

### Exercise 1:

1)

$$P = 2 \times 4 \times 6 \times \dots \times 2n$$

$$P = (2 \times 1) \times (2 \times 2) \times (2 \times 3) \times \dots \times 2n$$

$$P = (2 \times 2 \times 2 \times \dots \times 2) (1 \times 2 \times 3 \times \dots \times n) = 2^n \times n$$

2)

$$P = 1 \times 3 \times 5 \times \dots \times (2n+1)$$

$$P = \frac{1 \times 3 \times 5 \times \dots \times (2n+1) \times 2 \times 4 \times 6 \times \dots \times 2n}{2 \times 4 \times 6 \times \dots \times 2n} = \frac{(2n+1)!}{2^n n!}$$

### Exercise 3:

$$(a+b)^n = \sum_{k=0}^n C_n^k a^k b^{n-k}$$

$$1) \sum_{k=0}^n 2^k C_n^k = \sum_{k=0}^n C_n^k 2^k 1^{n-k} = (2+1)^n = 3^n$$

$$2) \sum_{k=0}^n C_n^k = \sum_{k=0}^n C_n^k 1^k 1^{n-k} = (1+1)^n = 2^n$$

$$\sum_{k=0}^n (-1)^k C_n^k = \sum_{k=0}^n C_n^k (-1)^k 1^{n-k} = (-1+1)^n = 0^n = 0$$