Week 8- Assignment 8-MCQ

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

1) In the following groups which is/are connected group(s)?

- \( SU(2) \)
- \( U(n) \)
- \( GL(n, \mathbb{C}) \)
- All of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
All of the above

2) Identify the number of independent parameters in the group \( Sp(6) \).

- 12
- 20
- 21
- 6

No, the answer is incorrect.
Score: 0
Accepted Answers:
21

3) An \( SU(2) \) matrix \( u_n \) is given as below, where \( \tau^i \) are Pauli matrices.\[
\begin{pmatrix}
\cos \alpha & \sin \alpha \\
-\sin \alpha & \cos \alpha
\end{pmatrix}
\]

\( \alpha = \) ______
\( \tau^1 = \) ______
\( \tau^2 = \) ______
\( \tau^3 = \) ______

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \alpha = 3\pi \)
\( \tau^1 = \) ______
\( \tau^2 = \) ______
\( \tau^3 = \) ______
4) Obtain a closed form expression for the one parameter subgroup \( \exp\{\alpha K_1\} \) where \( \alpha \) is a real parameter and \( \{K_1\}_i = \delta_{\alpha i}\delta_{\beta j} + \delta_{\alpha j}\delta_{\beta i}, \ i, j = 0, 1, 2, 3 \) is the generator of Lorentz boosts along the \( x^1 \) axis.

\[
\begin{pmatrix}
\cosh \alpha & -\sinh \alpha & 0 & 0 \\
-\sinh \alpha & \cosh \alpha & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{pmatrix}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \frac{1}{2} \begin{pmatrix} \sqrt{3} - i \ 0 \end{pmatrix} \)

5) In the following groups which is simply connected group?

\[
\begin{pmatrix}
\cosh \alpha & \sinh \alpha & 0 & 0 \\
\sinh \alpha & \cosh \alpha & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{pmatrix}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[
\begin{pmatrix}
cosh \alpha & \sinh \alpha & 0 & 0 \\
\sinh \alpha & \cosh \alpha & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{pmatrix}
\]
6) In Special Relativity, the Minkowski metric is
   \( SU(2) \)
   \( U(n) \)
   \( GL(n, \mathbb{C}) \)
   None of the above.

   No, the answer is incorrect.
   Score: 0
   Accepted Answers:
   \( SU(2) \)

7) For a Unitary matrix \( U \) we can write
   \[ U^{-1} = U^T \]
   \[ U^{-1} = U^\dagger \]
   \[ U^{-1} = U \]
   \[ U = U^\dagger \]

   No, the answer is incorrect.
   Score: 0
   Accepted Answers:
   \[ U^{-1} = U^\dagger \]

8) In Minkowski space, infinitesimal spacetime interval
   \[ (dl)^2 = (dr)^2 + r^2(d\theta)^2 + r^2 \sin^2 \theta (d\phi)^2 \]
   can be positive, negative or zero
   always positive
   always negative
   always takes a constant value

   No, the answer is incorrect.
   Score: 0
   Accepted Answers:
   can be positive, negative or zero

9) In spherical polar coordinates in 3 dimensions, \( (dl)^2 = (dr)^2 + r^2(d\theta)^2 + r^2 \sin^2 \theta (d\phi)^2 \), then the metric of this space can be
written in the \( \begin{pmatrix} r \\ \theta \\ \phi \end{pmatrix} \) basis as,

\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix}
\begin{pmatrix}
1 & 0 & 0 \\
0 & r^2 \sin^2 \theta & 0 \\
0 & 0 & r^2
\end{pmatrix}
\begin{pmatrix}
1 & 0 & 0 \\
0 & r^2 & 0 \\
0 & 0 & r^2 \sin^2 \theta
\end{pmatrix}
\begin{pmatrix}
r^2 & 0 & 0 \\
0 & r^2 & 0 \\
0 & 0 & r^2 \sin^2 \theta
\end{pmatrix}
\begin{pmatrix}
1 & 0 & 0 \\
0 & r^2 & 0 \\
0 & 0 & r^2 \sin^2 \theta
\end{pmatrix}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & r^2 & 0 \\
0 & 0 & r^2 \sin^2 \theta
\end{pmatrix}
\]

10) Find the \( \{ q^2 p, p^2 q \} \), where PB refers to the Poisson Bracket with respect to \( (q, p) \). 1 point

- \(-3p^2 q^2\)
- \(3pq^2\)
- \(3q^2\)
- \(3p^2q\)
- \(3p^2q^2\)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\(3p^2 q^2\)