

$$\begin{aligned}
 \textcircled{3a} \quad e^{\sin(x)} &= e^{x - \frac{(x)^2}{2} + \frac{(x)^3}{6} + \mathcal{O}(x^3)} = e^{x - \frac{8x^3}{6} + \mathcal{O}(x^3)} = e^{x - \frac{4x^3}{3} + \mathcal{O}(x^3)} \\
 &= 1 + \left[x - \frac{4x^3}{3} + \mathcal{O}(x^3) \right] + \frac{\left[\quad \right]^2}{2} + \frac{\left[\quad \right]^3}{6} + \mathcal{O}(x^3) \\
 &= 1 + x - \frac{4x^3}{3} + \mathcal{O}(x^3) + \frac{(x)^2}{2} + \frac{(x)^3}{6} + \mathcal{O}(x^3) \\
 &= 1 + x - \frac{4x^3}{3} + \mathcal{O}(x^3) + \frac{4x^2}{2} + \frac{8x^3}{6} + \mathcal{O}(x^3) \\
 &= 1 + 2x + 2x^2 + \mathcal{O}(x^3)
 \end{aligned}$$

$$\textcircled{3b} \quad \frac{\ln(1+x)}{1+x} = \frac{x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \mathcal{O}(x^4)}{1+x}$$

$$\begin{array}{r}
 x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \mathcal{O}(x^4) \\
 \hline
 -(x + x^2) \\
 \hline
 -\frac{3}{2}x^2 + \frac{x^3}{3} - \frac{x^4}{4} + \mathcal{O}(x^4) \\
 \hline
 -\left(-\frac{3}{2}x^2 - \frac{3}{2}x^3\right) \\
 \hline
 \frac{11}{6}x^3 - \frac{x^4}{2} + \mathcal{O}(x^4) \\
 \hline
 -\left(\frac{11}{6}x^3 + \frac{11}{6}x^4\right) \\
 \hline
 -\frac{7}{3}x^4 + \mathcal{O}(x^4)
 \end{array}$$

$$\begin{array}{r}
 1+x \\
 \hline
 x - \frac{3}{2}x^2 + \frac{11}{6}x^3 - \frac{7}{3}x^4 \\
 \hline
 \frac{1}{3} + \frac{3}{2} = \frac{2+9}{6} = \frac{11}{6} \\
 \hline
 \frac{1}{2} + \frac{11}{6} = \frac{3+11}{6} = \frac{14}{6} = \frac{7}{3}
 \end{array}$$

$$\frac{1}{3} + \frac{3}{2} = \frac{2+9}{6} = \frac{11}{6}$$

$$\frac{1}{2} + \frac{11}{6} = \frac{3+11}{6} = \frac{14}{6} = \frac{7}{3}$$

$$\frac{1}{2} + \frac{11}{6} = \frac{3+11}{6} = \frac{14}{6} = \frac{7}{3}$$

$$\frac{\ln(1+x)}{1+x} = x - \frac{3}{2}x^2 + \frac{11}{6}x^3 - \frac{7}{3}x^4 + \mathcal{O}(x^4)$$