# COMP270: 3D Computational Geometry Worksheet 1

1. Consider the set of five points (7, 11, -5), (2, 3, 8), (-3, 3, 1), (-5, -7, 0) and (6, 3, 4).  
   An *axis aligned bounding box (AABB)* is the smallest box whose edges are aligned with the coordinate axes that contains all the points, defined by its minimum and maximum vertices **p**min and **p**max.
   1. What are **p**min and **p**max for the above five points?
   2. List all eight vertices of the AABB.
   3. Determine the centre point **c** of the AABB.
   4. Multiply the five points by the following matrix (a 45° rotation about the z-axis):
   5. What is the AABB of these transformed points?
   6. What is the AABB we get by transforming the original AABB? (i.e. the bounding box of the transformed corner points).
2. A robot is at the position (1, 10, 3) and her right, up and forward vectors (expressed in world space) are , and respectively (note that these vectors form an orthonormal basis).  
   The following points are expressed in object space; calculate their coordinates in world space:
   1. (-1, 2, 0)
   2. (1, 2, 0)
   3. (0, 0, 0)
   4. (1, 5, 0.5)
   5. (0, 5, 10)  
        
      The coordinates below are in world space; find their positions relative to the robot:
   6. (1, 10, 3)
   7. (0, 0, 0)
   8. (2.732, 10, 2)
   9. (2, 11, 4)
   10. (1, 20, 3) [p758, 3.6.6]