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# **5.1.1 Composing Rotations**

# 5.1.1 Composing Rotations

Please note the following observation, posted on the discussion board:

Hello,

it appears to me that at minute 3:40 of the video , matrix component a10 is indicated as cos(rho)\*sin(theta)+x\*sin(rho)\*cos(theta) while in my opinion should be cos(rho)\*sin(theta)+sin(rho)\*cos(theta).

thanks Luca

#### Video

#### Download video file

## **Transcripts**

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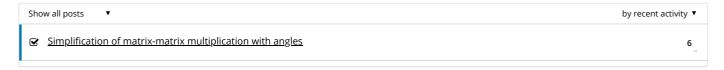


### Discussion

**Topic:** Week 5 / 5.1.1

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# Homework 5.1.1.1

3/3 points (graded)

For the following statements, find out if they are true or false.

$$ullet \left( egin{array}{c|c} cos(
ho+\sigma+ au) \ sin(
ho+\sigma+ au) \end{array} 
ight) = \left( egin{array}{c|c} cos( au) & -sin( au) \ \hline sin( au) & cos( au) \end{array} 
ight) \left( egin{array}{c} cos(
ho+\sigma) \ sin(
ho+\sigma) \end{array} 
ight)$$

True ✓ Answer: True

$$\bullet \begin{pmatrix} \cos(\rho + \sigma + \tau) \\ \sin(\rho + \sigma + \tau) \end{pmatrix} = \begin{pmatrix} \frac{\cos(\tau) & -\sin(\tau)}{\sin(\tau) & \cos(\tau)} \end{pmatrix} \begin{pmatrix} \cos(\rho)\cos(\sigma) - \sin(\rho)\sin(\sigma) \\ \sin(\rho)\cos(\sigma) + \cos(\rho)\sin(\sigma) \end{pmatrix}$$

True 

Answer: True

$$cos(\rho+\sigma+\tau)=cos(\tau)(cos(\rho)cos(\sigma)-sin(\rho)sin(\sigma))-sin(\tau)(sin(\rho)cos(\sigma)+cos(\rho)sin(\sigma))\\sin(\rho+\sigma+\tau)=sin(\tau)(cos(\rho)cos(\sigma)-sin(\rho)sin(\sigma))+cos(\tau)(sin(\rho)cos(\sigma)+cos(\rho)sin(\sigma))$$

True **▼ Answer:** True

#### **Explanation**

Answer: True Extending the observations in the video, we know that

$$R_{\rho+\sigma+\tau}(e_0) = R_{\tau}(R_{\rho+\sigma}(e_0)).$$

But

$$R_{\rho+\sigma+\tau}(e_0) = \begin{pmatrix} \cos(\rho + \sigma + \tau) \\ \sin(\rho + \sigma + \tau) \end{pmatrix}$$

and

$$R_{\tau}(R_{\rho+\sigma}(e_0)) = \begin{pmatrix} \cos(\tau) & -\sin(\tau) \\ \hline \sin(\tau) & \cos(\tau) \end{pmatrix} \begin{pmatrix} \cos(\rho+\sigma) \\ \sin(\rho+\sigma) \end{pmatrix}.$$

establishing the result.

$$\bullet \ \left( \begin{array}{c} \cos(\rho + \sigma + \tau) \\ \sin(\rho + \sigma + \tau) \end{array} \right) = \left( \begin{array}{c|c} \cos(\tau) & -\sin(\tau) \\ \hline \sin(\tau) & \cos(\tau) \end{array} \right) \left( \begin{array}{c} \cos\rho\cos\sigma - \sin\rho\sin\sigma \\ \sin\rho\cos\sigma + \cos\rho\sin\sigma. \end{array} \right)$$

True/False

Answer: True From the video we know that

$$R_{\rho+\sigma}(e_0) = \begin{pmatrix} \cos(\sigma) & -\sin(\sigma) \\ \sin(\sigma) & \cos(\sigma) \end{pmatrix} \begin{pmatrix} \cos(\rho) & -\sin(\rho) \\ \sin(\rho) & \cos(\rho) \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} \cos\rho\cos\sigma - \sin\rho\sin\sigma \\ \sin\rho\cos\sigma + \cos\rho\sin\sigma. \end{pmatrix}$$

establishing the result.

$$\cos(\rho + \sigma + \tau) = \cos(\tau)(\cos\rho\cos\sigma - \sin\rho\sin\sigma) - \sin(\tau)(\sin\rho\cos\sigma + \cos\rho\sin\sigma)$$

$$\sin(\rho + \sigma + \tau) = \sin(\tau)(\cos\rho\cos\sigma - \sin\rho\sin\sigma) + \cos(\tau)(\sin\rho\cos\sigma + \cos\rho\sin\sigma)$$
True/False

Answer: True This is a matter of multiplying the last result.

Submit

Answers are displayed within the problem

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