Mathematics of Engineering - ME17
Midterm Review, Spring 2008

- 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 2×2 matrices

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

  - 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

$$\boxed{f(x) = f(c) + f'(c)(x-c) + \frac{f''(c)}{2!}(x-c)^2 + \cdots}$$

- basics of complex numbers
  - Euler formula $\boxed{e^{ix} = \cos(x) + i\sin(x)}$
  - going from Cartesian to polar coordinates
- you will need to write a short Matlab program on the exam!