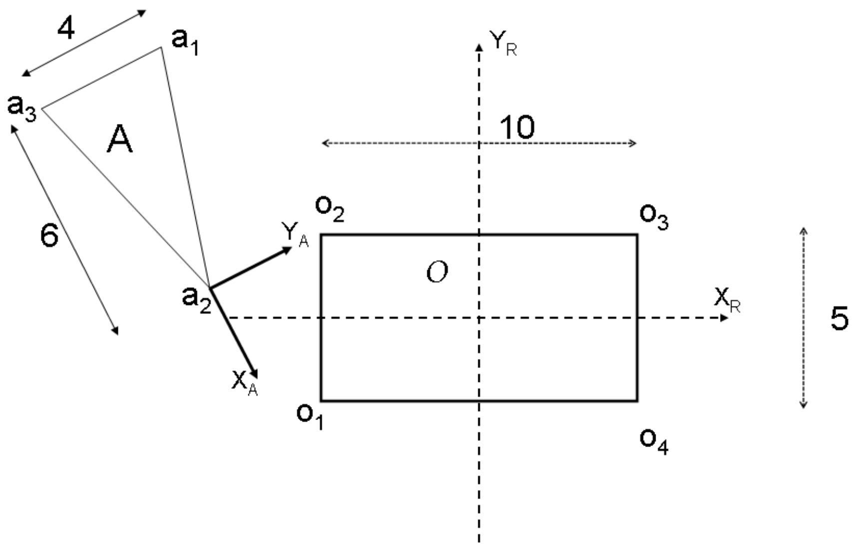
**ME/CS 132: Homework #1**

(Due Wednesday, January 28, 2009)

Consider the convex polygonal robot, $\mathcal{A}$, and obstacle, $\mathcal{O}$, shown in Figure . The obstacle is a rectangle with side dimensions of 5 and 10 units, whose center is coincident with the origin of the fixed workspace observing reference frame (whose axes are denoted by $X_R$ and $Y_R$). The rectangle faces are parallel to the workspace reference frame axes. 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 is located a




**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 $\theta$ 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 $\theta$).

**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.