Assignment 1: Linear Algebra and Affine Transformations

Task 1A: Dot Product
Calculate the dot product of vectors a and b (a * b)

a = (2,3,5,1)
b = (6,7,9,8)

Task 1B: Cross Product
Calculate the cross product of vectors c and d (c x d)

c = (2,3,5)
d = (6,1,2)

Task 2: Affine Transformations

Task 2A: Homogeneous Coordinates
Task 2A: Briefly describe what is meant by homogeneous coordinates and how a 3 dimensional point can be represented using them.

Task 2B: Translate vector along the x-axis
Task 2B: Use the given vector and move it along the x-axis.

(2 2)
(12 8)

Task 2C: Rotate 90 degrees around one axis -> give matrix
Task 2C: Use the given vector and rotate it 90° around the y-axis. Then give the matrix of the vector.

(3 0)
(0 3)

Task 2D: Scaling of factor 2 on all axes ->
Task 2D: Use the given vector and scale it by a factor of 2. Then give the matrix of the vector again.

(4 9)
(5 8)

Task 2E: Calculate the resulting matrix from applying the operations in Tasks 2B, 2C, and 2D.

Task 3: Unity
Task 3A: Install Unity (Link: https://unity.com/de) and create an empty 3D Project.
Task 3B: Create a blue cube that falls on a green plane. Add the Rigidbody component to the cube. Change the y coordinate to 5 and drop the cube on the plane.
Task 3C: Create a C# script to move an object using the arrow keys. Then apply this to the cube.
Task 3D: Create a C# script to rotate an object using R and L. Then apply this to the cube.

Task 3E: Build a course out of several cubes and use one of the cubes as the player. Change the color of each cube and place a sphere at the bottom left corner. Use it as a player and move it through the course.
Note: Always test via play on the top.