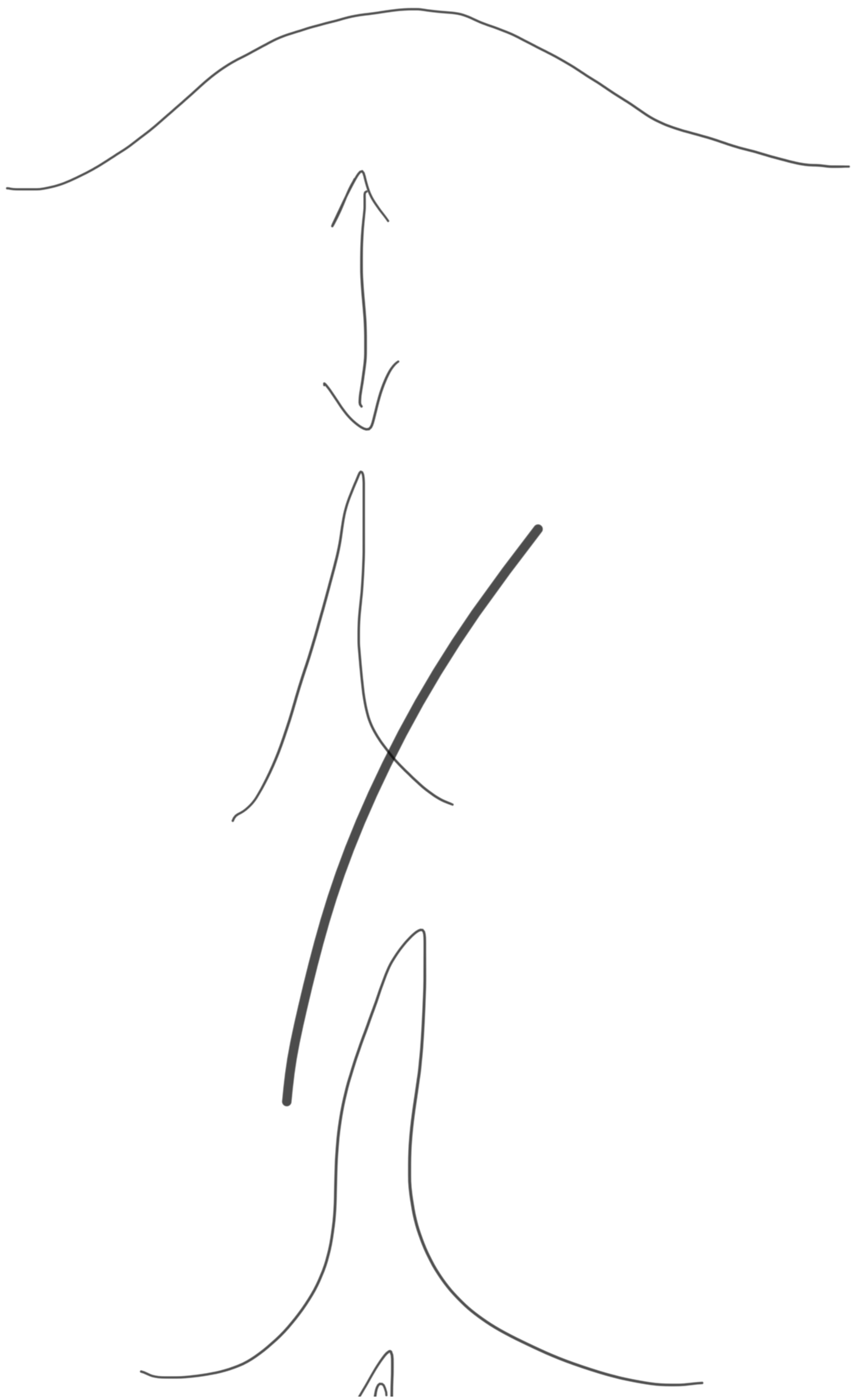
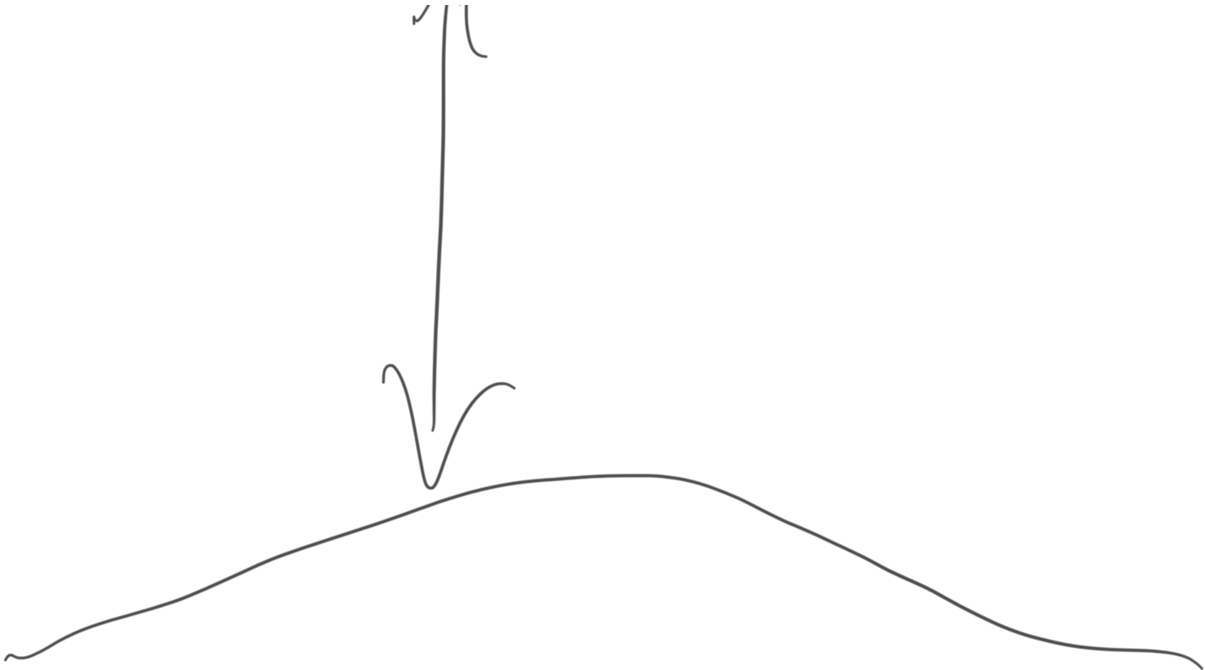
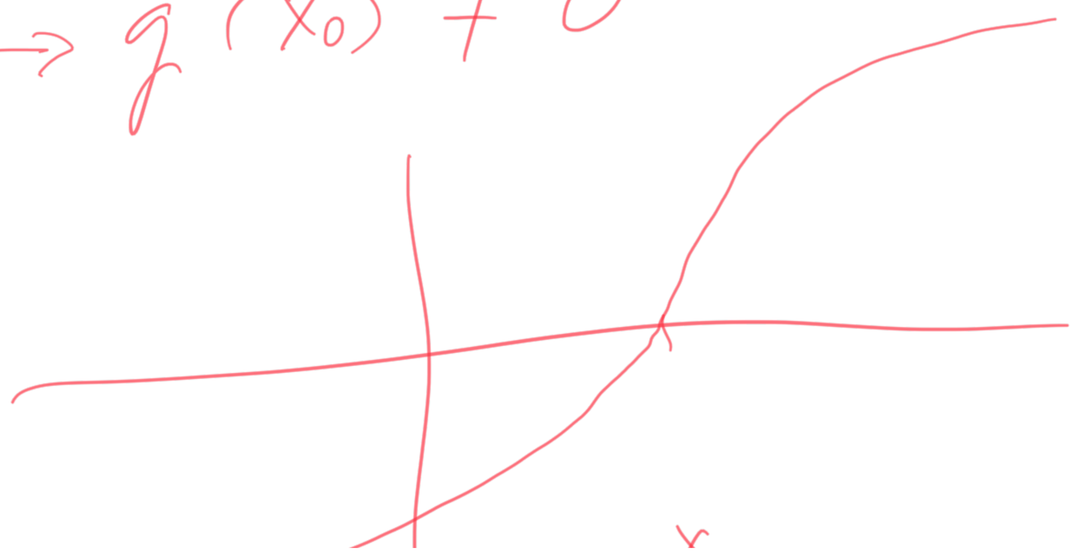




