Assignment 3

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

Due on 2019-02-20, 23:59 IST.

1) Consider the eigenvalue problem with \( \hat{B}\psi(x) = \int_{-\infty}^{x} x'\psi(x')dx' \). The eigenvalues \( \lambda \) lead to square integrable functions if and only if

- \( \lambda < 0 \)
- \( \lambda > 0 \)
- \( \lambda = 0 \)
- \( \lambda \) is imaginary

No, the answer is incorrect.
Score: 0

Accepted Answers:

2) If \( |V_1\rangle \) and \( |V_2\rangle \) are orthogonal pair of kets. The dual of the ket \( |V\rangle = (2 - 3i)|V_1\rangle + 5\exp{(i\pi/4)}|V_2\rangle \), will be

\[
(2 + 3i)|V_1\rangle + 5\exp{(-i\pi/4)}|V_2\rangle
\]

- \( (2 - 3i)|V_1\rangle + 5\exp{(i\pi/4)}|V_2\rangle \)
- \( (2 + 3i)|V_1\rangle - 5\exp{(-i\pi/4)}|V_2\rangle \)
- \( (2 + 3i)|V_1\rangle + 5\exp{(i\pi/4)}|V_2\rangle \)

No, the answer is incorrect.
Score: 0

Accepted Answers:
4) Consider an operator defined as an outer product of two states: \( \Omega = |\psi\rangle \langle \phi| \) where \( |\psi\rangle = a|\phi\rangle + b|\chi\rangle \) with \( \langle \chi | \phi \rangle \neq 0 \). This operator can be Hermitian if and only if

- \( a \) is real and \( b \) is zero.
- \( a \) is purely imaginary.
- \( a \) is any complex number.
- \( a \) is imaginary and \( b \) must be always real.

No, the answer is incorrect.
Score: 0
Accepted Answers:
- \( \sqrt{38} \)

5) The operator \( \hat{\Omega} = |\psi\rangle \langle \phi| \) is a projection operator if and only if

- \( |\phi\rangle \neq |\psi\rangle \)
- \( |\psi\rangle = |\phi\rangle \)
- \( |\psi\rangle = \frac{10+i}{\sqrt{11}} |\phi\rangle \)
- \( |\psi\rangle = i|\phi\rangle \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
- \( |\psi\rangle = |\phi\rangle \)

6) Which of the following operator is Hermitian?

- \( \hat{A} + \hat{A}^\dagger \)
- \( \hat{A} - \hat{A}^\dagger \)
- \( i(\hat{A} + \hat{A}^\dagger) \)
\( \hat{A} - i \hat{A}^\dagger \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \hat{A} + \hat{A}^\dagger \)

7) \( \hat{P}_1 \) and \( \hat{P}_2 \) are two projection operators, so the condition for the sum \( \hat{P}_1 + \hat{P}_2 \) to be a 1 point

projection operator is

\[ \hat{P}_1 \hat{P}_2 = \hat{P}_2 \hat{P}_1 = 0 \]
\[ \hat{P}_1 \hat{P}_2 = (\hat{P}_2 \hat{P}_1)^\dagger \neq 0 \]
\[ \hat{P}_1 + \hat{P}_2 + \hat{P}_2 \hat{P}_1 = 0 \]
\[ \hat{P}_1 \hat{P}_2 + \hat{P}_2 \hat{P}_1 \neq 0 \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \hat{P}_1 \hat{P}_2 = \hat{P}_2 \hat{P}_1 = 0 \)

8) For any operator to be Hermitian, we require their 1 point

eigenvalues to be purely imaginary
eigenvalues are complex numbers
eigenvalues are purely real
eigenvalues must be strictly 0 or 1

No, the answer is incorrect.
Score: 0
Accepted Answers:
eigenvalues are purely real

9) Which of the following can be treated as linearly dependent 0 points

\( \hat{A} = (6, -9, 0) ; \hat{B} = (2, 3, 0) \)
\( \hat{A} = (2, 3, -1) ; \hat{B} = (0, 1, 2) ; \hat{C} = (0, 0, -5) \)
\( \hat{A} = (1, -2, 3) ; \hat{B} = (-4, 1, 3) ; \hat{C} = (14, -7, -4) \)
\( \hat{A} = (3, 0, 0) ; \hat{B} = (0, -1, 0) ; \hat{C} = (0, 0, -5) \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \hat{A} = (1, -2, 3) ; \hat{B} = (-4, 1, 3) ; \hat{C} = (14, -7, -4) \)

10) If two operators are Hermitian then the commutator of the two operators will be 1 point
Hermitian
anti-Hermitian
anti-Unitary
Unitary

No, the answer is incorrect.
Score: 0
Accepted Answers:
anti-Hermitian