1. (a)

$$O = \frac{f(x) - f(-x)}{2} \qquad\qquad E = \frac{f(x) + f(-x)}{2}$$

(b)

$$i) \sum_{k\text{偶數}} C_k^n O^{n-k} E^k \qquad\qquad ii) \sum_{k\text{奇數}} C_k^n O^{n-k} E^k$$

2.

$$(1+x)^n(1+x) \geq (1+nx)(1+x)$$
$$= 1 + (1+n)x + nx^2$$
$$\geq 1 + (n+1)x$$

3. (a)

$$S_1 = \sum_{i=1}^{n} i$$

$$\binom{n}{n-1,1,0} a = \frac{n(n+1)}{2}$$

$$na = \frac{n(n+1)}{2}$$

$$a = \frac{(n+1)}{2}$$

$$S_2 = \sum_{i=1}^{n} i^2$$

$$\binom{n}{n-2,2,0} a^2 + \binom{n}{n-1,0,1} b = \frac{n(n+1)(2n+1)}{6}$$

$$\frac{n(n-1)}{2} a^2 + nb = \frac{n(n+1)(2n+1)}{6}$$

$$b = \frac{(n+1)(-3n^2 + 8n + 7)}{24}$$

(b)

$$a : b = 3 : 1$$

$$\frac{-3n^2 + 8n + 7}{12} = \frac{1}{3}$$

$$-3n^2 + 8n + 3 = 0$$

$$(3n+1)(n-3) = 0$$

$$n = 3$$