Quiz 4

Date : November 18, 2013, Total time : 50 minutes, Total points : 20 points.

Name: ______________________ Reg.No.: ______________________

All the points and lines in this quiz are in $\mathbb{RP}^2$.

1. Prove that the four lines

$$X - Y = 0, \qquad 2X - 2Y + Z = 0,$$
$$X - Y + 2Z = 0, \qquad X - Y - Z = 0$$

in $\mathbb{RP}^2$ are concurrent. What is the common point?

4 points.

2. Find the cross ratio of the above pencil.

4 points.

3. Consider the points $A = (0:0:1)$, $B = (0:1:1)$, $C = (0:2:1)$ and $D = (0:3:1)$ on the line $X = 0$. Suppose we have a projective transformation T such that

$$A' := T(A) = (0:0:1)$$
$$B' := T(B) = (2:0:1)$$
$$C' := T(C) = (4:0:1).$$

3a. Consider the projectivity from $X = 0$ to $Y = 0$ which takes $A \mapsto A'$, $B \mapsto B'$ and $C \mapsto C'$. Is this projectivity a perspectivity? (If you are using a theorem, mention it clearly.)

2 points.

3b. Find $D' = T(D)$, providing necessary justification and without using problem 4.

6 points.

4. Suppose in the situation of the previous problem, we are also given that $T(0:1:0) = (1:0:0)$, $T(1:0:0) = (0:1:0)$ and $T(1:1:1) = (2:1:1)$. What is the matrix for T?

4 points.