrees about its $\hat{\text{x}}$-axis. Now, given a matrix R_{sb} representing the orientation of {b} relative to {s}, which of the following represents the orientation of a frame (relative to {s}) that was initially aligned with {b}, but then rotated about the {b}-frame's $\hat{\text{x}}$-axis by 90 degrees?

- (●) $R_{sb}R$
- ( ) RR_{sb}

✓ **Correct**

R_{sb} should be viewed as a representation of an orientation and R should be viewed as a rotation operator. Performing the operation on the right means the operation is done in terms of the axes of the frame of the second subscript, {b}.

3. The matrix

1 / 1 point

$$R = \text{Rot}(\hat{\text{x}}, 90^\circ) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

represents the orientation R_{sa} of a frame {a} that has been achieved by rotating the {s} frame by 90 degrees about its $\hat{\text{x}}$-axis. Now, given a matrix R_{sb} representing the orientation of {b} relative to {s}, which of the following represents the orientation of a frame (relative to {s}) that was initially aligned with {b}, but then rotated about the {s}-frame's $\hat{\text{x}}$-axis by 90 degrees?

- ( ) $R_{sb}R$
- (●) RR_{sb}

✓ **Correct**

R_{sb} should be viewed as a representation of an orientation and R should be viewed as a rotation operator. Performing the operation on the left means the operation is done in terms of the axes of the frame of the first subscript, {s}.