

ECE661: Homework 1

Fall 2014

Turn in typed solutions via Blackboard. Additional instructions can be found at [I]

1. What are all the points in the representational space \mathcal{R}^3 that are the homogeneous coordinates of the origin in the physical space \mathcal{R}^2 .
2. Are all points at infinity in the physical plane \mathcal{R}^2 the same? Justify your answer.
3. Derive in just 3 steps the intersection of two lines l_1 and l_2 with l_1 passing through the points $(0, 0)$ and $(-1, -1)$, and with l_2 passing through the points $(3, 4)$ and $(-4, -3)$. How many steps would take you if the second line passed through $(3, 4)$ and $(-3, -4)$?
4. Argue that the matrix rank of a degenerate conic can never exceed 2.
5. As you know, when a point x is on a conic, the tangent to the conic at that point is given by $l = Cx$. That raises the question of what Cx corresponds to when x is, say, outside the conic. As you'll see later in class, when x is outside the conic, Cx is the line that joins the two points of contact if you draw tangents to C from the point x . This line is referred to as the *polar line*. Now consider for our conic a circle of radius 1 that is centered at the coordinates $(5, 5)$ and let x be the origin of the \mathcal{R}^2 physical plane. Where does the polar line intersect the y -axis in this case?

[I] <http://web.ics.purdue.edu/~bcomandu/ECE661/home/>