

1. Prove that for all integers $n \geq 3$,

$$P(n+1, 3) - P(n, 3) = 3P(n, 2)$$

2. Write down all 3-permutations of $\{a, b, c, d\}$.
3. (a) How many integers between 1 and 1001 are multiples of 2 or multiples of 3?
(b) How many integers between 1 and 1001 are multiples of 2 or multiples of 3 or multiples of 5?
4. Four different letters L_1, L_2, L_3, L_4 are intended for four different recipients R_1, R_2, R_3, R_4 , respectively. How many ways are there to mail these four letters so that every recipient receives exactly one letter not intended for him/her?
5. A rook is a chess piece that may move any number of unoccupied squares either vertically or horizontally.
(a) How many ways to place 8 indistinguishable rooks on the chess board so that no rook is attacked by another?
(b) How many ways to place 8 indistinguishable rooks on the chess board so that each unoccupied square is attacked by at least one rook?