Quiz 1

Due Sep 25 at 7:30pm   **Points** 100   **Questions** 10
Time Limit 60 Minutes   **Allowed Attempts** 3

Instructions

We use the conventions in the QBook101.

The default programming language for coding is Python. You may write pieces of code during this exercise.

Take the Quiz Again

Attempt History

	Attempt	**Time**	**Score**
LATEST	**Attempt 1**	42 minutes	90 out of 100

⚠ Correct answers are hidden.

Score for this attempt: **90** out of 100
Submitted Sep 24 at 7:24pm
This attempt took 42 minutes.

Question 1	**10 / 10 pts**

Find the value of the angle φ of the following right triangle, where $x = 2$ and $y = 4$
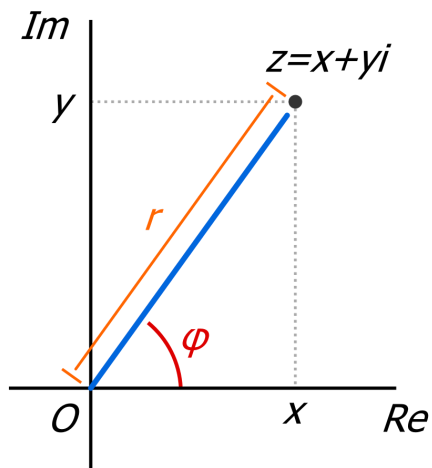
- ○ 58.25
- ○ 65.32
- ◉ 63.43
- ○ 45.01

Question 2

10 / 10 pts

Given the complex numbers $z_1 = 3 - 2i$, $z_2 = -8i$ and $z_3 = 5$, what is the result of the operation $z_3 \, \bar{z}_1 + \overline{z_2}$?

- ○ $18 - 15i$
- ○ $15 - 18i$
- ◉ $15 + 18i$
- ○ $18 + 15i$

Question 3

10 / 10 pts

Given the matrix $\mathbf{A}$ and the vector $\vec{c}$, what is the result of the operation $\mathbf{A}\,\vec{c}$?

$$\mathbf{A} = \begin{pmatrix} 3 & 2 & 1 \\ 0 & -6 & -4 \\ -1 & 1 & 5 \end{pmatrix} \quad , \quad \vec{c} = \begin{pmatrix} 6 \\ 7 \\ -3 \end{pmatrix}$$

○ $\begin{pmatrix} 29 & -30 & -14 \end{pmatrix}$

◉ $\begin{pmatrix} 29 \\ -30 \\ -14 \end{pmatrix}$

○ $\begin{pmatrix} -29 \\ 30 \\ 14 \end{pmatrix}$

○ $\begin{pmatrix} -29 & 30 & 14 \end{pmatrix}$

Question 4   10 / 10 pts

Find the result of the operation $\mathbf{C} - \lambda\mathbf{I}$

where $\lambda = 2$, $\mathbf{I}$ is the identity matrix of the appropriate size, and,

$$\mathbf{C} = \begin{pmatrix} 1 & 0 & 2 \\ 3 & -4 & 0 \\ -2 & 5 & 3 \end{pmatrix}$$

◉ $\begin{pmatrix} -1 & 0 & 2 \\ 3 & -6 & 0 \\ -2 & 5 & 1 \end{pmatrix}$

○ $\begin{pmatrix} 1 & 0 & 2 \\ 3 & 6 & 0 \\ 2 & 5 & 1 \end{pmatrix}$

○ $\begin{pmatrix} 1 & 0 & -2 \\ -3 & 6 & 0 \\ 2 & -5 & -1 \end{pmatrix}$

○ $\begin{pmatrix} -1 & 3 & -2 \\ 0 & -6 & 5 \\ 2 & 0 & 1 \end{pmatrix}$

Question 5

10 / 10 pts

Is the matrix $\mathbf{U}_2$ unitary?

$$\mathbf{U}_2 = \begin{pmatrix} \dfrac{i}{\sqrt{2}} & \dfrac{i}{\sqrt{2}} \\ \dfrac{i}{\sqrt{2}} & \dfrac{i}{\sqrt{2}} \end{pmatrix}$$

○ True

◉ False

Question 6

10 / 10 pts

Find the tensor product (Kronecker product) $\vec{a} \otimes \vec{b}$ where,

$$\vec{a} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \quad . \quad \vec{b} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

○ $\begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$

○ $\begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \end{pmatrix}$

◉ $\begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \end{pmatrix}$

○ $\begin{pmatrix} 0 \\ 1 \\ 1 \\ 0 \end{pmatrix}$

Question 7   10 / 10 pts

Find the *bra-ket* (or inner product) $\langle s|p \rangle$, where

$$|s\rangle = \begin{pmatrix} 3i \\ 5 \\ 1 - 2i \end{pmatrix} \quad , \quad |p\rangle = \begin{pmatrix} 2 + i \\ 4i \\ 3 \end{pmatrix}$$

◉ $6 + 20i$

○ $20 - 6i$

○ $20 + 6i$

○ $6 - 20i$

Question 8   10 / 10 pts

What should the commented line be replaced with so that the following code calculates the conjugate transpose of the matrix $\mathbf{A}$?,

i.e. $\mathbf{A}^*$

```
import numpy as np

A = np.matrix([
[complex(-2,-2), complex(1, 0)],
[complex( 0, 3), complex(2, 4)]
])

# missing line
print(A_transpose)
```

○　`A_transpose = A.transpose()`

○　`A_transpose = A.dagger()`

○　`A_transpose = A.conjugate()`

◉　`A_transpose = A.getH()`

Question 9 　　　　　　　　　　　　　　　10 / 10 pts

What postulate of quantum mechanics tells us how to describe states of quantum systems?

○　Postulate 4

○　Postulate 3

◉　Postulate 1

○　Postulate 2

Incorrect

Question 10 　　　　　　　　　　　　　　0 / 10 pts

What postulate of quantum mechanics tells us how quantum states evolve?

○ Postulate 1

◉ Postulate 4

○ Postulate 2

○ Postulate 3

Quiz Score: **90** out of 100