

Math 2280-1  
 Wednesday March 17  
 Matrix exponentials via Maple

> with(LinearAlgebra) :

> A := Matrix(2, 2, [4, 2, 3, -1]); #our first class example

$$A := \begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix} \quad (1)$$

> MatrixExponential(A, t);

$$\begin{bmatrix} \frac{1}{7} e^{-2t} + \frac{6}{7} e^{5t} & \frac{2}{7} e^{5t} - \frac{2}{7} e^{-2t} \\ \frac{3}{7} e^{5t} - \frac{3}{7} e^{-2t} & \frac{6}{7} e^{-2t} + \frac{1}{7} e^{5t} \end{bmatrix} \quad (2)$$

> B :=  $\begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ ; #diagonal matrix

MatrixExponential(B, t);

$$B := \begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$$

$$\begin{bmatrix} e^{-2t} & 0 & 0 \\ 0 & e^{3t} & 0 \\ 0 & 0 & e^{4t} \end{bmatrix} \quad (3)$$

> N := Matrix(3, 3, [0, 1, 2, 0, 0, -1, 0, 0, 0]);

#a nilpotent matrix

MatrixExponential(N, t);

$$N := \begin{bmatrix} 0 & 1 & 2 \\ 0 & 0 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & t & -\frac{1}{2} t^2 + 2t \\ 0 & 1 & -t \\ 0 & 0 & 1 \end{bmatrix} \quad (4)$$

> C := Matrix(3, 3, [3, 1, 2, 0, 3, -1, 0, 0, 3]);

MatrixExponential(C, t);

$$C := \begin{bmatrix} 3 & 1 & 2 \\ 0 & 3 & -1 \\ 0 & 0 & 3 \end{bmatrix}$$

$$\begin{bmatrix} e^{3t} & te^{3t} & -\frac{1}{2} te^{3t}(t-4) \\ 0 & e^{3t} & -te^{3t} \\ 0 & 0 & e^{3t} \end{bmatrix} \quad (5)$$

