

## 1 Sketch

$$\int e^{2x} * \arctan \sqrt{e^x - 1} \, dx$$

then calculate the integral:

$$\begin{aligned} & \int (t^2 + 1)^2 * \arctan t \, d \ln(t^2 + 1) \\ &= \int (t^2 + 1)^2 * \arctan t * \frac{2t}{1 + t^2} \, dt \\ &= \int 2t * (t^2 + 1) * \arctan t \, dt \\ &= \int \arctan t \, d(2/4t^4 + t^2) \\ &= \arctan t * (1/2t^4 + t^2) - \int (1/2t^4 + t^2) * \frac{1}{t^2 + 1} \, dt \\ &= \arctan t * (1/2t^4 + t^2) - \int (1/2 + t^2/2) - \frac{1/2}{t^2 + 1} \, dt \\ &= \arctan t * (1/2t^4 + t^2) - 1/2 * (t + 1/3t^3 - \arctan t) \\ &= \arctan t * (1/2t^4 + t^2 + 1/2) - 1/2 * (t + 1/3t^3) \end{aligned}$$

Then we have:

$$\text{LHS} = \frac{1}{6} (3e^{2x} \tan^{-1}(\sqrt{e^x - 1}) - \sqrt{e^x - 1}(e^x + 2))$$