$$k! \geq (\frac{k}{e})^k \tag{1}$$

$$e^k = 1 + \frac{k}{1!} + \frac{k^2}{2!} + \frac{k^3}{3!} + \frac{k^4}{4!} + ... + \frac{k^k}{k!} + ... \tag{2}$$

$$k!e^k = k!(1 + \frac{k}{1!} + \frac{k^2}{2!} + \frac{k^3}{3!} + \frac{k^4}{4!} + ... + \frac{k^k}{k!} + ...) \tag{3}$$

$$k!e^k = k! + k!\frac{k}{1!} + k!\frac{k^2}{2!} + k!\frac{k^3}{3!} + k!\frac{k^4}{4!} + ... + k!\frac{k^k}{k!} + ... \tag{4}$$

$$k!e^k = k! + k!\frac{k}{1!} + k!\frac{k^2}{2!} + k!\frac{k^3}{3!} + k!\frac{k^4}{4!} + ... + k^k + ... \tag{5}$$

$$k!e^k = k^k + \Delta \tag{6}$$

$$k!e^k \geq k^k \tag{7}$$

$$k! \geq \frac{k^k}{e^k} \tag{8}$$

$$k! \geq (\frac{k}{e})^k \tag{9}$$

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} \tag{10}$$