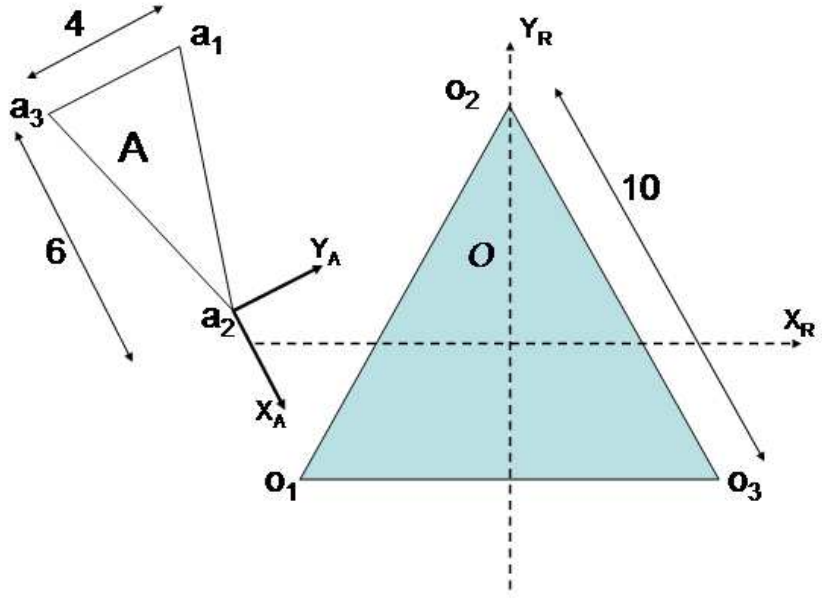
ME 115(b): Homework #3

(Due Friday, May 2, 2008)

Consider the convex polygonal robot, $\mathcal{A}$, and obstacle, $\mathcal{O}$, shown in Figure . The obstacle is an equilaterial triangle with side dimension of 10 units, whose center is coincident with the origin of the fixed workspace observing reference frame (whose axes are denoted by X_R and Y_R). One triangle face is parallel to the x-axis of the workspace reference frame. The robot is an isoceles triangle whose base dimension is 4 and whose height is 6. Its body fixed reference frame is located so that its x-axis is aligned with the triangle's centerline, and its origin



Problem 1: Write a Mathematica (or other programming language) function to create the outline of the c-obstacle for a fixed orientation of $\mathcal{A}$. Create the c-obstacle outline for the case of $\theta = 45^o$, where θ is the orientation of $\mathcal{A}$.

Problem 2: Using the function from Problem 1, create an visualization of the c-obstacle by superimposing on a single 3-dimensional view the constant orientation c-obtacle boundaries for orientations of $\mathcal{A}$ in 10^o increments (in the range $\theta \in [0^o, 360^o]$). That is, plot 36 constant orientation slices (with each orientation differing by 10^o) on a single 3-dimensional view (with the axes being x, y, and θ).

Problem 3: Create the function that describes the surface boundary "patch" of the c-obstacle associated with Type EV contact between robot edge $E_1^{\mathcal{A}}$ (which connects vertices a_1 and a_2) and obstacle vertex o_1. Also determine the boundaries of this patch. Plot this patch using Mathematica, Matlab, or anoother approach.