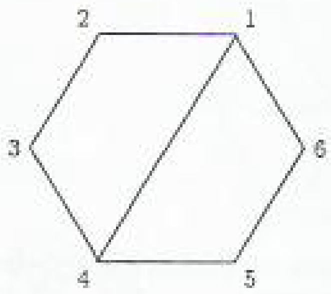
(51) (91)

Let G be the symmetry group of the plane figure below (which is a regular hexagon with one diagonal line drawn).



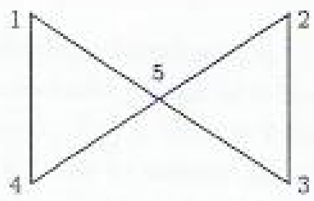
(a) Using the numbering of the locations of the six vertices as shown, write down the elements of G as permutations in cycle form.

(b) List all the subgroups of G.

(c) State, giving brief reasons, whether or not the group G is cyclic. [6]

(89)

(52) Let G denote the symmetry group of the plane figure below (two equilateral triangles, the positions of the vertices being labelled as shown, and the lines joining 1 and 3, 2 and 4 both passing through 5).



(a) Using the above labelling, write down the elements of G in either bracket or cycle notation. State the order of G. (e, (12)(34), (14)(23), (13)(24)) [2]

(b) Write down all the subgroups of G. [2]

(c) Show that G is not isomorphic to Z_4. check e. $\neq Z_4$ cyclic [1]

(d) Explain why G is not (isomorphic to) a subgroup of S_3. [1]

(53) In this question G is the symmetry group of the regular pentagon with vertices labelled as shown (Figure 1).

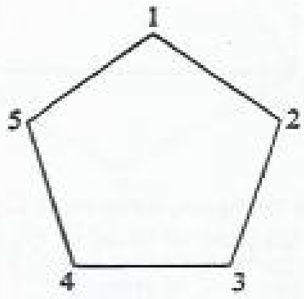


Figure 1

(81)

Let g be the symmetry which rotates the pentagon *anticlockwise* through an angle of $\frac{6\pi}{5}$ about its centre.

(i) Write g as a permutation of the vertices. (13524) [1]

(ii) Write down the order of g. |5| [1]

(iii) Write down the elements of a subgroup of order 2 in G. (e, (25)(34)) [2]

(iv) How many elements are there in G? 10 [1]

(v) Prove that G has no subgroup of order 4. [1] (81)