CIRCULAR PERMUTATIONS

Types of circular permutations:

a) stationary - table, people in a ring, etc.
b) movable - key ring, necklace, charm bracelet

1. In how many ways can:
   a) four people be seated at a table?
   b) six people be seated at a table?
   c) twelve people be seated at a table?
   d) twenty-four students be arranged in a circle?

2. In how many ways can:
   a) four people be seated at a table if:
      i) two must sit together?
      ii) three must sit together?
   b) eight people be seated at a table if:
      i) two must be seated together?
      ii) three must be seated together?
      iii) five must be seated together?

3. In how many ways can:
   a) four boys and four girls be arranged in a circle so that they alternate?
   b) eight boys and eight girls be arranged in a circle so that they alternate?
   c) ten boys be arranged in an outside ring and ten girls be arranged in an inside ring?

4. Ten people (5 men and 5 women) are attending a dinner party. In how many ways can they be arranged if:
   a) they are to be arranged in a line for a picture?
   b) they are arranged in a line for a picture but the man and women must alternate?
   c) they are arranged in two lines, men in back and women in front, for a picture?
   d) they are to be arranged in one line but as couples?
   e) they are to be arranged around the dinner table?
   f) they are to be arranged with men and women alternating around the table?
   g) they are to be arranged as couples around the dinner table?
   h) only the host and hostess are to sit together?

5. In how many ways can:
   a) 5 different keys be arranged on a key chain?
   b) 12 different keys be arranged on a key chain?
   c) 8 different coloured beads be arranged on a necklace?
   d) 6 different charms be arranged on a charm bracelet?

6. In how many ways can:
   a) 4 red beads, 6 blue beads and 4 green beads be arranged on

a necklace (only difference in beads is colour)?

b) 3 "c" master keys, 2 "a" master keys and 7 "f" master keys are to be arranged on a key ring?