(1) $e^{-\beta H} = e^{-i(-i\beta)H}$

imaginary time
generating functional
$\phi(\beta) = \phi(0)$

(2) $$Z[J] = e^{-\beta H + J\cdot\Phi} = \oint \phi e^{-S_\beta[\phi]+J\cdot\Phi}$$

(3) $$S_\beta[\Phi] = \int_0^\beta {}^4x\,[\partial^\mu\Phi\partial_\mu\Phi + V(\Phi)]$$

(4) $$J\cdot\Phi := \int_0^\beta x^0 \int^3 xJ(x)\Phi(\vec{x}).$$

(5) $$\phi(t_0 - i\beta, \vec{x}) = \phi(t_0, \vec{x}) =: \phi_0(\vec{x})$$

(6) $$\ldots\phi(t-i\beta,\vec{x})\ldots = \ldots\phi(t,\vec{x})\ldots.$$

(7) $\omega, \vec{p}) = \int te^{-i\omega t}G(t,\vec{p}) = \int te^{-i\omega t}\sum_{n=-\infty}^{\infty} e^{i\omega_n}tf_n(\vec{p}) = \sum_{n=-\infty}^{\infty}(2\pi)\delta(\omega - \omega_n)f_n(\vec{p})$ $with f_n(\vec{p}) = T\int_0^\beta tG(t,\vec{p})e^{i\omega_n t}$ $\omega_n = 2\pi nT.$

(8) $$G(t,\vec{p}) = \int \frac{\omega}{2\pi}e^{i\omega t}G(\omega,\vec{p}) = \sum_{n=-\infty}^{\infty} e^{i\omega_n t}G(\omega_n,\vec{p})$$

(9) $$G(\omega_n,\vec{p}) = \int_0^\beta te^{-i\omega_n t}G(t,\vec{p}) = \frac{1}{\omega_n^2 + \vec{p}^2 + V''(\phi)}$$

(10) $$G(t=0,\vec{p}) = \sum_{n=-\infty} \frac{1}{\omega_n^2 + E^2} = \frac{1}{2E}\coth\frac{\beta E}{2} = \frac{1}{E}\left[n_B(E)+\right].$$

(11) $$T\sum_n \int \to \int \frac{{}^4p}{(2\pi)^4}.$$

(12) $G(t = 0, \vec{p})$
$$E = \frac{\epsilon}{2}\coth\frac{\beta\epsilon}{2}.$$

(13) $$T\sum_{n=-\infty}^{\infty} f(2n\pi T) = i\oint zf(z)\left[n_B(iz)+\right]$$

(14) $$n_B(\omega) = \frac{1}{e^{\beta\omega}-1}.$$

(15) $$T\sum_{n=-\infty}^{\infty} f((2n+1)\pi T) = i\oint f(z)\left[n_F(iz)-\right]$$

$$n_F(\omega) = \frac{1}{e^{\beta\omega}+1}.$$