1. What is binary relation?

2. What is binary operation?

3. Number of binary relations on a set.

4. Definition of a groupoid.

5. Definition of a semigroup.

6. Definition of monoid.

    I. Identity element of (Z,+)
    II. Identity element of (Z, .)
    III. (R-{0}, .)

7. Definition of a Group.

    a) (R, +), (R-{0}, .), (Q,+), (C, +), (Q-{0}, .), (c-{0}, .) is a group.
    b) (Q, .), (C,.) is not a group

8. Definition of a finite group.

9. Order of finite group.

10. Equivalance classes. Show that set of residues of integer modulo n forms a group.

11. Commutative(abelian) Group and Non Commutative Group.

12. Show tha GL(n, R) forms a non commutative Group.

13. Show tha SL(n,R) forms a Group.

14. Definition of permutation.

15. Show that set of permutation of n elements forms a group.(Symmetric class).

16. A_n set of alleven permutation forms a group.
17. Definition of subgroup.
18. Necessary and sufficient condition for a subgroup

    a) Let (G,.) be a group and H be a non-empty subset of G then H is a subgroup of G if and only if $a.b^{-1} \in H \quad \forall\ a, b \in H$.
    b) Let (G,.) be a group and H be a non-empty finite subset of G then H is a subgroup of G if and only if $a \in H, b \in H \Rightarrow a.b \in H$

19. Show that SL(n, R) is a subgroup of GL(n,R).

20. Show that alternating permutation A_n is a subgroup of S_n

21. (3Z, .) is a subgroup of (Z,.)

22. Every group is a subgroup f itself(trivial subgroup)

23. Let G be a group and H and K be two subgroup of G

    a) Show that $H \cap K$ is a subgroup of G
    b) Show tha $H \cup K$ may not be a subgroup
    c) $H \cup K$ forms a subgroup if and only if $H \subset K$ or $K \subset H$.

24. Definition of cyclic group. Additive and multiplicative notation.
Eg kelin's 4 group.

25. Generator of a cyclic group.
   a) Generator of {1, -1, I, -i}
   b) Generator of {1, w, w^2}

26. A finite group G has a unique generator if and only if oredr(G) = 2.

27. Every cyclic group is a commutative group.

28. Prove that if G is a cyclic group then G = <a> for some a $\in$ G.

29. Prove that subgroup of a cyclic group is cyclic.
   a) Eg. Kelin's 4 group, subgroup and its generators.

30. How many subgroups of a cyclic group of order 36 ?

31. Order of an element is a group G.

32. Let a be an element of a group (G, .) then if order(a) = n, then for a positive integer m, $o(a^m)=n/gcd(m,n)$

33. Cosets. Definition of left cosets and right cosets.

34. Let G be a group and H be a subgroup of G. any two left cosets of H in G are either identical or they have no common element.

35. Let G be a group and H be a subgroup of G. then the set of all left cosets of H in G and the set of all right cosets of H in G have same cardinality.

36. Lagrange Theorem and converse of it. Proof of them.

37. Noramal subgroup
   a) A_n is a normal subgroup of S_n
   b) SL(n, R) is a normal subgroup of GL(n,R)

38. Necessary and sufficient condition of being a normal subgroup
   a) Let G be a group and H be a subgroup of G then H is a Normal Subgroup of G if and only if $ghg^{-1} \in H \quad \forall\ g \in G$ and $h \in H$
   b) Proof SL(n,R) is a normal subgroup of GL(n,R) using this theorem

39. Definition of center of a group denoted by Z(G)
   a) If it is commutative the Z(G) is a subgroup of G

40. Quotient of a set.

41. What is Quotient Group. Examples.