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16. Worked example Worked example: matrix exponential

Matrix Exponentials | MIT 18.03SC Differential Equations, Fall 2011 1 comment



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Review

0 points possible (ungraded)

Which of the following matrices could be an exponential matrix of the form $e^{\mathbf{A}t}$?

(Choose all that apply.)

$$lacksquare \left(egin{array}{cc} \cos(t) & \sin(t) \ -\sin(t) & \cos(t) \end{array}
ight)$$

$$egin{array}{ccc} igcup \left(egin{array}{ccc} e^t & e^{2t} \ -2e^t & -2e^{2t} \end{array}
ight)$$

$$\left(egin{array}{cccc} e^{-3t} & e^t & te^t \ 2e^{-3t} & 0 & 0 \ 0 & e^t & e^t \end{array}
ight)$$

$$\left(egin{array}{cccc} e^{-3t} & e^t & e^t \ 0 & e^t & 0 \ 0 & 0 & e^t \end{array}
ight)$$

$$egin{array}{ccc} egin{array}{ccc} e^{it} & e^{-it} \ -ie^{it} & ie^{-it} \ \end{array} \end{array}$$



Solution:

We need to check that $\mathbf{X}(0) = \mathbf{I}$. We identified $\mathbf{X}(0)$ in a previous concept check:

$$ullet \left. egin{pmatrix} \cos(t) & \sin(t) \ -\sin(t) & \cos(t) \end{matrix}
ight|_{t=0} = I$$

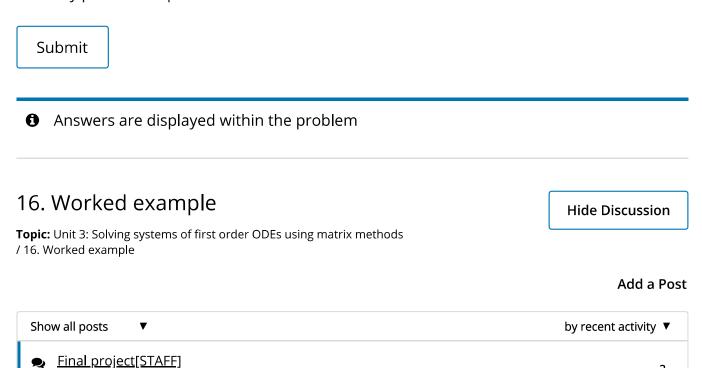
$$ullet \left. egin{pmatrix} e^t & e^{2t} \ -2e^t & -2e^{2t} \end{pmatrix}
ight|_{t=0} = \left(egin{array}{cc} 1 & 1 \ -2 & -2 \end{array}
ight)$$

$$ullet \left(egin{array}{cccc} e^{-3t} & e^t & te^t \ 2e^{-3t} & 0 & 0 \ 0 & e^t & e^t \end{array}
ight)igg|_{t=0} = \left(egin{array}{cccc} 1 & 1 & 0 \ 2 & 0 & 0 \ 0 & 1 & 1 \end{array}
ight)$$

$$ullet \left. egin{pmatrix} e^{-3t} & e^t & e^t \ 0 & e^t & 0 \ 0 & 0 & e^t \end{pmatrix}
ight|_{t=0} = egin{pmatrix} 1 & 1 & 1 \ 0 & 1 & 0 \ 0 & 0 & 1 \end{pmatrix}$$

$$ullet \left. \left(egin{array}{cc} e^{it} & e^{-it} \ -ie^{it} & ie^{-it} \end{array}
ight)
ight|_{t=0} = \left(egin{array}{cc} 1 & 1 \ -i & i \end{array}
ight)$$

The only potential exponential matrix is the first one.



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Since there's just a week left before the final project I started making some calculations about the likelih...

Why ungraded on Review question (under 16. Worked example)?

Just curious.

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