$g(x_0)=0$

$g(x) \neq 0$ if $x \neq x_0$

$\rightarrow g'(x_0) \neq 0$



$$\int \delta(x-y)\,dx = 1$$

$$\int \delta(x-y)\,u(x)\,dx = u(y) = 1$$

$$u(x) = 1$$

$$\hat{f}(k) = \frac{1}{k^2}$$

$$\tilde{f}(k) = \frac{1}{k}$$

$[x, p] = i\hbar$

$[x, p] = i\hbar$

$$\langle A \rangle = \mathrm{Tr}\, A\rho$$
$$= \mathrm{Tr}\, \rho A$$

$$\mathrm{Tr}\, AB = \mathrm{Tr}\, BA$$

$$ZG = I$$

$$ZG(x - x') = \delta(x - x')$$

Laplacian $\equiv \nabla^2 = \nabla \cdot \nabla$

$$\int \frac{dx}{2\pi} e^{i(p-k)\cdot x} = \delta(p-k)$$

$$\int \frac{dy}{2\pi} e^{i(q-p)y} = \delta(q-p)$$

4.13

$$\vec{A}(\vec{x}) = \int e^{i\vec{h}\cdot\vec{x}} \tilde{A}(\vec{h}) \frac{d^3h}{(2\pi)^3}$$

