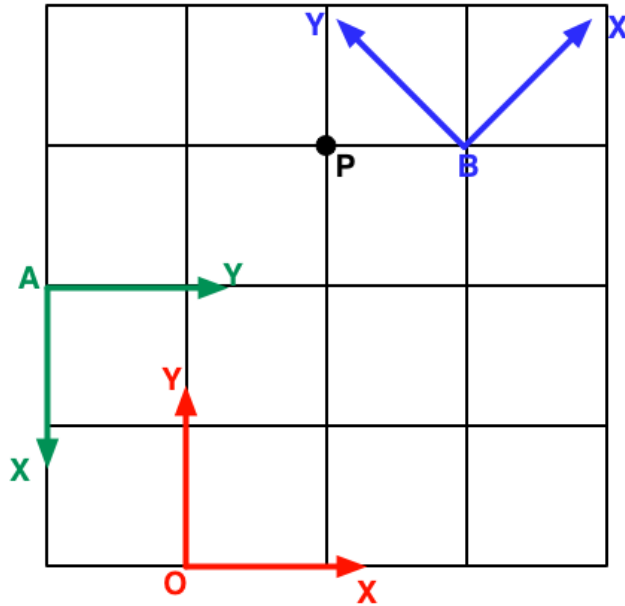# Friday Exercise E09: Transformation & Coordinate System

Name: Conor Race

Due Date: 11/17 11:59pm.

Consider the following three coordinate systems O, A and B for Q1 – Q5.

Note:

- Cells of the grid are unit cells, which means the cell edge length is equal to 1.
- M_{AB} is denoted as a math notation to represent the 3x3 matrix that transforms the coordinate system **A** to **B**.
- M^{-1}_{AB} represents the inverse matrix of M_{AB}, transforming the coordinate system **B** to **A**.

Q1: (15pts) What are the coordinates of P in the coordinate system O?

P = (1, 3) in coordinate system O

Q2: (15pts) What are the coordinates of P in the coordinate system A?

P = (-1, 2) in coordinate system A

Q3: (15pts) What are the coordinates of P in the coordinate system B?

P = (-0.71, 0.71) in coordinate system B

Q4: (15pts) Derive and calculate the values of M_{AB}.

A = [0, 0, 1] | B = [3, 1, 1]

T(ab) = [1, 0, 3   R(ab) = [cos(135deg), -sin(135deg), 0
        0, 1, 1   sin(135deg), cos(135deg), 0
        0, 0, 1]   0,   0,   1]

M(ab) = T(ab) * R(ab) = [-0.707, -0.707, 3
**   0.707, -0.707, 1**
**   0,   0,   1]**

Q5: (15pts) Use M_{AO} and M_{BA} to represent M_{OB}. There is no need to calculate matrix values. Please use the provided math notations (M_{AO} and M_{BA}), their inverse forms, and the multiplication sign as necessary to express your answer.

M(ao) = [0, -1, 1   M(ba) = [-0.707, 0.707, -3   M(ob) = [0.707, -0.707, 2
        1, 0, -2   -0.707, -0.707, -1   0.707, 0.707, 3
        0, 0, 1]   0,   0,   1]   0,   0,   1]

M-1(ao) = [0, 1, 2   M-1(ba) = [-0.707, -0.707, -2.828
          -1, 0, 1   0.707, -0.707, 1.414
          0, 0, 1]   0,   0,   1]

M-1(ao) * M-1(ba) = M(ob)