

In[1]:= **Series[Log[1 + x], {x, 0, 6}]**

$$\text{Out[1]}= x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - \frac{x^6}{6} + O[x]^7$$

In[3]:= **d2 = 4/h^2 \* Log[1/2 \* delta0 + Sqrt[1 + 1/4 \* delta0^2]]^2**

$$\text{Out[3]}= \frac{4 \text{Log}\left[\frac{\text{delta0}}{2} + \sqrt{1 + \frac{\text{delta0}^2}{4}}\right]^2}{h^2}$$

In[5]:= **Series[d2, {delta0, 0, 10}]**

$$\text{Out[5]}= \frac{\text{delta0}^2}{h^2} - \frac{\text{delta0}^4}{12 h^2} + \frac{\text{delta0}^6}{90 h^2} - \frac{\text{delta0}^8}{560 h^2} + \frac{\text{delta0}^{10}}{3150 h^2} + O[\text{delta0}]^{11}$$

In[6]:= **1440 / 16**

Out[6]= 90

In[8]:= **d2s = (2/h \* Log[1/2 \* delta0 + Sqrt[1 + 1/4 \* delta0^2]])^(2 \* s)**

$$\text{Out[8]}= 2^{2s} \left( \frac{\text{Log}\left[\frac{\text{delta0}}{2} + \sqrt{1 + \frac{\text{delta0}^2}{4}}\right]}{h} \right)^{2s}$$

In[19]:= **a = Series[d2s, {delta0, 0, 6}]**

$$\text{Out[19]}= \left(\frac{\text{delta0}}{h}\right)^{2s} \left( 1 - \frac{s \text{delta0}^2}{12} + \left(\frac{3s}{320} + \frac{1}{576} s(-1+2s)\right) \text{delta0}^4 + \left(-\frac{5s}{3584} - \frac{s(-1+2s)}{2560} - \frac{s(-2+2s)(-1+2s)}{41472}\right) \text{delta0}^6 + O[\text{delta0}]^7 \right)$$

In[31]:= **a2 = Expand[Normal[a]]**

$$\text{Out[31]}= \left(\frac{\text{delta0}}{h}\right)^{2s} - \frac{1}{12} \text{delta0}^2 \left(\frac{\text{delta0}}{h}\right)^{2s} s + \frac{11 \text{delta0}^4 \left(\frac{\text{delta0}}{h}\right)^{2s} s}{1440} - \frac{191 \text{delta0}^6 \left(\frac{\text{delta0}}{h}\right)^{2s} s}{181440} + \frac{1}{288} \text{delta0}^4 \left(\frac{\text{delta0}}{h}\right)^{2s} s^2 - \frac{11 \text{delta0}^6 \left(\frac{\text{delta0}}{h}\right)^{2s} s^2}{17280} - \frac{\text{delta0}^6 \left(\frac{\text{delta0}}{h}\right)^{2s} s^3}{10368}$$

In[36]:= **a3 = Coefficient[Coefficient[a2, (delta0/h)^(2\*s)], delta0^6]**

$$\text{Out[36]}= -\frac{191 s}{181440} - \frac{11 s^2}{17280} - \frac{s^3}{10368}$$

In[37]:= **Simplify[a3]**

$$\text{Out[37]}= -\frac{s(382 + 231 s + 35 s^2)}{362880}$$