$$= \int e^{i\vec{h}\cdot\vec{x}} \mu_0 \frac{\tilde{\vec{J}}(\vec{h})}{\vec{k}^2} \frac{d^3h}{(2\pi)^3}$$

$$= \boxed{\int e^{i\vec{h}\cdot\vec{x}} \frac{\mu_0}{\vec{k}^2} \frac{d^3h}{(2\pi)^3}} \int e^{-i\vec{h}\cdot\vec{y}} \vec{J}(\vec{y}) d^3y$$

$$= \mu_0 \int \frac{\vec{J}(\vec{y})}{4\pi |\vec{x}-\vec{y}|} d^3y$$

↓ 21 September 2021

$$\delta(x) \longleftrightarrow I$$

$$G_p = P^{-1}$$

$$\frac{\partial}{\partial x^1} \int d^n k \, e^{ik\cdot x} \tilde{G}_p(k)$$

$$= \int d^n k \, e^{ik\cdot x} \tilde{G}_p(k) \, ik^1$$

$$k \cdot x = k^1 x^1 + k^2 x^2 + \dots k^n x^n$$

$$P = \partial^2$$

$$P(ih) = (ih)^2 = -h^2$$

$$P = \partial^3$$

$$P(ih) = (ih)^3 = -ih^3$$

$$L_f(s) = \int_0^\infty e^{-st^2} F(t)\,dt$$

$$\frac{d^n}{ds^n} f(s) = \int \frac{d^n}{ds^n} e^{-st} P(-t) F(t)\,dt$$

$$= \int (-t)^n P(-t) F(t)\,dt$$

(φ, A)

time component
4-vector

field A^i $i = 0,1,2,3$

$$\delta(g(x)) = \frac{\delta(x_0)}{|g'(x_0)|}$$

$$\vec{h} \longrightarrow -\vec{k}$$

$$\phi(x) = \phi^\dagger(x)$$

$$= \int e^{-i(k\cdot x - \omega_k t)} h_+^{\dagger}(k) \qquad e^{i(k\cdot x - \omega_k t)} h^{\dagger}(-k)$$

$+ e \qquad h_-$

$$h_+^{*}(k) = h_-(-k)$$

$$= h_+^{*}(k)$$

$$\int e^{i\omega t} \, d\omega = \int e^{i i D k^2 t} \boxed{i k A k^2}$$

$$(D k^2 + i\omega)\, \tilde{\rho}(\vec{k}, \omega) = 0$$

$$\rho(x,t) = \int e^{ik\cdot x + i\omega t} \, \delta(-Dk^2 - i\omega)\, h(k,\omega)\, d^3k\, d\omega$$

$$-Dk^2 - i\omega = 0$$

$Dh + i\omega = 0$

$$(D\nabla^2 - \partial_t)\,\rho(x,t)$$

$$= \int e^{ik\cdot x - i\omega t} \underbrace{(-Dk^2 - i\omega)}\,\delta(-Dk^2 - i\omega)\,h(k,\omega)\, d^3k\, d\omega$$

$$\int f(x)\, x\, \delta(x)\, dx$$

$$= f(0)\,0 = 0$$

$$\int f(x^2)\, x^2\, \delta(x^2)\, dx$$

$$= f(0)\,0 = 0$$

4.7

$$\rho(k) = \int e^{-ikx} \rho(x)\, dx$$

$$\chi(k) = \int e$$

$$\int e^{-iky} \frac{dk}{2\pi} \chi(k) = \int e^{ik(x-y)} P(x)\, dx \frac{dk}{2\pi}$$

$$\int e^{ik(x-y)} \frac{dk}{2\pi} = \delta(x-y)$$

$$= \int \delta(x-y) P(x)\, dx$$

$$= P(y)$$

$$P(y) = \int e^{-iky} \chi(k) \frac{dk}{2\pi}$$

$$\underbrace{ds^2}_{\text{physical}} = \sum_{i,k=0} g_{ik}\, dx^i dx^k$$

$i,k = 0,1,2,3$

arbitrary coordinates

$$= \sum_{i,k=0}^{3} g'_{ik}\, dx'^i\, dx'^k$$

$$g'_{ik}(x') = \frac{\partial x^j}{\partial x'^i} \frac{\partial x^l}{\partial x'^k} g_{jl}(x)$$

$$dx'^i = \frac{\partial x'^i}{\partial x^m} dx^m$$

$$ds^2 = \sum_{ik} g_{ik}\, dx^i\, dx^k$$