Exercise 1

Yiwei Ye

# Steps:

1. To find the coordinates of the origin of A seen from B:
   * We constructed a rotation matrix R\_AB using the 30-degree angle between frame A's x-axis and frame B's y-axis.
   * The rotation matrix R\_AB is:

R\_AB = [ [cos(30 degrees), sin(30 degrees)], [-sin(30 degrees), cos(30 degrees)] ]

* + Using the coordinates of point p in both frames, we found the translation vector t\_AB so that when we rotate point p from A and add t\_AB, we get its coordinates in B.
  + The coordinates of the origin of A seen from B are the negative of t\_AB, which are approximately (7.10, 1.46).

1. To find the coordinates of the origin of B seen from A:
   * We used the inverse of the rotation matrix R\_AB, which is its transpose R\_BA, because rotation matrices are orthogonal.
   * The origin of B seen from A is found by rotating the negative of t\_AB by R\_BA.
   * The coordinates of the origin of B seen from A are approximately (5.42, 4.82).
2. To find the coordinates of a point p expressed in A if B\_q = (3, 1):
   * We applied the inverse rotation matrix R\_BA to the given coordinates of point q in frame B.
   * We then added the origin of B as seen from A to this rotated vector to find the coordinates in frame A.
   * The coordinates of point q expressed in A are approximately (7.51, 7.18).

# In conclusion:

1. Coordinates of the origin of A seen from B:

The translation vector t\_AB was calculated using the given point coordinates in both frames A and B, and considering the rotation due to a 30-degree angle.

The coordinates of the origin of A as seen from B were found to be approximately (7.10, 1.46).

1. Coordinates of the origin of B seen from A:

Using the inverse transformation (the transpose of the rotation matrix), we found the coordinates of the origin of B as seen from A to be approximately (5.42, 4.82).

1. Coordinates of point p expressed in A if B\_q = (3, 1):

For point q with known coordinates in frame B, we applied the inverse rotation and translation to find its coordinates in frame A, resulting in approximately (7.51, 7.18).