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8210 - Basic algebra Fs 2007

How to solve :

1. If you have to show a function f is one-one, begin with f(x) = f(y). Proceed logically from there using whatever is known or given. Then arrive at x= y. Now you can conclude that f is one-one.

2. If you have to prove a function f is onto, start with f(x) =y. Solve for x.

3. If you have to check that a number n is a multiple of a number k, it is a good idea to use division algorithm to write, n = ka+r. Then knowing that r=0 or 0¡r¡k. will be helpful.

4. To prove a subset H of G is a subgroup, you must do these three things. Let $*$ denote the operation in G and e the identity.

i. Prove that $e \in H$.

ii. Let $x, y \in H$.. Then show that $x * y \in H$.

iii. Let $x \in H$. Show that $x^{-1} \in H$.

5. To prove that a group G is abelian or commutative. Let $x, y \in G$ be any two arbitrary elements in G. Show that $x * y = y * x$. Warning: Just knowing some two elements in G commute is not enough to conclude the group is abelian.

6. To show a group is not abelian, all you need to do is to find and specify two elements in it that do not commute.

7. To show that a finite group G is cyclic, all you need to do is to produce one element in G that has the same order as that of G

8. To compute the order of an element g in a group G, compute $g, g^2, \cdots$, till you get the identity. The first time you hit identity, you get the order of the element g.

9. If g in G has infinite order, then $g^n \neq e$ for any positive integer n.

10. To find all subgroups of a group G, first write down all the cyclic groups, then the groups generated by two elements and so on. If you put an element g in a subgroup, remember, the entire cyclic group generated by g must be in that subgroup. So, pick an element h not in the cyclic subgroup $< g >$ to get a group generated by two elements.