

Q3. matrices are unitary

10 A matrix is unitary iff $UU^* = U^*U = I$

11 $A = \begin{pmatrix} 1+i & 2-i \\ 3+i & 4-i \end{pmatrix}$

12 $A^* = \begin{pmatrix} 1-i & 3-i \\ 2+i & 4+i \end{pmatrix}$

3 $AA^* = \begin{pmatrix} 7 & 13 \\ 13 & 27 \end{pmatrix}$

no, it's not
unitary

5 $B = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}$

6 $B^* = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \end{bmatrix}$

7 $BB^* = I_{4 \times 4}$

hence, unitary

$B^*B = I_{4 \times 4}$

2017

AUGUST
TUESDAY

01

$$c) C = \begin{pmatrix} \cos(\theta/2) & -e^{i\phi} \sin(\theta/2) \\ e^{i\phi} \sin(\theta/2) & e^{i(\phi+\pi)} \cos(\theta/2) \end{pmatrix}$$

$$C^* = \begin{pmatrix} \cos \theta/2 & e^{-i\phi} \sin \theta/2 \\ -e^{-i\phi} \sin \theta/2 & e^{-i(\phi+\pi)} \cos \theta/2 \end{pmatrix}$$

$$CC^* =$$

$$\sin^2\left(\frac{\theta}{2}\right) + \cos^2\left(\frac{\theta}{2}\right)$$

$$e^{-i\phi} \sin\left(\frac{\theta}{2}\right) \cos\frac{\theta}{2} - \sin\left(\frac{\theta}{2}\right) \cos\frac{\theta}{2}$$

$$e^{i\phi} \sin\left(\frac{\theta}{2}\right) \cos\frac{\theta}{2} - \sin\left(\frac{\theta}{2}\right) \cos\left(\frac{\theta}{2}\right) e^{i(\phi+\pi)-i\phi} \sin^2\left(\frac{\theta}{2}\right) + \cos^2\frac{\theta}{2}$$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$I_{2 \times 2}$$

$$\text{Hence } C^*C = I_{2 \times 2}$$

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2017 SEPTEMBER

Mo	4	11	18	25	
Tu	5	12	19	26	
We	6	13	20	27	
Th	7	14	21	28	
Fr	1	8	15	22	29
Sa	2	9	16	23	30
Su	3	10	17	24	