

$$a_k = \frac{(2m)! (1.5)^{2m}}{(m+k)! (m-k)!} = a_0 \frac{(m)(m-1)\dots(m-k+1)}{(m+1)(m+2)\dots(m+k)} \\ = a_0 \frac{(1)(1-\frac{1}{m})\dots(1-\frac{k-1}{m})}{(1+\frac{1}{m})(1+\frac{2}{m})\dots(1+\frac{k}{m})}$$

So

$$\ln a_k \approx \ln a_0 + 2 \left(\frac{1}{m} + \frac{2}{m} + \dots + \frac{k-1}{m} \right) - \frac{k^2}{m}$$

$$\ln a_k \approx \ln a_0 - \frac{k^2}{m}$$

∴ desired.