Please use the Snipping Tool (`https://mathpix.com`) on one single equation at a time! Performance is highest when the images are well zoomed in.

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.

$$\delta B^p_{\mu\nu}=\mathcal{D}^{pq}_\mu\xi^q_\nu-\mathcal{D}^{pq}_\nu\xi^q_\mu\equiv R^{pq}_{\mu\nu\alpha}\xi^{q\alpha},\qquad \delta A^p_\mu=0$$

5.

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

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.

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

8.

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

9.

$$T^{(t)}_{j,i}:=\mathrm{P}(Z_i=j|X_i=\mathbf{x}_i;\theta^{(t)})=\frac{\tau^{(t)}_j f(\mathbf{x}_i;\boldsymbol{\mu}^{(t)}_j,\Sigma^{(t)}_j)}{\tau^{(t)}_1 f(\mathbf{x}_i;\boldsymbol{\mu}^{(t)}_1,\Sigma^{(t)}_1)+\tau^{(t)}_2 f(\mathbf{x}_i;\boldsymbol{\mu}^{(t)}_2,\Sigma^{(t)}_2)}$$

10.

$$\frac{\gamma}{4}(\frac{(D\Omega)^2}{\Omega^2}-2\frac{D\cdot D\Omega}{\Omega})+(1-\lambda)\mu\Omega^{-\lambda}-\frac{1}{4}(1-\frac{\epsilon}{2})\Omega^{-\epsilon/2}F^2=T^X_\Omega$$

11.

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

12.

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

13.

$$\Delta S\propto\int d^4xn_smv^2_\theta\propto\ell\Delta t(n_s/m)\int d^2xr^{-2}\sim(\ell\Delta t/\ell^2_P)\log(R_0/a_0)\sim\ell\Delta t/\ell^2_P$$

14.

$$\hat{H}=\int dr\Big(\frac{\hbar^2}{2M_B}\nabla\hat{\Psi}^+_m\nabla\hat{\Psi}_m+\frac{c_0}{2}\hat{\Psi}^+_m\hat{\Psi}^+_{m_1}\hat{\Psi}_{m_1}\hat{\Psi}_m+\frac{c_2}{2}\hat{\Psi}^+_{m_1}\hat{\Psi}^+_{m_2}F_{m_1m_4}F_{m_2m_3}\hat{\Psi}_{m_3}\hat{\Psi}_{m_4}\Big)$$

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.

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

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.

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

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.

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