Assignment 2

➽ Read the assignment carefully! Remember that the first line of a script must be the call to the script preamble.

Write a MATLAB script Assignment02_IDxx.m[1] that solves the following elementary geometry problems. **Put each solution in a separate section**. Useful functions are: dot, cross, norm, sin, cos, asin, acos, linsolve

1. Two lines g, h in the (x, y)-plane are given in parametric form:

$$\text{g: } \boldsymbol{x} = \boldsymbol{p}_\text{g} + \lambda \cdot \boldsymbol{a}_\text{g}, \quad \lambda \in \mathbb{R}$$
$$\text{h: } \boldsymbol{x} = \boldsymbol{p}_\text{h} + \mu \cdot \boldsymbol{a}_\text{h}, \quad \mu \in \mathbb{R}$$

   Compute and display the intersection point X and the intersection angle α of g and h with $\boldsymbol{x} = (x, y), \boldsymbol{p}_\text{g} = (2, 3), \boldsymbol{a}_\text{g} = (2, -1), \boldsymbol{p}_\text{h} = (4, -1), \boldsymbol{a}_\text{h} = (3, 2)$. *(1 pt)*

2. Two lines g, h in the (x, y)-plane are given by the equations:

$$\text{g: } \boldsymbol{n}_\text{g} \cdot \boldsymbol{x} = c_\text{g}$$
$$\text{h: } \boldsymbol{n}_\text{h} \cdot \boldsymbol{x} = c_\text{h}$$

   Compute and display the intersection point X and the intersection angle α of g and h as well as the distance d of line h from the origin with $\boldsymbol{n}_\text{g} = (2, -3), c_\text{g} = 4, \boldsymbol{n}_\text{h} = (3, 5), c_\text{h} = 2$. *(1 pt)*

3. Two lines g, h in 3D-space are given in parametric form:

$$\text{g: } \boldsymbol{x} = \boldsymbol{p}_\text{g} + \lambda \cdot \boldsymbol{a}_\text{g}, \quad \lambda \in \mathbb{R}$$
$$\text{h: } \boldsymbol{x} = \boldsymbol{p}_\text{h} + \mu \cdot \boldsymbol{a}_\text{h}, \quad \mu \in \mathbb{R}$$

   Compute and display the shortest distance in space between the lines and the end points C, D of the shortest line segment joining g and h with $\boldsymbol{x} = (x, y, z), \boldsymbol{p}_\text{g} = (1, 3, -2), \boldsymbol{a}_\text{g} = (2, -1, 4), \boldsymbol{p}_\text{h} = (4, 1, 2), \boldsymbol{a}_\text{h} = (-2, 3, 5)$. *(2 pt)*

4. A triangle in 3D-space has the vertices A$(-3, 2, -4)$, B$(-2, 5, -1)$ and C$(1, 4, 6)$. Compute and display the lengths of the edges a, b, c, the angles α, β, γ, and the area F in two ways (Heron's formula and trigonometric formula[2]). By convention the edge $a/b/c$ is opposite the vertex A/B/C and the angle $\alpha/\beta/\gamma$ is at the vertex A/B/C. *(2 pt)*

➽ Please make sure that the relevant results and only those are shown in the output to the command window, so that I can check the correctness quickly and without digging into the code.

➽ Submit the scripts to rudolf.fruehwirth@oeaw.ac.at until 5pm on March 24. Any violation of the naming convention will lead to the rejection of the submission! If I ask for a correction, please submit the corrected version until 5pm on March 28.

[1] xx is your 2-digit ID number

[2] see https://en.wikipedia.org/wiki/Triangle