$\sqrt{z}$

$$z = |z| e^{i\phi_z} = |z| e^{i\phi_z} e^{2\pi i n}$$

$$(z)^{1/2} = |z|^{1/2} e^{i\phi_z/2} e^{i\pi n} = |z|^{1/2} e^{i\phi_z/2} (-1)^n$$

$n=0 \quad +|z|^{1/2} e^{i\phi_z/2}$

$n=1 \quad -|z|^{1/2} e^{i\phi_z/2}$

$\ln z$

$\ln z = \ln|z| + i\phi_z + 2\pi i n \rightarrow$ infinite Riemann sheets

$$\ln \frac{\sigma(s)-1}{\sigma(s)+1} \qquad \sigma(s) \geq 1 \quad \forall\, s \geq 4m^2 \quad \left[\sigma(s) = \sqrt{1 - \frac{4m^2}{s}}\right]$$

$\rightarrow \sigma(s) - 1 \leq 0$, but $\operatorname{Im}\sigma(s) = +i\epsilon$

$$\sigma(s) - 1 = -\boxed{\times} + i\epsilon \rightarrow \ln = \boxed{\times}' + i\pi$$

$$\operatorname{Im}\left[\frac{1}{16\pi^2}\left(-\sigma \ln \frac{\sigma-1}{\sigma+1} + \dots\right)\right] = \frac{1}{16\pi^2}(-\sigma) i\pi + \dots = -i\frac{\sigma(s)}{16\pi}$$