Unit 11 - Week 9

Assessment 9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-11-18, 23:59 IST.

1) Consider the propagator $\Pi(\vec{x})$ in the context of the field theory in *D*-dimensional Euclidean space. The normalization factor $\int \Pi(\dot{x})d^D x$ works out to: *1 point*

- $\frac{1}{2m}$
- $\frac{\hbar}{m^2}$
- $\frac{1}{\hbar}$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\hbar}{m^2}$

2) The 2-point function $\langle \varphi(\vec{x}_1)\varphi(\vec{x}_2)\rangle$ in *D*-dimensional Euclidean position space is given by: *1 point*

- $\frac{1}{(2\pi)^D}\frac{1}{\vec{k}_1^2+m^2}\exp\left[ik_1(\vec{x}_1-\vec{x}_2)\right]$
- $(2\pi)^D\frac{\delta^{(D)}(\vec{k}_1+\vec{k}_2)}{\vec{k}_1^2+\vec{k}_2^2+m^2}$
- $\frac{\hbar}{(2\pi)^D}\int d^Dk\frac{1}{\vec{k}\cdot\vec{k}+m^2}\exp\left[i(\vec{x}_1-\vec{x}_2).k\right]$
- None of the above

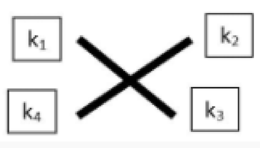
No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\hbar}{(2\pi)^D}\int d^Dk\frac{1}{\vec{k}\cdot\vec{k}+m^2}\exp\left[i(\vec{x}_1-\vec{x}_2).k\right]$

3) The 2-point function $\langle \varphi(\vec{k}_1)\varphi(\vec{k}_2)\rangle$ in D-dimensional Euclidean mode space is given by: *1 point*

- $\frac{1}{(2\pi)^D}\frac{1}{\vec{k}_1^2+m^2}$
- $(2\pi)^D\frac{\delta^{(D)}(\vec{k}_1+\vec{k}_2)}{\vec{k}_1^2+m^2}$
- $\frac{1}{(2\pi)^D}\frac{\delta^{(D)}(\vec{k}_1)}{\vec{k}_1^2+m^2}$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$(2\pi)^D\frac{\delta^{(D)}(\vec{k}_1+\vec{k}_2)}{\vec{k}_1^2+m^2}$

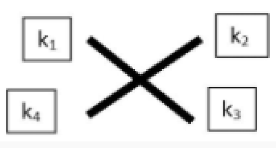
4) In *D*-dimensional Euclidean mode space, the Feynman diagram shown below represents: *1 point*



- Conservation of momentum
- Conservation of mass-energy
- Conservation of field strength
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Conservation of momentum

5) In *D*-dimensional Euclidean mode space, the Feynman diagram shown below evaluates to: *1 point*



- $-\frac{\lambda_4^4}{\hbar}$
- $-\frac{\lambda_4}{\hbar}(2\pi)^D\delta^D(k_1+k_2+k_3+k_4)$
- $-\frac{\lambda_4}{\hbar}(2\pi)^D\delta^D(k_1+k_2)$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-\frac{\lambda_4}{\hbar}(2\pi)^D\delta^D(k_1+k_2+k_3+k_4)$

6) In Minkowski space with the flat metric $diag(+1,-1,-1,-1)$, a spacelike interval is given by: *1 point*

- $ds^2=\sum_{\mu=0}^{3}dx^\mu dx_\mu<0$
- $ds^2=\sum_{\mu=0}^{3}dx^\mu dx_\mu>0$
- $ds^2=\sum_{\mu=0}^{3}dx^\mu dx_\mu=0$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$ds^2=\sum_{\mu=0}^{3}dx^\mu dx_\mu<0$

7) The Hamiltonian density for the free Klein Gordon filed in Minkowski space with the flat metric $diag(+1,-1,-1,-1)$ is given by: *1 point*

- $\mathcal{H}_0=\frac{1}{2}\Pi^2-\frac{1}{2}(\nabla\varphi)^2+\frac{1}{2}m^2\varphi^2$ 280
- $\mathcal{H}_0=\frac{1}{2}\Pi^2-\frac{1}{2}(\nabla\varphi)^2-\frac{1}{2}m^2\varphi^2$ 392
- $\mathcal{H}_0=\frac{1}{2}\Pi^2+\frac{1}{2}(\nabla\varphi)^2+\frac{1}{2}m^2\varphi^2$
- $\mathcal{H}_0=-\frac{1}{2}(\nabla\varphi)^2-\frac{1}{2}\Pi^2+\frac{1}{2}m^2\varphi^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\mathcal{H}_0=\frac{1}{2}\Pi^2+\frac{1}{2}(\nabla\varphi)^2+\frac{1}{2}m^2\varphi^2$

8) Which of the following is a candidate for the Feynman propagator of a Klein Gordon free field in Minkowski space described by the flat metric $diag(+1,-1,-1,-1)$: *1 point*

- $\Delta(x-x')=\int\frac{d^4k}{(2\pi)^4}\frac{e^{-ik(x-x')}}{-k^2-m^2-i\varepsilon}$
- $\Delta(x-x')=\int\frac{d^4k}{(2\pi)^4}\frac{e^{ik(x-x')}}{k^2+m^2+i\varepsilon}$
- $\Delta(x-x')=\int\frac{d^4k}{(2\pi)^4}\frac{e^{ik(x+x')}}{k^2+m^2-i\varepsilon}$
- $\Delta(x-x')=\int\frac{d^4k}{(2\pi)^4}\frac{e^{-ik(x-x')}}{-k^2+m^2-i\varepsilon}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Delta(x-x')=\int\frac{d^4k}{(2\pi)^4}\frac{e^{-ik(x-x')}}{-k^2+m^2-i\varepsilon}$

9) Consider a φ^4 field in *D*-dimensional Euclidean space. The following mode-space Feynman diagram evaluates to: *1 point*

- $\frac{J(\vec{k}_2)}{\hbar}(2\pi)^D\delta^D(\vec{k}_1+\vec{k}_2)$
- $\frac{J(\vec{k}_2)}{\hbar}(2\pi)^D\delta^D(\vec{k}_1^2+\vec{k}_2^2)$
- $\frac{J(\vec{k}_1+\vec{k}_2)}{\hbar}(2\pi)^D\delta^D(\vec{k}_1+\vec{k}_2)$
- $\frac{1}{\hbar}(2\pi)^D\delta^D(\vec{k}_1+\vec{k}_2)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{J(\vec{k}_2)}{\hbar}(2\pi)^D\delta^D(\vec{k}_1+\vec{k}_2)$

10) Which of the following expressions correctly represents the D'Alembert (box) operator $\Box=\partial_\mu\partial^\mu$ in Minkowski space with the flat metric $diag(+1,-1,-1,-1)$: *1 point*

- $\frac{1}{c}\frac{\partial}{\partial t}-\nabla^2$
- $\frac{1}{c^2}\frac{\partial^2}{\partial t^2}+\nabla^2$
- $\frac{1}{c}\frac{\partial}{\partial t}-\nabla$
- $\frac{1}{c^2}\frac{\partial^2}{\partial t^2}-\nabla^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{c^2}\frac{\partial^2}{\partial t^2}-\nabla^2$