ECE661: Homework 1

Fall 2018

Turn in typed solutions via Blackboard. Additional instructions can be found at $[\mathbf{I}]$

- 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 \mathbb{R}^2 the same? Justify your answer.
- 3. Argue that the matrix rank of a degenerate conic can never exceed 2.
- 4. 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 (2,6), and with l_2 passing through the points (-6,8) and (-3,2). How many steps would take you if the second line passed through (-10,-3) and (10,3)?
- 5. Consider that there are two lines. The first line is passing through points (0,0) and (2,-2). The second line is passing through points (-3,0) and (0,-3). Find the intersection between these two lines. Comment on your answer.
- 6. As you know, when a point x is on a conic, the tanget 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 \mathbb{R}^2 physical plane. Where does the polar line intersect the x and y axes in this case?
- 7. Find the intersection of two lines whose equations are given by x = 1 and y = 1.
 - $[I] \ \texttt{https://engineering.purdue.edu/RVL/ECE661_2018/}$