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0.

$$f(x) = \frac{1}{\sqrt{2\pi\sigma x}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

1.

$$\mathcal{L}(q) = E_{q(\tau)}[\log p(\tau)] + E_{q(\theta)}[\log p(\theta)] + E_{q(\mathbf{z}|q(\tau))}[\log p(\mathbf{z}|\tau)]$$

2.

$$H(Y|X) = \sum_{x \in \mathcal{X}, y \in \mathcal{Y}} p(x, y) \log \left(\frac{p(x)}{p(x, y)} \right)$$

3.

$$\begin{pmatrix} ct' \\ x' \\ y' \\ z' \end{pmatrix} = \begin{pmatrix} \gamma & -\gamma\beta & 0 & 0 \\ -\gamma\beta & \gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} ct \\ x \\ y \\ z \end{pmatrix}$$

4.

$$\delta B_{\mu\nu}^p = \mathcal{D}_{\mu}^{pq} \xi_{\nu}^q - \mathcal{D}_{\nu}^{pq} \xi_{\mu}^q \equiv R_{\mu\nu\alpha}^{pq} \xi^{\alpha}, \quad \delta A_{\mu}^p = 0$$

5.

$$\Phi^{(I)} = -\frac{se^2 F(1-F)}{12\pi^2 |m|} \int_1^{\infty} \frac{dv}{v\sqrt{v-1}} \frac{(1+F)(1+Av^F) - (2-F)(1+A^{-1}v^{1-F})}{Av^F + 2 + A^{-1}v^{1-F}}$$

6.

$$\Gamma_{\epsilon}(x) = [1 - e^{-2\pi\epsilon}]^{1-x} \prod_{n=0}^{\infty} \frac{1 - \exp(-2\pi\epsilon(n+1))}{1 - \exp(-2\pi\epsilon(x+n))}$$

7.

$$T_x(\theta_r) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos \theta_r & \sin \theta_r & 0 \\ 0 & -\sin \theta_r & \cos \theta_r & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

8.

$$W_b^* = n(\hat{\theta}_b^* - \hat{\theta})' \hat{V}_b^* (\hat{\theta}_b^* - \hat{\beta})$$

9.

$$T_{j,i}^{(t)} := P(Z_i = j | X_i = \mathbf{x}_i; \theta^{(t)}) = \frac{\tau_j^{(t)} f(\mathbf{x}_i; \boldsymbol{\mu}_j^{(t)}, \Sigma_j^{(t)})}{\tau_1^{(t)} f(\mathbf{x}_i; \boldsymbol{\mu}_1^{(t)}, \Sigma_1^{(t)}) + \tau_2^{(t)} f(\mathbf{x}_i; \boldsymbol{\mu}_2^{(t)}, \Sigma_2^{(t)})}$$

10.
$$\frac{\gamma}{4} \left(\frac{(D\Omega)^2}{\Omega^2} - 2 \frac{D \cdot D\Omega}{\Omega} \right) + (1 - \lambda) \mu \Omega^{-\lambda} - \frac{1}{4} \left(1 - \frac{\epsilon}{2} \right) \Omega^{-\epsilon/2} F^2 = T_\Omega^X$$

11.
$$\langle v_{I, A\bar{A}}(\tau) v_{J, B\bar{B}}^\dagger(\tau') \rangle = \delta^{IJ} \delta^{AB} \delta^{\bar{A}\bar{B}} \int \frac{dk}{2\pi} \frac{e^{ik(\tau - \tau')}}{k^2 + r^2/\lambda^2} \equiv \delta^{IJ} \delta^{AB} \delta^{\bar{A}\bar{B}} \Delta(\tau - \tau')$$

12.
$$\Omega_{a\nu}(az, bz) = \frac{\bar{K}_\nu^{(b)}(bz) / \bar{K}_\nu^{(a)}(az)}{\bar{K}_\nu^{(a)}(az) \bar{I}_\nu^{(b)}(bz) - \bar{K}_\nu^{(b)}(bz) \bar{I}_\nu^{(a)}(az)}$$

