

ECE661: Homework 1

Fall 2018

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. 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 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 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] https://engineering.purdue.edu/RVL/ECE661_2018/