

All questions have equal weight.  
Complete, clear, and concise explanations are sought.  
Show your work in the space provided.

Q1: Find the homogeneous coordinates of AB meet CD, where  $A:(1,2,3)$ ,  $B:(3,2,1)$ ,  $C:(1,1,1)$ , and  $D:(1,1,2)$ .

Q2. Six points A, B, C, D, E, and F are given as shown. By careful pencil sketch, confirm that the triangles DBA and CFE (in that order) are in perspective. In your sketch, identify both the centre and the axis of perspectivity for these triangles. [A figure accompanied this in the original.]

Q3. Find the matrix of the collineation that maps the standard frame of reference to the frame whose points have coordinates  $\{(1,1,1), (0,1,1), (0,0,1), (2,3,6)\}$

Q4. A point P and a conic Gamma are given. Give a clear, concise explanation of the reasons why every point on the polar of P has a polar that is on P.

Q5. A certain conic contains the three points  $(1,0,0)$ ,  $(0,1,0)$ , and  $(0,0,1)$ . In addition we are given that it is tangent to the line  $[1,2,3]$  at the point  $(1,2,3)$ . What can we know about the equation of the conic?