13.
$$\Delta S \propto \int d^4 x n_s m v_\theta^2 \propto \ell \Delta t (n_s/m) \int d^2 x r^{-2} \sim (\ell \Delta t / \ell_P^2) \log(R_0/a_0) \sim \ell \Delta t / \ell_P^2$$

14.
$$\hat{H} = \int dr \left(\frac{\hbar^2}{2M_B} \nabla \hat{\Psi}_m^+ \nabla \hat{\Psi}_m + \frac{c_0}{2} \hat{\Psi}_m^+ \hat{\Psi}_{m_1}^+ \hat{\Psi}_{m_1} \hat{\Psi}_m + \frac{c_2}{2} \hat{\Psi}_{m_1}^+ \hat{\Psi}_{m_2}^+ F_{m_1 m_4} F_{m_2 m_3} \hat{\Psi}_{m_3} \hat{\Psi}_{m_4} \right)$$

15.
$$\frac{d^2 \psi(\zeta)}{d\zeta^2} + \frac{2\zeta - 1}{\zeta(\zeta - 1)} \frac{d\psi(\zeta)}{d\zeta} - \frac{q + r(1 - 2\zeta)^2}{\zeta^2(\zeta - 1)^2} \psi(\zeta) = 0$$

16.
$$D = \det \begin{pmatrix} D_{tt} - D_{tb}(Q^{-1})_{bc} D_{ct} & D_{tj} - D_{tb}(Q^{-1})_{bc} D_{cj} & D_{tb} \\ D_{it} - D_{ib}(Q^{-1})_{bc} D_{ct} & D_{ij} - D_{ib}(Q^{-1})_{bc} D_{cj} & D_{ib} \\ 0 & 0 & Q^{ab} \end{pmatrix}$$

17.
$$Z[A_+, \eta, \bar{\eta}] = \int D\bar{\psi} D\psi \exp \left\{ i \int d^2 x [\bar{\psi} i \gamma^\mu \partial_\mu \psi + \psi_-^\dagger A_+ \psi_- + \eta \psi_+^\dagger \psi_- + \bar{\eta} \psi_-^\dagger \psi_+] \right\}$$

18.
$$\begin{aligned} \mathcal{P}_+ &= |\langle + | \psi \rangle|^2 \\ &= \langle + | \psi \rangle^* \langle + | \psi \rangle \\ &= \langle \psi | + \rangle \langle + | \psi \rangle \\ &= \langle \psi | P_+ | \psi \rangle \end{aligned}$$

19.
$$\int \operatorname{sech} u du = \sin^{-1}(\tanh u) \text{ or } 2 \tan^{-1} e^u$$

20.

$$\begin{aligned} P(e) &= \frac{1}{2}P(e|s_0) + \frac{1}{2}P(e|s_1) \\ &= \frac{1}{2} \int_{\frac{1}{2}A\sqrt{T}}^{\infty} p(r|s_0)dr + \frac{1}{2} \int_{-\infty}^{\frac{1}{2}A\sqrt{T}} p(r|s_1)dr \end{aligned}$$

21.

$$W(x, C) = P_* \exp\left[i \int_0^1 d\tau (q_\mu \theta^{\mu\nu} A_\nu(x + \xi(\tau)) + q_{\perp i} X^i(x + \xi(\tau)))\right]$$

22.

$$= \frac{1}{2} \underbrace{\langle [A, B] \rangle}_{\text{purely imaginary}} + \frac{1}{2} \underbrace{\langle \{\Delta A, \Delta B\} \rangle}_{\text{purely real}}$$

23.

$$\operatorname{argmin}_{\mathbf{w}} \left(\psi(\mathbf{w}^{(0)}) + \nabla \psi(\mathbf{w}^{(0)})^T (\mathbf{w} - \mathbf{w}^{(0)}) + \frac{\gamma}{2} \|\mathbf{w} - \mathbf{w}^{(0)}\|_2^2 + \Omega(\mathbf{w}) \right)$$