MATLAB Tutorial: Outline

version 2

- MATLAB Environment
- Variables: `A` ≠ `a` ⚠
  - Real/Complex, `1i`, `1j`, `NaN`, `Inf`
  - Strings
  - Vectors, matrices
  - Cells
- Input/Output
  - `input`, `disp`, `fprintf`
  - `num2str`
  - Import data from file
- `help`, `doc`, `clear`, `close`
- .m files and functions
  - .m files: running & debugging
  - `function`
  - paths/directories
- Operations/Basic functions
  - Boolean: `1`: true, `0`: false
    - `==`: equal, `&`: and, `|`: or, `~`: not
    - `<`, `>`, `<=`, `>=`, `~=`
  - Scalar
    - `+`, `-`, `*`, `/`, `^`, `sqrt`, `rem`
      - Order: `1-2^3/4+5*6` = ?
    - `'`: complex conjugate
    - `real`, `imag`, `abs`, `conj`, `angle`
    - `sin`, `cos`, `tan`, …
    - `round`, `ceil`, `floor`
    - `exp`, `log2`, `log10`
    - `log` $=\log_e = \ln()$ ⚠
  - Vector
    - Vector creation: `linspace`, `:`, `zeros`, `ones`
    - Indexing, concatenation
    - `length`
    - `min`, `max`, `mean`
  - Matrix
    - `zeros`, `ones`, `eye`
    - indexing, linear indexing, concatenation
    - `size`
    - `det`, `rank`, `inv`
    - `*`, `/`, `^` *vs.* `.*`, `./`, `.^`
    - `exp`, `sqrt`, `log` *vs.* `expm`, `sqrtm`, `logm` ⚠
    - Vector/Matrix: `'`: conjugate transpose, `.'` = `transpose`: transpose ⚠

- Random Variables: `rand`, `randn`, `randi`
- Loops
  - `for` … `end`
  - `if` … `elseif` … `end`
  - `while` … `end`
  - `break` to terminate
- Plotting
  - `plot(X, Y)` or `plot(X, Y, '--ro')`
  - `figure;`
  - `hold on;`, `hold off;`, `grid on;`, `grid off;`
  - `title('…')`, `xlabel('…')`, `ylabel('…')`
  - `subplot(m, n, k)`
  - Other plots:
    - `semilogx(X, Y)`, `semilogy(X, Y)`, `loglog(X, Y)`
    - `stem(Y)` or `stem(X, Y)`
    - `bar(Y)` or `bar(X, Y)`
- `find` in vectors/matrices
  For a matrix `A`,
  - `A == 3`: Boolean
  - `A(3)`: linear indexing
  - `find(A)`
  - `find(A == 3)`
  - `[r c] = find(A)`
  - `[r c] = find(A == 3)`
  - `A(A > 3)`
- Symbolic toolbox
  - `syms`, `solve`
- Simulink/Toolboxes