• basic manipulations of matrices with Matlab and by hand
  – assigning a matrix in Matlab
  – view element, row, column of matrix in Matlab
  – + − ∗ . ∗ / . / . ^ . ^ ‘
  – matrix addition, subtraction, multiplication
  – inverse of matrix, trick for $2 \times 2$ matrices

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}^{-1} = \frac{1}{ad-bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$

  – calculate rank, determinant, trace, eigenvalues/eigenvectors of matrix

• plotting commands in Matlab
  – plot, semilogx, semilogy, loglog, subplot, title, xlabel, ylabel

• curve fitting
  – plots using logarithmic axes
    * $y = Ax^b \Rightarrow$ plotting $\log_{10}(y)$ vs. $\log_{10}(x)$ gives straight line
    * $y = A \times 10^{\lambda x} \Rightarrow$ plotting $\log_{10}(y)$ vs. $x$ gives straight line
    * $x = A \times 10^{\lambda y} \Rightarrow$ plotting $y$ vs. $\log_{10}(x)$ gives straight line

• Matlab functions
  – trig functions, abs, sqrt, exp, log, log10
  – max, min, sum, cumsum, prod, cumprod

• logical statements in Matlab
  – if statement
    – ~ & | ==

• external, inline, anonymous functions

• loops: for, while
- probability
  - basic definitions
  - rules for mutually exclusive events and independent events
  - probability distribution functions
  - expected values
- Limits
  - definition
  - calculation using Taylor series, using L'Hospital
- Derivatives
  - definition
  - product rule, chain rule, quotient rule
- Integrals
  - definition as area under a function
  - fundamental theorems of calculus
  - solving using substitution, integration by parts
- Taylor series

\[ f(x) = f(c) + f'(c)(x - c) + \frac{f''(c)}{2!}(x - c)^2 + \cdots \]
- basics of complex numbers
  - Euler formula \( e^{ix} = \cos(x) + i\sin(x) \)
  - going from Cartesian to polar coordinates
- you will need to write a short Matlab program on the exam!