

# 5ELEN018W - Tutorial 5 Exercises

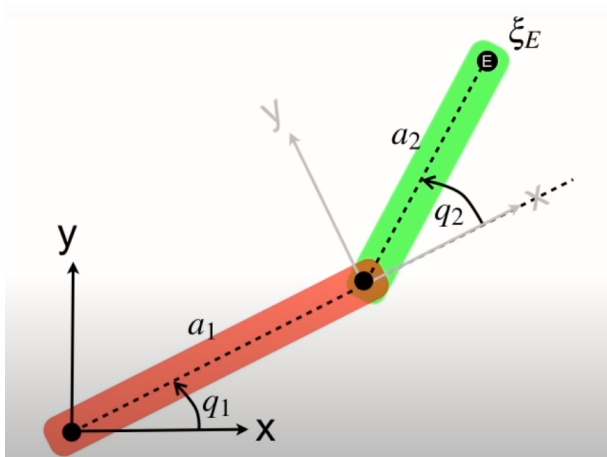
## Sample In-Class Questions

Attempt as many as possible from the questions found at the following URL. Sample answers are provided for the majority of the questions, but if you have any questions ask your tutor.

[https://ddracopo.github.io/DOCUM/courses/5elen018w/sample\\_in\\_class\\_questions\\_2025.pdf](https://ddracopo.github.io/DOCUM/courses/5elen018w/sample_in_class_questions_2025.pdf)

## Inverse Kinematics

Consider a 2-joint Planar (2D) Robot



Given the position of the end-effector  $(x_E, y_E)$  you are asked to calculate (using Python and the robotics toolbox we have been using) the required joint angles to achieve this position.

This was covered in the lecture. Effectively you need to study the lecture slides and the code included.

1. Calculate the analytical solution.
2. Calculate the numerical solution for a desired end-effector position  $(0.8, 0.49)$
3. Verify that the calculated numerical solution is correct (this is already in the slides!)