Handling Matlab data

1. Data types in Matlab
    - Numerical data: `double`, `int`
    - String data: `str`, `char`
    - Boolean: `0`, `1`
2. Defining Matlab *array*
    - How define an array manually: `,` and `;`
    - Array assignment functions: `zeros`, `ones`, `linespace`
    - Manipulating data: `[]`, `find`, `sort`, `size`, `length`
    - Reshape the data: `repmat`, `reshape`
    - Defining multidimensional data
3. Matlab *cell* data
    - A cell array of *strings*, *char*
    - Conversion from cell to array: `cell2mat`, `double`
4. Using Matlab *table (when time permits)*
    - Creating a table: `table`
    - Sort by columns: `sortrows`
    - Merging two tables: `join, innerjoin, outerjoin`
    - Searching in table: `T(tf,'colname1','colname2')`

Basic operations in Matlab

1. Arithmetics: `+`, `-`, `*`, `/`, `^`, `sqrt`, `nthroot`
2. Elementary functions: `exp`, `log`, `log10`
3. Trigonometric functions: `sin` (`sind`), `cos` (`cosd`), `tan` (`tand`), `asin`, `acos`, `atan`
4. Hyperbolic trigonometric functions: `sinh`, `cosh`, `tanh`, `asinh`, `acosh`, `atanh`
5. Array arithmetics: `.*`, `./`, `.^`
6. Vector operations: `dot`, `cross`
7. Matrix operations: `det`, `inv`

Exercise

1. Find the angle between two vectors

$$\mathbf{v} = \left(\sqrt{2}, \frac{\log 5}{1+\tan(50^\circ)}, \sin^{-1}(0.5)\right), \quad \mathbf{w} = \left(\exp(\cos(\sqrt{2})), \sinh^{-1}(1), \log_5(2)\right)$$

2. Find the volume of a parallelopipied bounded by three vectors:

$$\mathbf{x}_1 = (1,2,0), \quad \mathbf{x}_2 = (-2,5,-1), \quad \mathbf{x}_3 = (2,-3,1)$$

3. Create the 256×4 matrix of the form

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 2 \\ & & \vdots & \\ 1 & 1 & 2 & 1 \\ & \vdots & & \\ \vdots & & & \\ 4 & 1 & 1 & 1 \\ 4 & 1 & 1 & 2 \\ \vdots & & & \\ 4 & 4 & 4 & 4 \end{bmatrix}$$

4. Create the following `string` using the fact that `char(97)` is 'a' and `char(122)` is 'z'.

```
"abcdefghijklmnopqrstuvwxyz"
```